LIST OF ABSTRACTS

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WHICH BLOOD GROUP WILL DOMINATE IN MALAYSIA IN THE FUTURE

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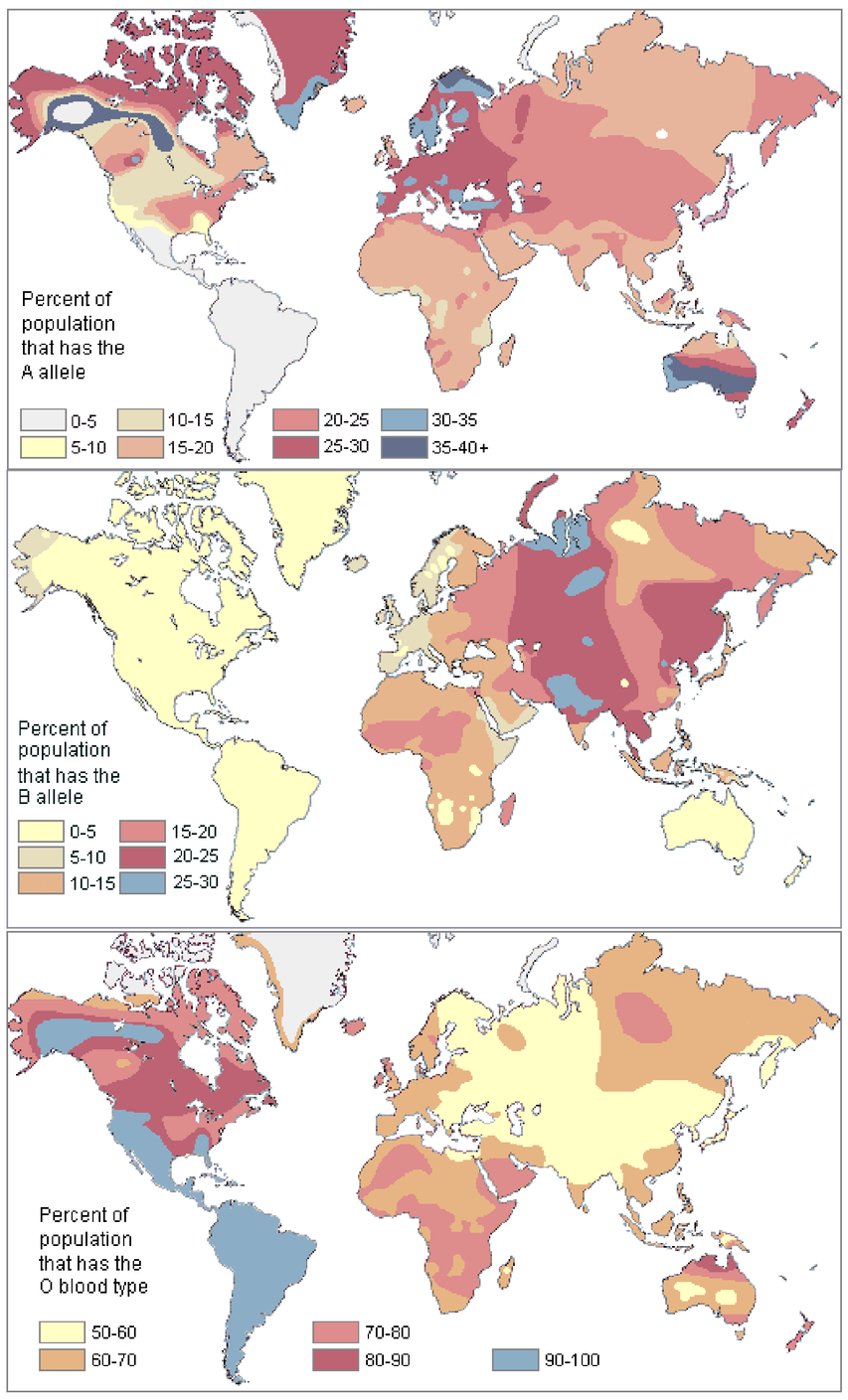
ABO Blood Groups

