

Genetic Polymorphisms

Variation: discontinuous/continuous

polymorphisms: variable expressions of genes which occur in at least 1 - 5% of some populations (i.e. genetic variant which occurs at too high a frequency to be due solely to repeated mutations and genetic drift).

- red cell antigens (e.g. ABO, Rh, MN, etc.)
- serum proteins (e.g. haemoglobin, transferrin, albumin)
- hemoglobin
- enzymes and proteins

Blood elements: r.b.c., w.b.c., Hb, antigens...
liquid: serum or plasma

r.b.c. = erythrocytes

antigens = mucoproteins or mucopolysaccharides

antibodies = serum, substances produced to counteract antigens' immunological response

ABO Landsteiner 1901

anti-B	anti-A	Blood type
-	-	O
+	-	B
-	+	A
+	+	AB

Bernstein 1924

3 alleles: I^A, I^B, I^O

Allele	Genotype	Phenotype	Antigen on r.b.c.	Antibody in serum
A, B, O	AA, AO	A	A	anti-B
	BB, BO	B	B	anti-A
	AB	AB	A, B	---
	OO	O	---	anti-A, anti-B

MN blood system MM, MN, NN
geographical distribution

I^O .623
I^A .215
I^B .162

natural selection and ABO
disease associations: infectious and noninfectious diseases

- O - duodenal and gastric ulcer, birth pills
- A - cancer of the stomach and cervix
- A - smallpox
- B - infant diarrhea
- O - bubonic plague
- O - malaria

hemolytic disease of newborn (erythroblastosis fetalis): Rh - Mother & Rh+ Fetus

ABO incompatibilities:(e.g. O mother & A, B fetus; A mother & AB, B fetus)

Hemoglobin - oxygen transport
Hb molecule: 2 alpha and 2 beta chains + heme
A₂: 2 alpha + 2 delta
infant Hb: 2 alpha + 2 gamma
hemoglobin variants A, S, C, E

<u>Alleles</u>	<u>Genotype</u>	
A, S	AA	normal Hb
	AS	sickle-cell trait
	SS	sickle-cell anemia

Allison (1954)
malaria and HbS
sickle-cell trait (HbAS)
statistics
biochemical and physiological basis
mosquito

HbC
HbE

Thalassemia major (Cooley's anemia and Med. anemia)
G-6PD - glucose-6-phosphate dehydrogenase deficiency (X-linked)
hemolysis of r.b.c./primaquine/favism (fava bean)
Tay-Sachs Disease
NIDD (noninsulin-dependent diabetes) e.g. Nauru