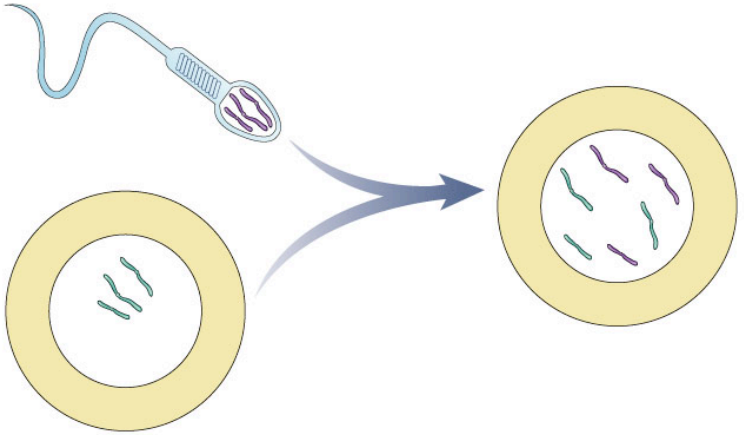
Probability & Genetics

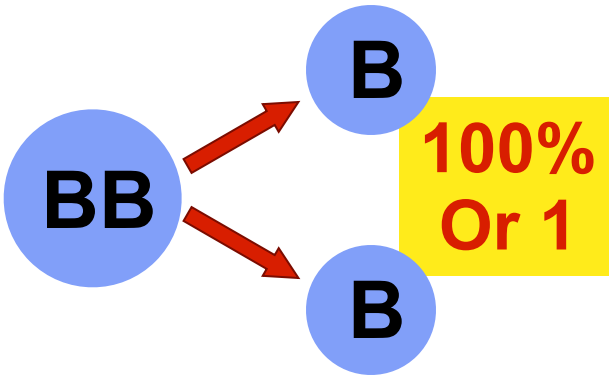


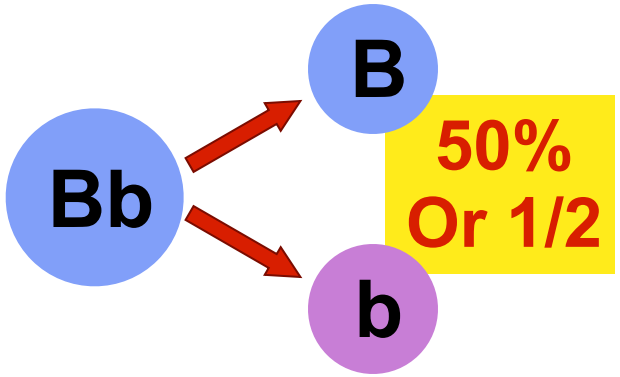
Genetics & Probability

- **Mendel's laws:**
  1. segregation
  2. independent assortment
     - Reflect same laws of probability that apply to tossing coins or rolling dice

Probability & genetics

- **Calculating probability of making a specific gamete is just like calculating the probability in flipping a coin**
  - **probability of tossing heads? 1/2**
  - **probability making a B gamete?**





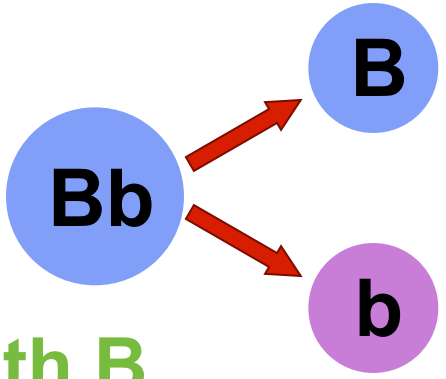
Probability & genetics

- Outcome of 1 toss has no impact on the outcome of the next toss
  - probability of tossing heads?

    50% or 1/2
  - probability of tossing heads?

    50% or 1/2

  - probability making a B gamete each individual time?



