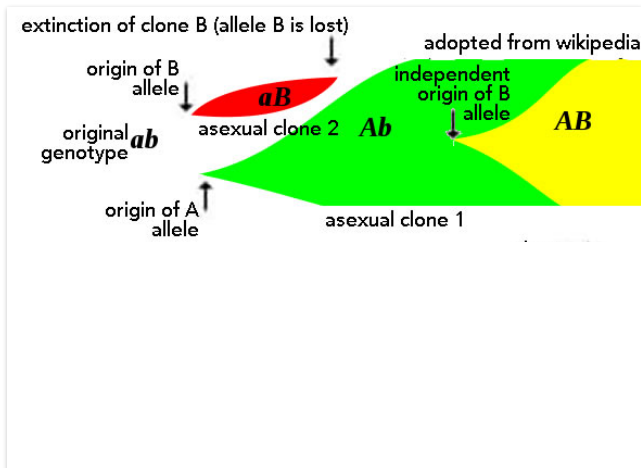




hand in questions

Value of sexual reproduction

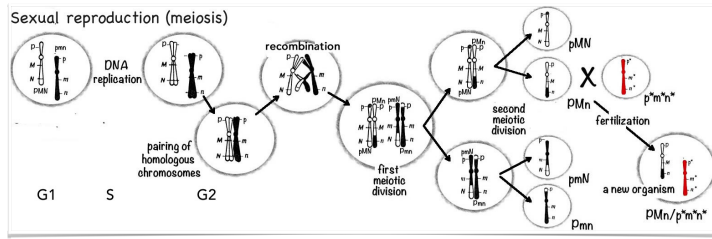


Questions to answer and ponder:

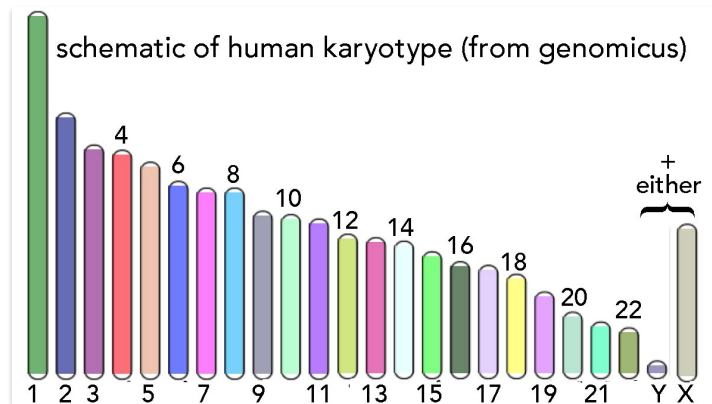
Consider the odds of an organism obtaining the 3 new mutations necessary for the appearance of a new trait.

If you were to predict, which would be faster (in terms of the number of generations required) in achieve this goal, a sexual or an asexual organism. Generate a drawing that illustrates your thinking.

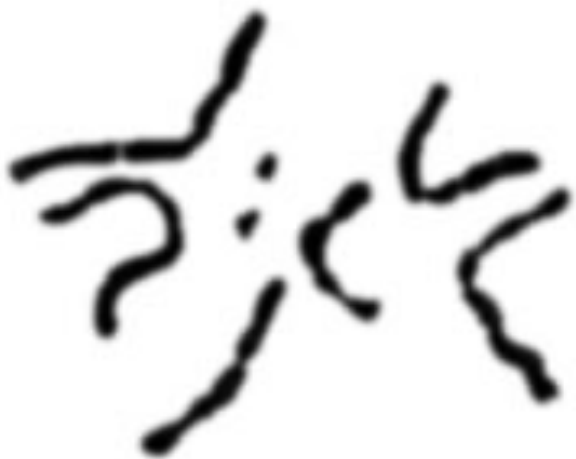
introducing meiosis: diploid to haploid



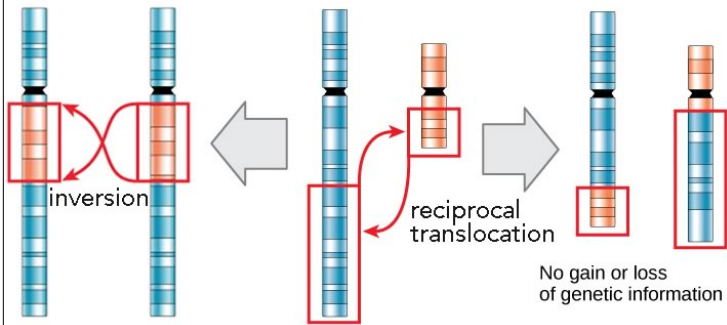
First step - pairing of homologous chromosomes



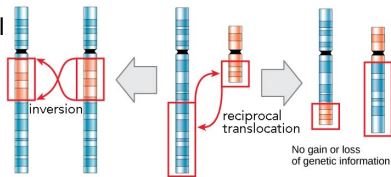
which chromosomes will pair (these are from drosophila)



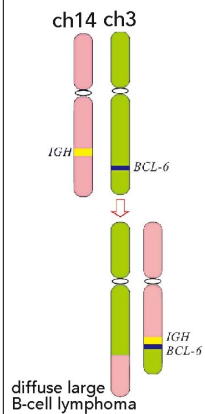
chromosomal rearrangements



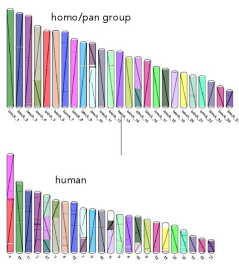
draw out how chromosomal rearrangements influence meiosis?



