

## Genetics Problems #5: Blood Types, Multiple Alleles and Co-dominance

- Read pages 300 – 301 in your textbook.
- Answer question 4 on page 302.
- The human blood groups A, B, AB, and O are determined by three possible alleles for blood type:  $I^A$ ,  $I^B$ , or  $i^O$ . What blood types could be expected from the following parents?  
 a) ♂  $I^A I^B$  x ♀  $i^O i^O$       b) ♂  $I^A I^B$  x ♀  $I^A I^A$       c) ♂  $I^A I^B$  x ♀  $I^B i^O$       d) ♂  $I^A i^O$  x ♀  $I^B i^O$
- A man has Type A blood and his wife has Type B blood. They have four children and each child has a different blood type. Show how this is possible.
- A wealthy elderly couple dies together in a car accident. Soon a man shows up claiming to be their only son who ran away from home when he was a boy. Other relatives dispute his claim. Hospital records show that the deceased man had Type AB blood while the woman had Type O. The man who claims to be their son has Type O. Is it possible that the man is the dead couple's son? Should he inherit all of their money? Explain.
- A woman who has Type A (homozygous) blood gave birth to a child. There was a blackout in the hospital and it's possible that some of the babies got mixed up in the confusion. The woman's husband is Type A (heterozygous). The baby the couple took home from the hospital has blood Type O. Could this baby belong to this couple?
- Butterbox Babies** (Adapted from <http://www.idealmaternityhomesurvivors.com/the-story/>)



The Ideal Maternity Home was operated by William and Lila Young in Nova Scotia, between the late 1920's through the 1940's. William was a chiropractor and Lila was a midwife but marketed herself as an obstetrician. The Home began as a place for local married couples to find maternity care, as well as a discreet location for unwed mothers to have their babies. At the time, there was a shortage of babies available for legal adoption in the United States, so many American couples traveled to Nova Scotia to adopt from the Ideal Maternity Home. The cost of the

adoptions varied but it is believed that some couples paid up to \$10,000 for a baby. At times, there were upwards of 100 babies available for adoption. As time went on, the Youngs' practices became more and more corrupt. Babies who were considered 'unadoptable', either because of skin color or health issues, were left to die and buried in the woods behind the Home or dumped into the ocean. The term 'Butterbox Baby' comes from the small pine butterboxes that came from the local dairy and were used as coffins, just the right size for a newborn.



A few Butterbox survivors later tried to find their birth mothers. A man who is homozygous for Type A blood found several women who had delivered babies around the time that he was born. Without knowing the father's blood type, what are the possible types of blood that his birth mother could have?

### Answers

- a) 50%  $I^A i^O$ , 50%  $I^B i^O$       b) 50%  $I^A I^B$ , 50%  $I^A I^A$       c) 25%  $I^A I^B$ , 25%  $I^B I^B$ , 25%  $I^A i^O$ , 25%  $I^B i^O$   
 d) 25%  $I^A I^B$ , 25%  $I^A i^O$ , 25%  $I^B i^O$ , 25%  $i^O i^O$
- The father is Type  $I^A i^O$  and the mother is Type  $I^B i^O$ . A Punnett square shows that all four genotypes are possible.
- No, because the father is AB, any child they had would have to be either type A or B. Type O is impossible.
- The baby could not belong to the couple. The mother is homozygous  $I^A I^A$  so all of their children will have at least one  $I^A$  allele.
- A man with homozygous Type A blood must get one  $I^A$  allele from his mother, so she could have  $I^A I^A$ ,  $I^A I^B$  or  $I^A i^O$  blood. As long as the mother provides one  $I^A$  allele, the father could provide the other  $I^A$  allele.