Generating a map using 3 or more genes

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc
abc/abc
Abc/abc
aBC/abc
ABc/abc
abC/abc
AbC/abc
aBc/abc

ABC, BAC, or BCA?

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc	PARENTAL
abc/abc	PARENTAL
Abc/abc	RECOMB
aBC/abc	RECOMB
ABc/abc	RECOMB
abC/abc	RECOMB
AbC/abc	RECOMB
aBc/abc	RECOMB

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc	PARENTAL	479
abc/abc	PARENTAL	473
Abc/abc	RECOMB	15
aBC/abc	RECOMB	13
ABc/abc	RECOMB	9
abC/abc	RECOMB	9
AbC/abc	RECOMB	1
aBc/abc	RECOMB	1

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc	PARENTAL	479	Parental (AB)
abc/abc	PARENTAL	473	Parental (ab)
Abc/abc	RECOMB	15	Recombinant (Ab)
aBC/abc	RECOMB	13	Recombinant (aB)
ABc/abc	RECOMB	9	Parental-like (AB)
abC/abc	RECOMB	9	Parental-like (ab)
AbC/abc	RECOMB	1	Recombinant (Ab)
aBc/abc	RECOMB	1	Recombinant (aB)

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc	PARENTAL	479
abc/abc	PARENTAL	473
Abc/abc	RECOMB	15
aBC/abc	RECOMB	13
ABc/abc	RECOMB	9
abC/abc	RECOMB	9
AbC/abc	RECOMB	1
aBc/abc	RECOMB	1

Identify recombinants between A and C, and between B and C.

Calculate all map distances:
A-B = 0.03M = 3cM
A-C = ?
B-C = ?

Order = ?

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc	PARENTAL	479
abc/abc	PARENTAL	473
Abc/abc	RECOMB	15
aBC/abc	RECOMB	13
ABc/abc	RECOMB	9
abC/abc	RECOMB	9
AbC/abc	RECOMB	1
aBc/abc	RECOMB	1

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order? Is A next to B or A next to C?

ABC/abc	PARENTAL	479
abc/abc	PARENTAL	473
Abc/abc	RECOMB	15
aBC/abc	RECOMB	13
ABc/abc	RECOMB	9
abC/abc	RECOMB	9
AbC/abc	RECOMB	1
aBc/abc	RECOMB	1

Map distances:
A-B = 0.03M = 3cM
A-C = 0.046M = 4.6cM
B-C = 0.02M = 2cM

B – A – C

A – C – B

A – B – C

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order?

A – B – C

ABC/abc	PARENTAL	479
abc/abc	PARENTAL	473
Abc/abc	RECOMB	15
aBC/abc	RECOMB	13
ABc/abc	RECOMB	9
abC/abc	RECOMB	9
AbC/abc	RECOMB	1
aBc/abc	RECOMB	1

Map distances:
A-B = 0.03M = 3cM
A-C = 0.046M = 4.6cM
B-C = 0.02M = 2cM

Why don't AB + BC add up to AC total?

So, what if have THREE genes?

- **ABC/abc x abc/abc**
- Parental phase is ABC or abc, but what is the linear order?

A – B – C

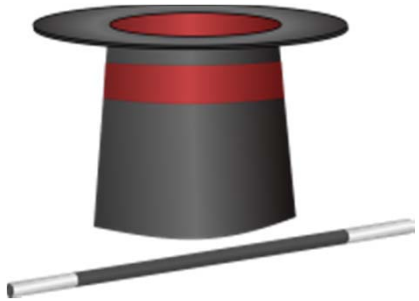
ABC/abc	PARENTAL	479
abc/abc	PARENTAL	473
Abc/abc	RECOMB	15
aBC/abc	RECOMB	13
ABc/abc	RECOMB	9
abC/abc	RECOMB	9
AbC/abc	RECOMB	1
aBc/abc	RECOMB	1

Map distances:
A-B = 0.03M = 3cM
A-C = 0.046M = 4.6cM
B-C = 0.02M = 2cM

Why don't AB + BC add up to AC total?

Bottom two counted as "PARENTAL" for A-C but are actually "double crossovers"

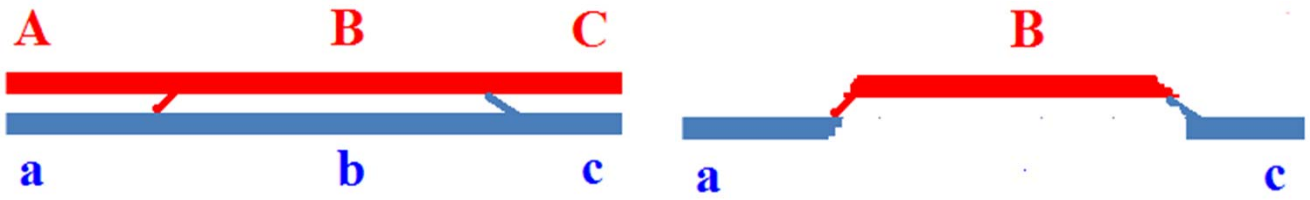
Some tricks!