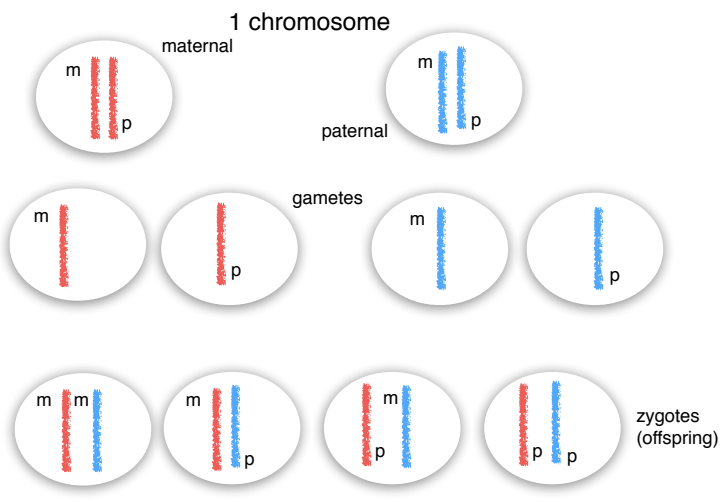
chromosomal rearrangements - effects on gene expression



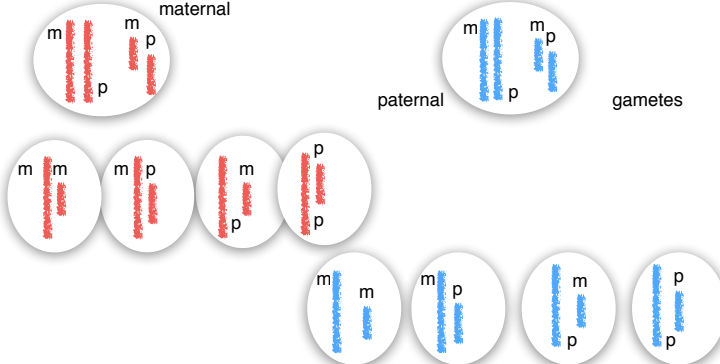
evolutionary chromosomal rearrangements



how many different types of outcome from “simple” meiosis



2 chromosomes



calculate (draw) the number of different zygotes

What happens if there are 4 or 23 distinct chromosomes
for 4 chromosomes: how many gametes
how many (genetically) different zygotes (new organism)

Now consider mutation rate

Article | [OPEN](#)

Differences between germline and
somatic mutation rates in humans and
mice

Brandon Milholland, Xiao Dong, Lei Zhang, Xiaoxiao Hao, Yousin Suh & Jan Vijg 

Nature Communications 8,
Article number: 15183 (2017)
doi:10.1038/ncomms15183

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Received: 21 July 2016
Accepted: 08 March 2017
Published online: 09 May 2017

in human: germline mutation rate (males) $\sim 3 \times 10^{-11}$ per bp
Somatic mutation rate $\sim 3 \times 10^{-9}$ per bp
haploid human genome $\sim 3 \times 10^9$ bps

both mutation rates are higher in mouse

Genetics

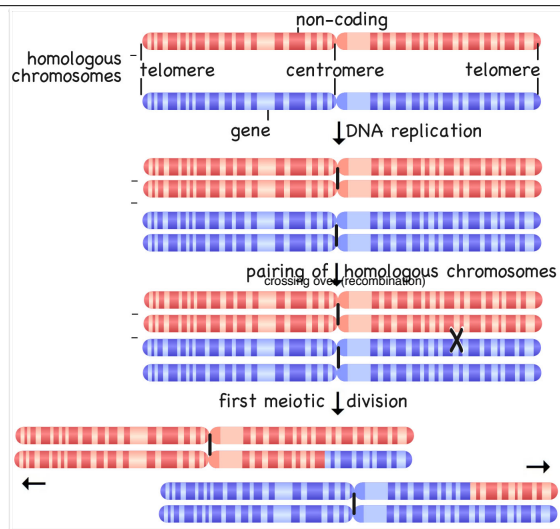
Fathers pass on four times as many new
genetic mutations as mothers – study

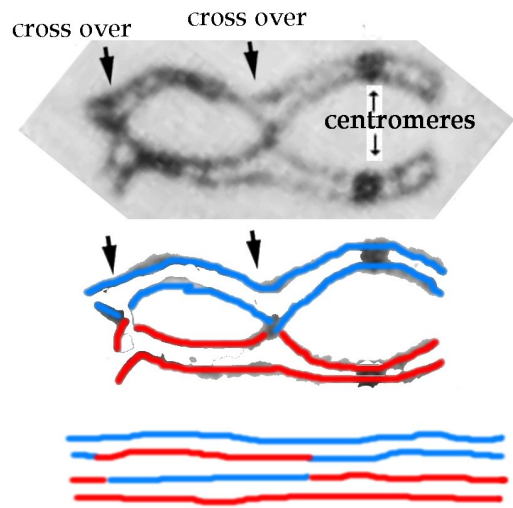
The figures mean that a child born to 30-year-old parents would, on average,
inherit 11 new mutations from the mother, but 45 from the father.

why, exactly?

