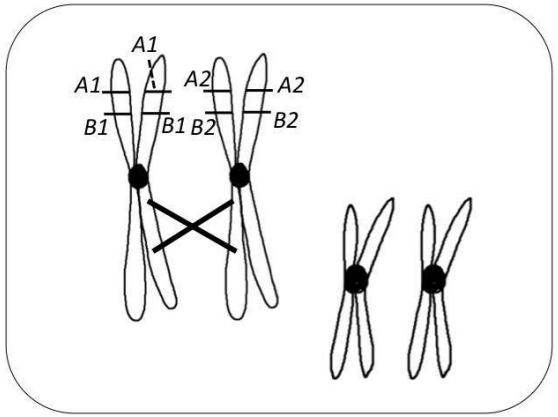
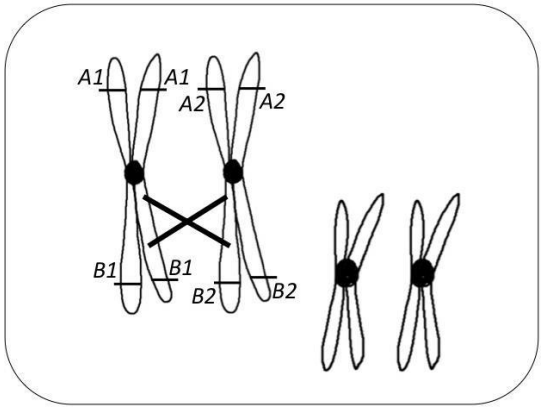
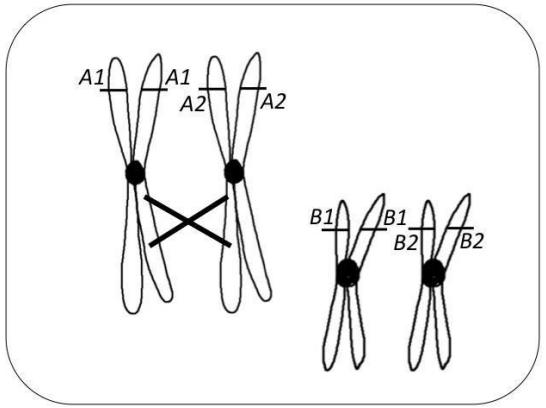
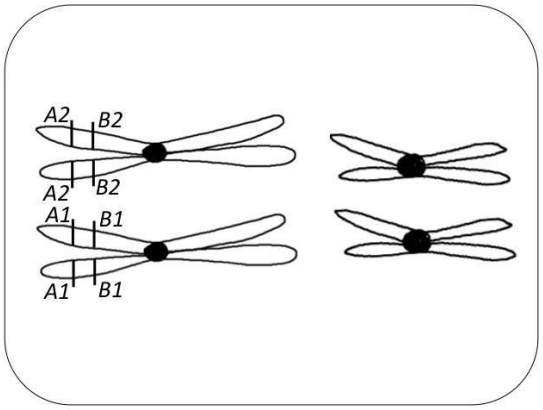
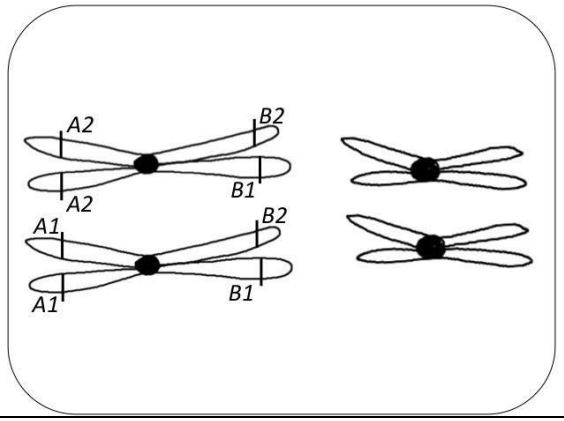
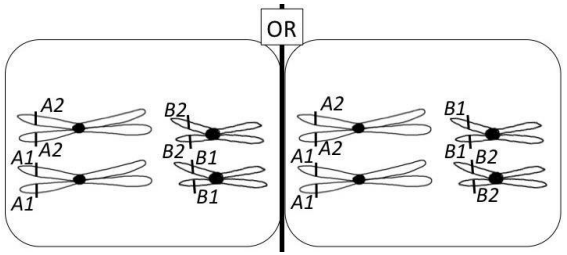
MEIOSIS & GENOTYPES – 3 Hypotheses – KEY

A man has the genotype *A1*/*A2*; *B1*/*B2*. He inherited the *A1* and *B1* alleles from his mother, and the *A2* and *B2* alleles from his father. The diagrams below show one of the man's sex cells undergoing meiosis to form gametes (sperm), under three possible hypotheses. The location of gene *A* is known; we do not currently know the location of gene *B*. The approximate location of a crossover event is marked with an "X"; you can assume this crossover happens 100% of the time.