Always 50% or
1/2 chance of getting gamete with B
(one out of two chance)

Rule of multiplication

- Used to calculate the chance that 2 or more independent events will occur together.
  - THE CHANCE THAT THIS AND THAT WILL OCCUR
    - Ex: To calculate the probability that 2 coins tossed at the same time will land heads up
      - Multiply the probability that each coin will land heads up

1/2 x 1/2 = 1/4

Calculating probability of obtaining a certain genotype in the offspring

P*p* x P*p*

What is the probability of getting an offspring with a particular genotype?

male / sperm

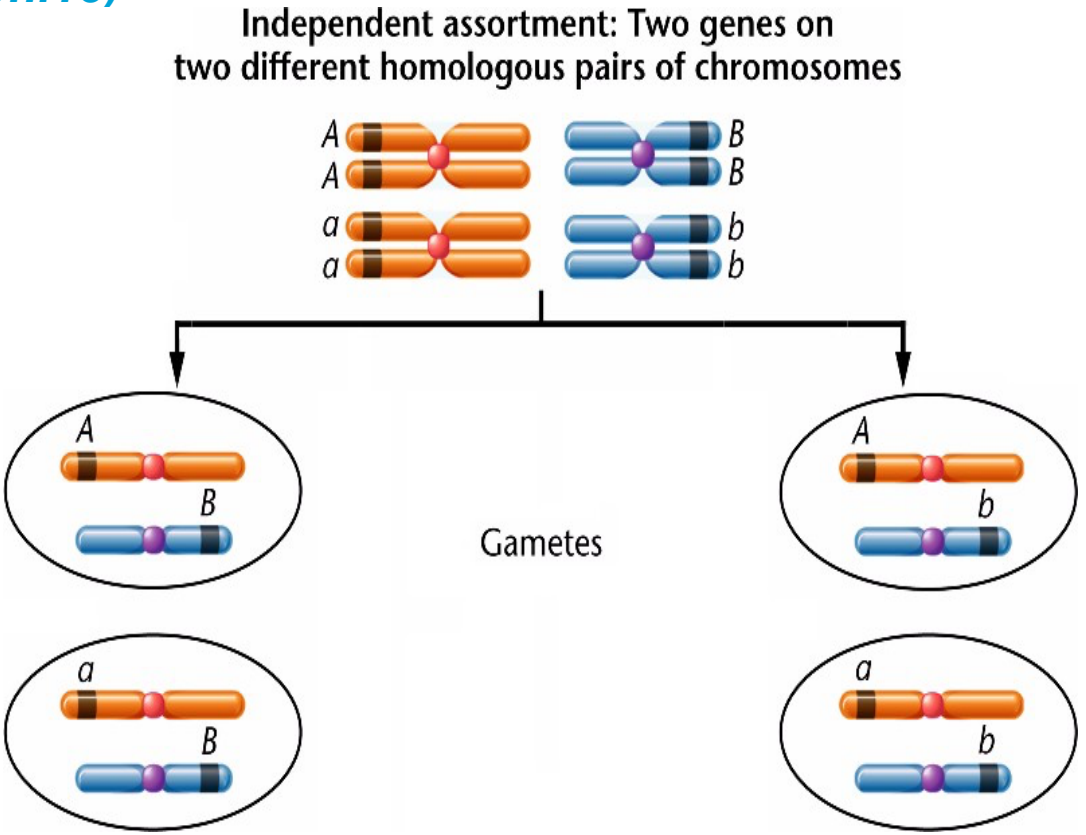
female / eggs	P	*p*
P	PP	P*p*
p	P*p*	*pp*

sperm		egg		offspring
P		P		PP
1/2	x	1/2	=	1/4
P		*p*		P*p*
1/2	x	1/2	=	1/4
p		P		P*p*
1/2	x	1/2	=	1/4
p		*p*		*pp*
1/2	x	1/2	=	1/4

Calculating probability of one character AND another character being inherited together

Recall that, when comparing multiple genes, allelic pairs *(the pairs of alleles for the same gene located on two homologous chromosomes)* segregate independently of allelic pairs of other genes located on a different set of homolous chromosomes during gamete formation *(Ch.13)*