- If all loci are linked:
  - Largest two will be original, non-recombinant parentals
  - Smallest two will be “double crossover”
    - Why?

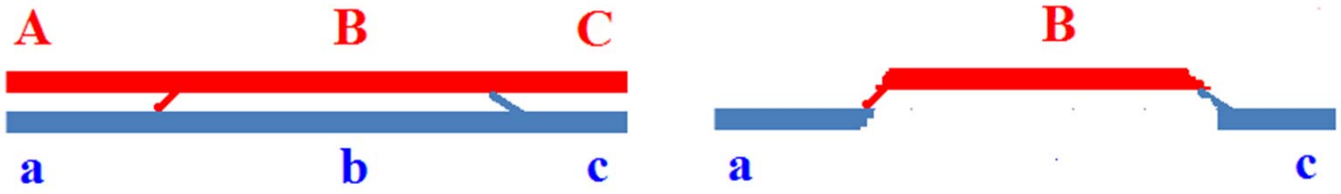
Double crossovers

- **a B c** would be a "double crossover" gamete
- If 1% recombination between A - B, 1% between B - C, then 0.01% for double c.o.
- **This is why they're the rarest class from cross**



Double crossovers

- **a B c** would be a "double crossover" gamete
- **Can identify which marker is in the middle in rarest class because alleles at two markers will be parental, while allele at third will be recombinant**



Order of genes?

- ABC/abc: 462
- abc/abc: 439
- AbC/abc: 24
- Abc/abc: 24
- abC/abc: 1
- ABc/abc: 3
- aBc/abc: 23
- aBC/abc: 24

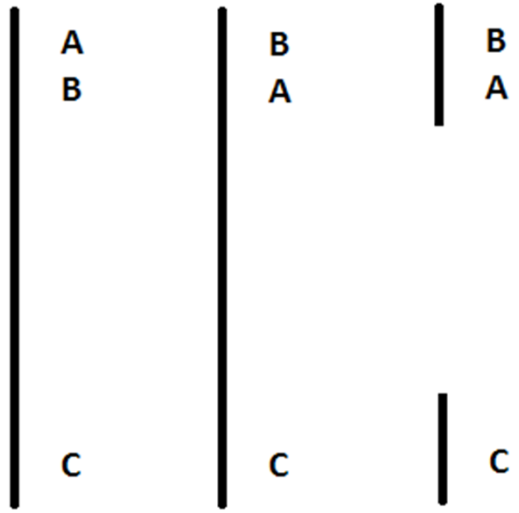
Calculate distance

- ABC: 462
- abc: 439
- AbC: 24
- Abc: 24
- abC: 1
- ABc: 3
- aBc: 23
- aBC: 24

What would it mean if you got these map distances?

- A-B = 11%
- B-C = 49%
- A-C = 50%

- Remember, above 40%, map distances are very inaccurate (and may be basically 50%)...



Same thing is done in the context of "phenotypes"

- **vg cn b / vg^+ cn^+ b^+ x vg cn b / vg cn b**


+ + + 784


+ + b 88


vg + + 90


vg + b 11


+ cn + 5


+ cn b 84


vg cn + 77


vg cn b 861

2 steps to solve

Correct answer in notes, see other example on pg 132

Same thing is done in the context of "phenotypes"