A blood group provides an ideal opportunity for the study of human variation without cultural prejudice. It can be easily classified for many different genetically inherited blood typing systems. Also significant is the fact that we rarely take blood types into consideration in selecting mates. A few people know their own type today and no one did prior to 1900. As a result, differences in blood type frequencies around the world are most likely due to other factors than social discrimination. **ABO blood group** is the classification of human blood based on the inherited properties of red blood cells (erythrocytes) as determined by the presence or absence of the alleles **A** and **B**, which are carried on the surface of the red cells. Persons may thus have group **A** (which is carrying only **A** allele), group **B** (which is carrying only **B** allele), group **O** (which is neither carrying **A** allele nor **B** allele), and group **AB** (which is carrying both **A** and **B** alleles). The **ABO** blood group system has been discovered by the Austrian scientist **Karl Landsteiner**, who found three different blood types in 1900. He was awarded the **Nobel Prize** in Medicine in 1930 for his work. When we donate blood or have surgery, a small sample is usually taken in advance for at least **ABO** and **Rh** systems typing. We have learned a good deal about how common each of the **ABO** blood types is around the world. It is quite clear that the distribution patterns are complex. About **21%** of all people in the world share the **A** blood group. The highest frequencies of **A** are found in small, unrelated populations, especially the Blackfoot Indians of Montana (**30-35%**), the Australian Aborigines (many groups are **40-53%**). Overall in the world, the **B** blood group is the rarest **ABO** blood group. Only **16%** of humanity have it. Note that it is highest in Central Asia and lowest among the indigenous peoples of the Americas and Australia. The **O** blood group is very common around the world. About **63%** of humans share it. The group **O** is particularly high in frequency among the indigenous populations of Central and South America, where it approaches **100%.** The rest of people in the world are sharing **AB** blood group.



A Mathematical Model of Blood Transmissions

A quadratic stochastic operator (QSO) is a primary source for investigations of dynamical properties of population genetics. It describes a distribution of a species for the next generation if the current distribution of these species was given. In this project, we present a mathematical model of human blood transmissions by QSO. ***One of the interesting problems in blood group distributions is that if we know the current blood group distributions of the society then can we predict the blood groups distributions in the future?*** An attempt to solve this problem was started in the works [1,2]. In the work [3], it was given a general mathematical model of the evolution of population systems having Fisher's sex ration law. During the period 2007-2008, the first Author collected the current blood group distributions of Malaysian people from more than 10 000 families in Pahang and Kuala Lumpur states. According to statistics, the current blood distribution was as follows: **20% from A; 29.3% from B; 8.4% from AB; 42.3% from O.** Now, we are aiming to write a mathematical model of the transmission of blood groups. To this end, we do some assumption. ***Suppose that the probability having child from every blood group would be preserved in every future generation. This was the main assumption which was made by the first Author***. For example, the probability having a child with blood group **A** from the parents having blood groups **A** is $P_{AA,A}=N_A(F_A,M_A)/N(F_A,M_A)$ and it would be preserved during the evolution. Based on this assumption, one may derived the mathematical model of the transmission of the human blood group as QSO:

$$
\begin{aligned}
x'_A &= 0.913x_A^2 + 0.608x_Ax_B + 0.982x_Ax_{AB} + 0.992x_Ax_O + 0.011x_B^2 \\
&\quad +0.172x_Bx_{AB} + 0.028x_Bx_O + 0.108x_{AB}^2 + 0.438x_{AB}x_O + 0.010x_O^2 \\
x'_B &= 0.005x_A^2 + 0.772x_Ax_B + 0.304x_Ax_{AB} + 0.026x_Ax_O + 0.925x_B^2 \\
&\quad +1.300x_Bx_{AB} + 1.042x_Bx_O + 0.081x_{AB}^2 + 0.422x_{AB}x_O + 0.010x_O^2 \\
x'_{AB} &= 0.005x_A^2 + 0.498x_Ax_B + 0.652x_Ax_{AB} + 0.026x_Ax_O + 0.011x_B^2 \\
&\quad +0.426x_Bx_{AB} + 0.018x_Bx_O + 0.798x_{AB}^2 + 0.418x_{AB}x_O + 0.007x_O^2 \\
x'_O &= 0.077x_A^2 + 0.172x_Ax_B + 0.062x_Ax_{AB} + 0.956x_Ax_O + 0.053x_B^2 \\
&\quad +0.102x_Bx_{AB} + 0.912x_Bx_O + 0.013x_{AB}^2 + 0.722x_{AB}x_O + 0.937x_O^2
\end{aligned}
$$

By investigating fixed points and asymptotic behaviour of the derived QSO, one can predict the future distribution of human blood groups in Malaysia: ***in future, the transmission of ABO blood groups in Malaysia will be eventually stable and ABO blood groups would be distributed as follows:* 12.7%** ***from A;* 45.7%** ***from B;* 7%** ***from AB; and* 34.6%** ***from O.***

Journal Papers and Conference Presentations

1. N.Ganikhodjaev An application of the theory of Gibbs distributions to mathematical genetics. Dokl. Math. (2001) 321-323.
2. N.Ganikhodjaev, J.Daoud and M.Usmanova Linear and nonlinear models of heredity for blood groups and Rhesus factors. JAS. 10 (2010) 16, 1748-1754.
3. N.Ganikhodjaev, M.Saburov and U.Jamilov Mendelian and non-Mendelian quadratic stochastic operators of bisexual populations. Applied Math and Information Science (Submitted).
4. M.Saburov Which blood group will dominate in Malaysia in future (SYSPAGE-2011) IIUM.