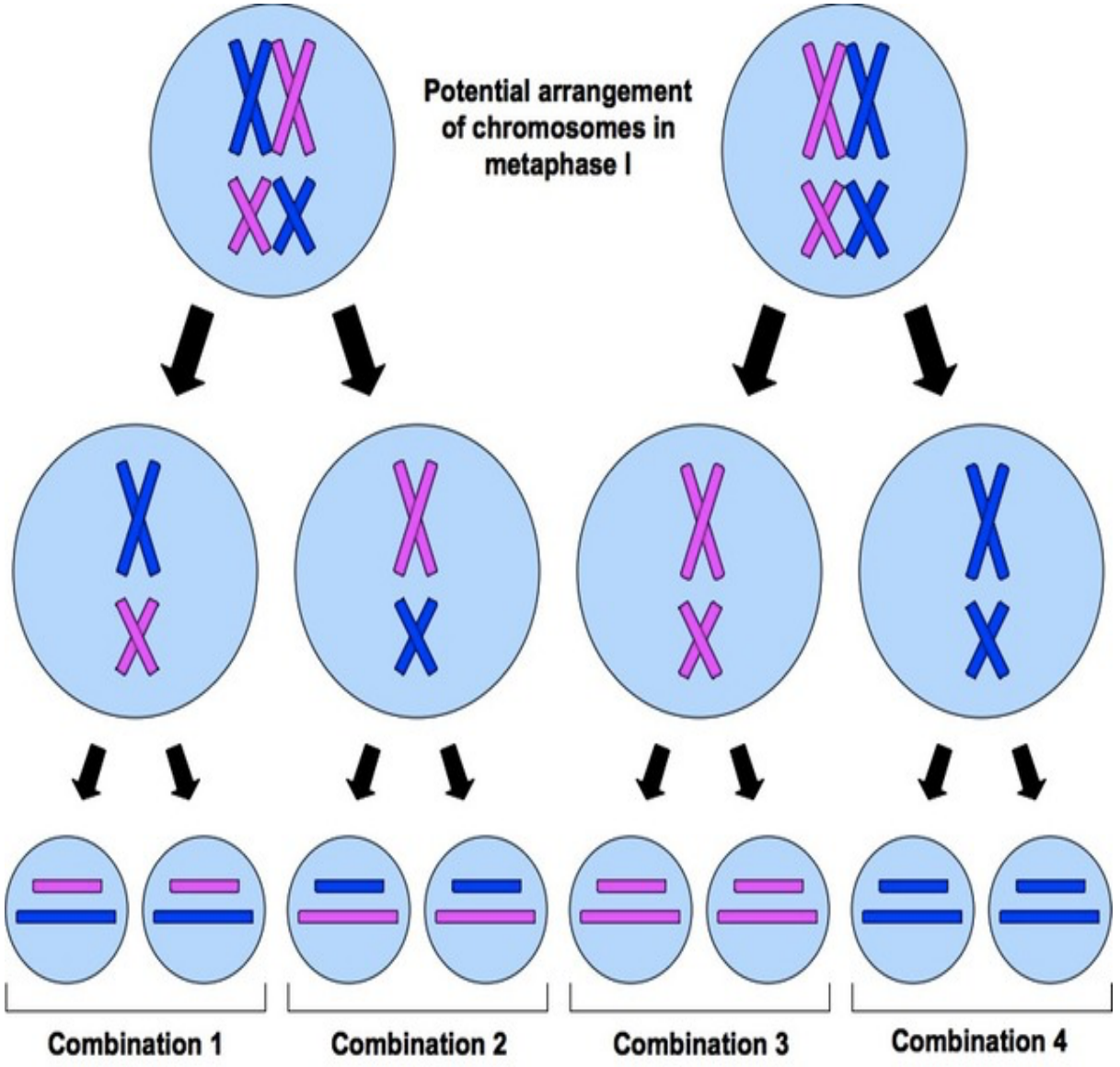
- **This is always the case as long as the 2 genes for different characters are located on 2 DIFFERENT chromosome types**
  - **This is because after homologs pair up in Prophase I, tetrads line up independently of one another on the metaphase plate during metaphase I of meiosis *(the law of independent assortment).***



Calculating probability of one character AND another character being inherited together

If the genes are not considered "linked," they are not located on the same chromosome type (same piece of DNA), but on different types of chromosomes.