Please complete each of the diagrams (and formulate predictions for each hypothesis) by labelling the location of the alleles:

Hypothesis 1:	Hypothesis 2:	Hypothesis 3:
Both genes are physically linked, and they are close together.	Both genes are physically linked, but they are far apart.	Gene *A* is found on one pair of homologs, and gene *B* is on a different pair of homologs.
Prophase I	Prophase I	Prophase I
		
Metaphase I	Metaphase I	Metaphase I (Two possiblities, because nonhomologous chromosomes assort independently)
		50% of the time: 50% of the time: 

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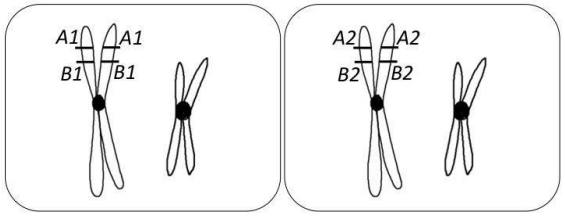
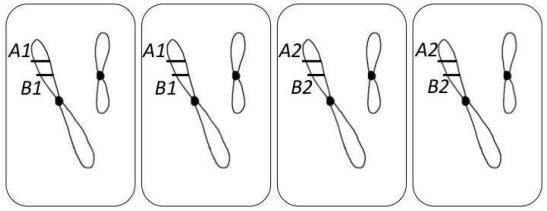
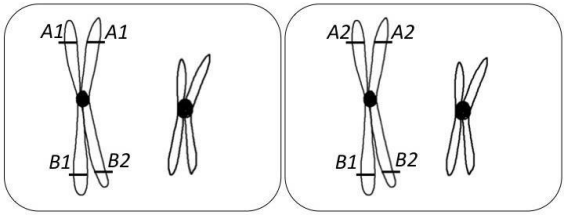
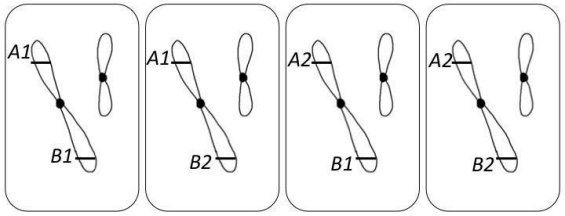
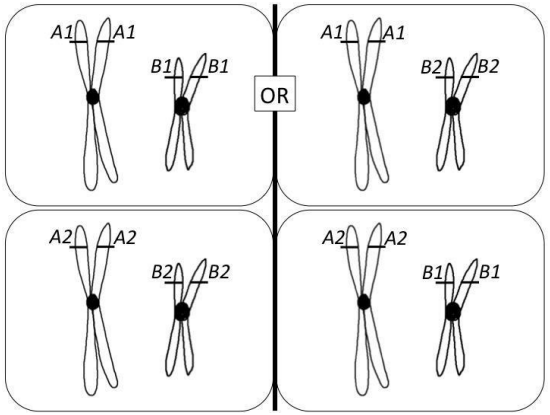
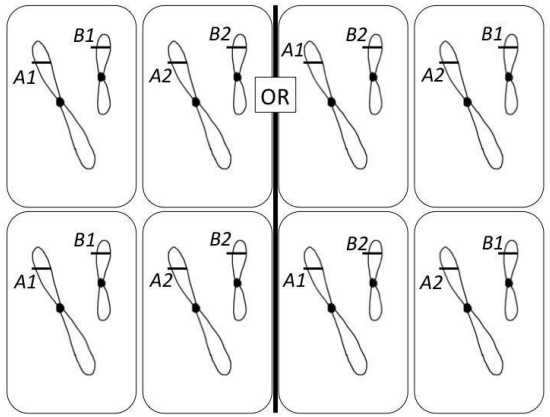
Hypothesis 1:	Hypothesis 2:	Hypothesis 3:
End of Telophase I  **Genotypes of cells are: *A1;B1* and *A2;B2*** End of Telophase II  	End of Telophase I  **Each chromosome has both an *A1* and an *A2* allele, due to recombination** End of Telophase II  	End of Telophase I 50% of the time: 50% of the time:  **Depending on how the chromosomes align, genotypes of cells are either:** ***A1;B1* and *A2;B2* OR *A1;B2* and *A2;B1*** End of Telophase II 50% of the time: 50% of the time: 
Hypothesis 1 prediction: ***A1;B1*: ½ = 0.5 = 50%** ***A2;B2*: ½ = 0.5 = 50%** **(*A1;B1*:*A2;B2*= 1:1)**	Hypothesis 2 prediction: ***A1;B1*: ¼ = 0.25 = 25%** ***A1;B2*: ¼ = 0.25 = 25%** ***A2;B1*: ¼ = 0.25 = 25%** ***A2;B2*: ¼ = 0.25 = 25%** **(*A1;B1*: *A1;B2*: *A2;B1*: *A2;B2*= 1:1:1:1)**	Hypothesis 3 prediction: ***A1;B1*: ¼ = 0.25 = 25%** ***A1;B2*: ¼ = 0.25 = 25%** ***A2;B1*: ¼ = 0.25 = 25%** ***A2;B2*: ¼ = 0.25 = 25%** **(*A1;B1*: *A1;B2*: *A2;B1*: *A2;B2*= 1:1:1:1)**