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Lab #3: Blood typing and population genetics

Abstract: The purpose of this experiment was to analyze any inheritance patterns in blood types of a given human population as well as to analyze the field of population genetics. The first part of this experiment was accomplished using synthetic blood samples to identify blood genotypes of the population with unknown ancestry. The second portion of this experiment analyzed the process of patterns and changes in allelic variation. Four primary microevolutionary mechanisms were analyzed in this experiment; mutation, gene flow, natural selection and genetic drift as well as non-random mating which can influence genotype frequencies rather than allelic frequencies. This was accomplished using a genetic simulator PopG. The blood genotypes presented in the island population reported 15% A+, 29% A-, 15% B+, 8% B-, 6% AB+, 0% AB-, 12% O+ and 12% O-. Overall, based on the simulator and analyzing the blood samples was that the large the population the less genetic drift there would be. In conclusion, based on the results obtained from blood typing on the island of Odd, genetic flow occurred through the concept of founder effect.

Introduction: Human blood typing is an important factor in the medical field especially in the process of transfusion. There are 4 primary human blood types; Type A, B, AB and O. Type AB is known as the universal recipient; thus it can receive blood from any of the other 3 blood types. Blood type O is known as the universal donor, individuals with this blood type can donate blood to anyone. Blood typing is determined through the presence of antigen in an individuals red blood cell. According to Blair, C. (2018), individuals with type A blood present with type A antigen on red blood cells as for individuals with type B present with type B antigen. Those with type AB blood present with both type A and B antigens on their red blood cells. Type O individuals do not carry any antigen in their red blood cells (Blair, 2018). When testing for an individual's blood Rh factor is also tested to determine if an individual is Rh + or Rh-. Besides of carrying antigens that determine the blood type of a person, red blood cells carry antibodies. Antibodies are present in an individual's blood this will react with different blood types if presented to an individual. For example, if an individual with type A is transfused with type B then the antibodies present in these individuals' blood will attack the transfused blood causing it to agglutinate. Thus, it is important to know what blood type an individual is before donating blood.

In the study of genetic population four primary mechanisms are used to analyze microevolution. Mutation being the first mechanism is when a creation of a new allele occurs with in the genome. Gene flow is when alleles from one population transfer to another and natural selection is when the environment influences the favor one population against another. Genetic drift occurs when there is changes in allele frequencies due to matting efficiency. Nonrandom mating is force in microevolution due to changes in genotype rather than allele. Besides these mechanisms genetic population also presents two additional concepts which are related to genetic drift, the founder events and bottleneck. These conditions tend to involve external force that reduce the number of alleles in a population. The founder effect is described as when a small set of individuals colonize in a new location. (Blair, 2018).

Method:

To complete this experiment 16 synthetic blood samples were provided for the class however; each group took about 3 samples. Blood dishes were obtained for each sample as well as mixing sticks. One drop of blood was placed in a dish tray in the corresponding 3 wells. Then one drop of Anti-A serum was added

into the A well, Anti-B serum in the B well and Anti-D in the Rh well. Using the correct mixing stick each blood sample was mixed with the serum. Then each well was analyzed to determine if any agglutination occurred. A positive agglutination indicates the blood type of that sample. Two runs were done for each sample in the course of two weeks. All the results were recorded and then analyzed. For the second portion of this experiment a computer with the program PopG was used. Different stimulations were performed and analyzed to understand the mechanisms and concepts of genetic population.

Results:

Blood Group	Total for the Blood Group	Blood Group Frequency %
A+	5	15
A-	10	29
B+	5	15
B-	3	8
AB+	2	6
AB-	0	0
O+	4	12
O-	4	12

Figure 1: Demonstrates the class percentage of blood type frequency

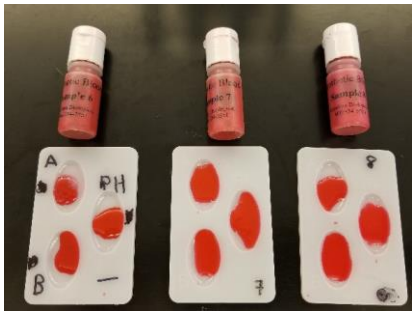

Figure 2: Demonstrates blood typing for samples #6,7 &8.

Blood Type Expected Results:

O- *ii = 64%*
Rh += 75% of the population
Rh- = 25% of the population

Blood Type observed Results:

O- *ii*= 24 %
Rh +: 48% =50%
Rh - : 49 % =50%

Discussion/ Conclusion:

In conclusion this experiment demonstrated the frequencies of a blood types in a given population on the island of Odd. Based on the frequencies obtained from our research and the studies already conducted on the island one can conclude that genetic flow occurred. Due to the flounder effect a gene flow movement from one place to another can be concluded. The expected frequency for blood type O was of 64%. However, based on the calculations obtained as a class one can conclude that type O was only 24%. As for the Rh factor the expected values were 75% for Rh + and 25% for Rh -. Thus, the islander who carried the disease and almost destroyed all of the Odd's native population was type A. According to the calculations and data obtained there could have been some discrepancies due to our percentage and the data obtained, perhaps cross contamination. However, one can conclude that microevolution did occur in this population and there was some type of genetic flow occurred.

Reference:

Blair, Christopher, (2018). Bio 2450L Genetics Laboratory Manual., pg. 34-69