Aidan: most meaningful problematic question

Now add recombination (crossing over)



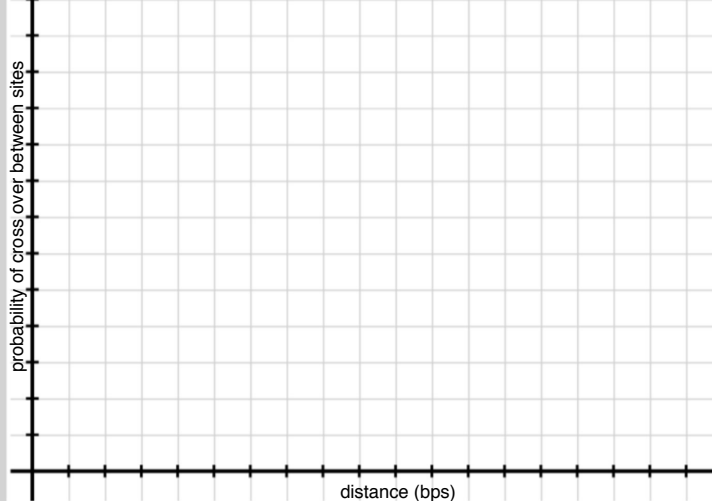


calculate average number of crossing over events
(50 Mbps = probability on crossing over ~1

Chromosome No.	Relative length ^{a)} (%)	Chromosome length (μm)	Type ^{b)}
1	20.30±0.16	8.07±0.05	m
2	11.19±0.08	4.45±0.06	m
3	7.47±0.03	2.97±0.05	sm
4	7.47±0.01	2.97±0.02	st
5	6.39±0.11	2.54±0.10	sm
6	6.19±0.05	2.46±0.08	st
7	5.11±0.23	2.03±0.05	sm
8	5.10±0.09	2.09±0.04	sm
9	5.01±0.08	1.99±0.01	sm
10	4.58±0.03	1.82±0.04	sm
11	4.15±0.09	1.65±0.05	sm
12	3.72±0.04	1.48±0.03	st
13	3.62±0.02	1.44±0.01	sm
14	3.30±0.10	1.31±0.06	sm
15	3.19±0.01	1.27±0.05	sm
16	3.19±0.01	1.27±0.03	sm
Total		39.81±0.73	

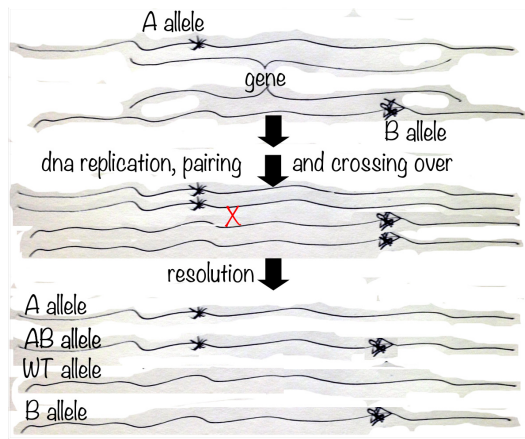
is crossing over deterministic>

probability of cross over as a function of distance

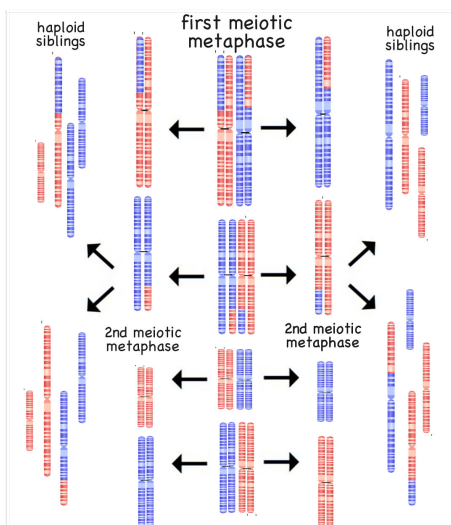


evolutionary effects: disconnect alleles

cross over to generate new allele (rarity) - why?



generation of variation



Questions to answer:

209. You are working with an organism with 5 autosomes and 1 sex chromosome. Considering only the effects of independent assortment during meiosis, how many different types of gametes could be generated? A drawing of the process could help.

210. Indicate (in a drawing and associated explanation) how a deleterious mutation within a gene could be generated by or eliminated from a gene.

211. How would genetic diversity be altered if meiotic recombination occurred during meiosis II, rather than during meiosis I?

Questions to ponder

-Under what conditions might you expect the evolution of sexual reproduction to be selected against?

-Why are parents and their siblings not necessarily good donors for organ transplantation?
