

# Bio 111 Answer to iClicker Question 7A

For re-green color blindness:

Allele	Contribution to phenotype
$X^B$	normal color vision (dominant)
$X^b$	red-green color blind (recessive)
Y	none

Therefore, I must be  $X^BY$  and my wife must be  $X^BX^b$ . Our offspring would then be:

- $\frac{1}{4} X^BX^B$  normal female
- $\frac{1}{4} X^BX^b$  normal (carrier) female
- $\frac{1}{4} X^BY$  normal male
- $\frac{1}{4} X^bY$  color-blind male

Of the male children (the question asked about SONS),  $\frac{1}{2}$  will have normal color vision and  $\frac{1}{2}$  will be red-green colorblind. So the chance is  $\frac{1}{2}$  (answer C).

# Bio 111 Answer to iClicker Question 7B

This question tripped a lot of people up (it was meant to...).

Here are three key mistakes people made:

- Fred's parent's are both Dd, so they have a 1/4 chance of having a dd kid (this first part is correct), therefore Fred's risk is zero (or very low) since his sister has already gotten the disease. This is not right, since each kid is independent of the other, so Fred's risk is still 1/4.
- Since John's mother is dd (correct), John's risk is 1/2. This is not right, since John's father is not necessarily Dd - he might be DD (in fact, he is more likely to be DD since the disease is rare).
- John's father has a 50% chance of being Dd and a 50% chance of being DD (you might think this since there are two possible genotypes for John's father and then assume that they are equally likely). Therefore John's chance of being dd is 1/2 (the chance his Dad is a carrier)  $\times$  1/2 (the chance that he will be affected if his dad is dd) = 1/4. This is not correct, since the chance that John's dad is Dd (a carrier) was given as 1/1000 in the statement of the problem.

Here is the way to get to the right answer:

- Fred's parents must both be Dd in order for Fred's sister to be affected.
- Therefore. Fred's risk of being dd is exactly 1/4. ( $Dd \times Dd \Rightarrow 1/4$  chance of dd)
- John's mom is dd since she is affected.
- John's dad is either DD or Dd.
- If John's dad is DD, John's risk of being dd is ZERO ( $DD \times dd$  can not give dd offspring).
- If John's dad is Dd (a carrier), John's risk is 1/2 ( $Dd \times dd$  parents).
- For John to be affected, his dad must be a carrier (less than 1/1000 chance since the disease is rare) **AND** his dad has to give him a d (a 1/2 chance).
- Therefore, on average, John's risk is less than  $1/1000 \times 1/2$  or less than 1/2000.
- 1/4 is much larger than 1/2000, so Fred is at a higher risk.