- vg cn b / vg^+ cn^+ b^+ x vg cn b / vg cn b


+ + + 784


+ + b 88


vg + + 90


vg + b 11


+ cn + 5


+ cn b 84


vg cn + 77

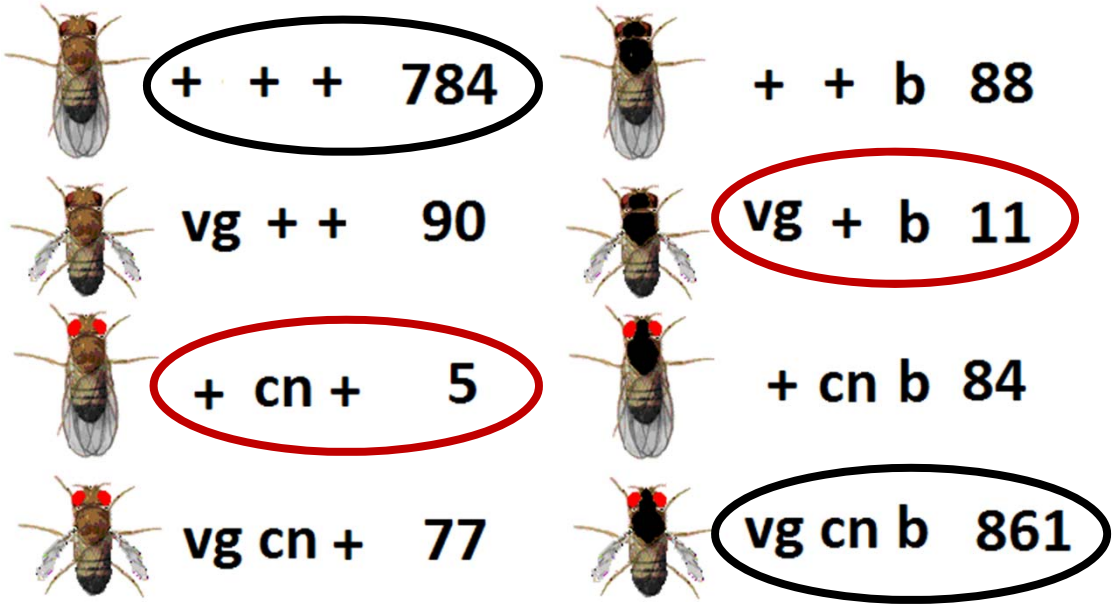

vg cn b 861

2 steps to solve

Correct answer in notes, see other example on pg 132

Same thing is done in the context of "phenotypes"

- vg cn b / vg^+ cn^+ b^+ x vg cn b / vg cn b

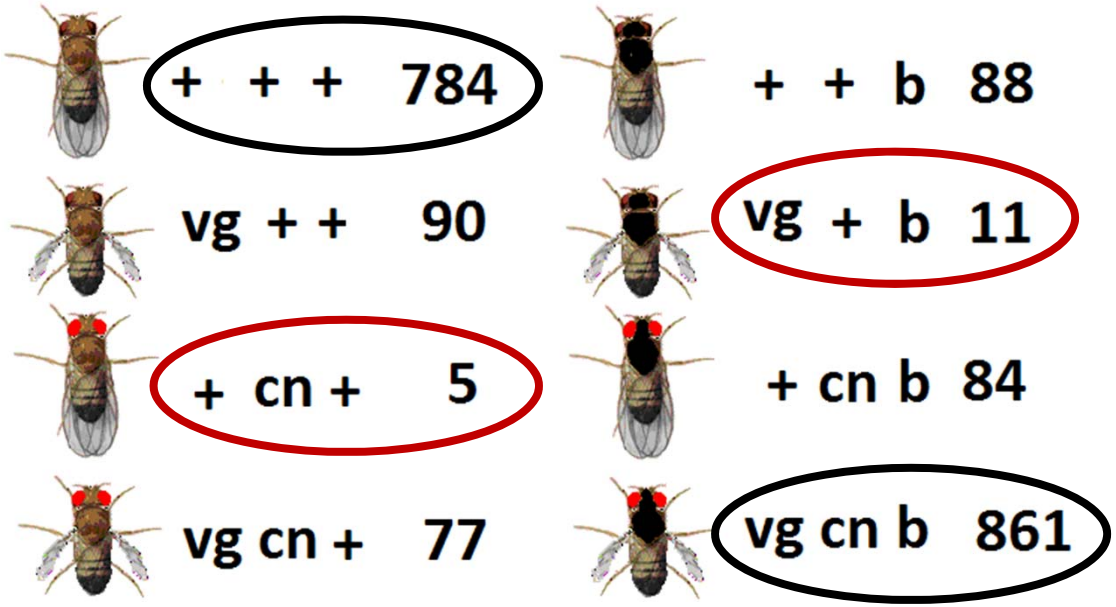


2 steps to solve

Correct answer in notes, see other example on pg 132

Same thing is done in the context of "phenotypes"

- vg cn b / vg^+ cn^+ b^+ x vg cn b / vg cn b



Order:
vg-cn-b

Correct answer in notes, see other example on pg 132

Perl program online

- **Same program that will be used to generate your problem set & test questions**
- Make your own practice problems!
- Assumptions of program—
  - Program assumes one parental type ABC/abc
  - Program assumes other parent abc/abc

Perl is free for download:
http://www.perl.org/get.html
Typically already installed
on Macs or Unix platforms

Image Credits, Unit 4-3

- Fruit fly drawings, © Rob Wyatt, Western Kentucky University, all rights reserved, reprinted with permission