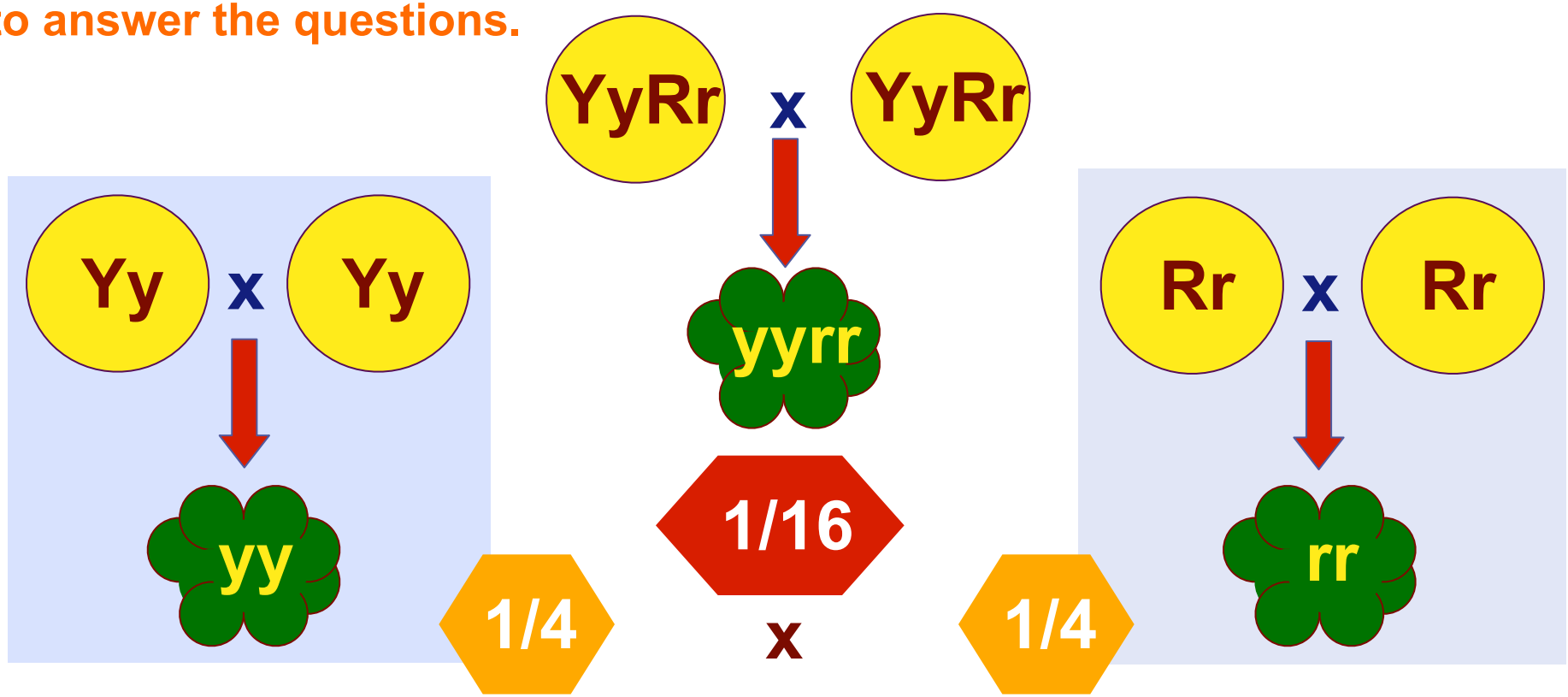
- **Because of the Independent Assortment of tetrads at Metaphase I, there is an equal probability of a haploid gamete inheriting any combination of alleles for the different non-linked genes located on different chromosomes types.**
  - **Recall, a gamete inherits one copy of each chromosome in a set.**



If two or more different genes are NOT linked, and so are found on different chromosomes (and, thus, different tetrads during Meiosis I), the results of a dihybrid cross or multi-character cross end up being equivalent to two or more independent monohybrid crosses occurring simultaneously.

What is the probability that these two parents produce this offspring?

You can either do one large dihybrid Punnet Square OR you can do two separate monohybrid Punnet Squares and apply the Multiplication Rule to answer the questions.



Apply the Rule of Multiplication

What is the probability that a cross between these two individuals will produce an offspring with this given genotype?

AABbccDdEEFf x AaBbccDdeeFf

AabbccDdEeFF

AA x Aa → Aa	1/2
Bb x Bb → bb	1/4
cc x cc → cc	1
Dd x Dd → Dd	1/2
EE x ee → Ee	1
Ff x Ff → FF	1/4

1/64

Rule of Addition

- Used to calculate the chance that an event can occur 2 or more different ways
  - THE CHANCE THAT THIS OR THAT WILL OCCUR
    - take the sum of the separate probabilities of each event
      - Ex: What is the probability of getting an offspring that is heterozygous when crossing Bb x Bb?

sperm		egg		offspring
B		b		Bb
1/2	x	1/2	=	1/4
b		B		Bb
1/2	x	1/2	=	1/4

1/4
+ 1/4
1/2

The probability of getting Bb OR bB

Any Questions??