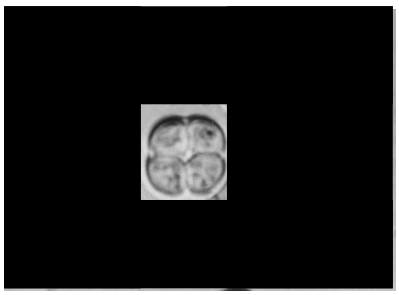
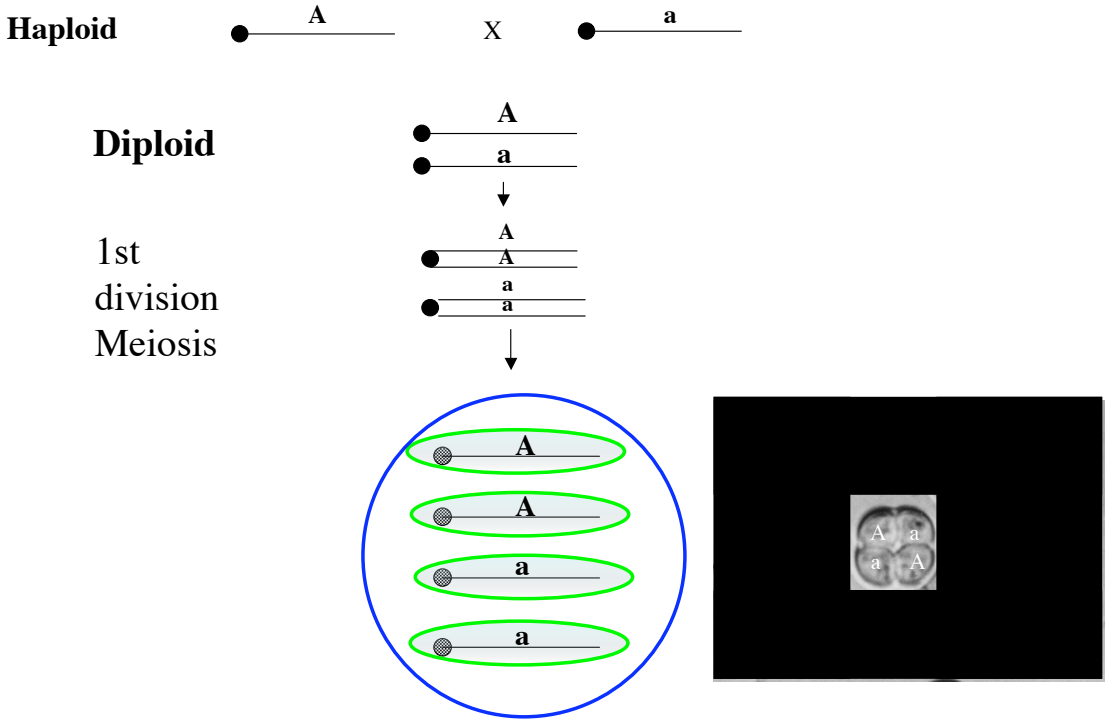
TETRAD ANALYSIS IN FUNGI



THE PRODUCTS OF A SINGLE MEIOSIS
ARE PACKAGED IN A SAC (ASCUS)

THE PRODUCTS OF A SINGLE MEIOSIS

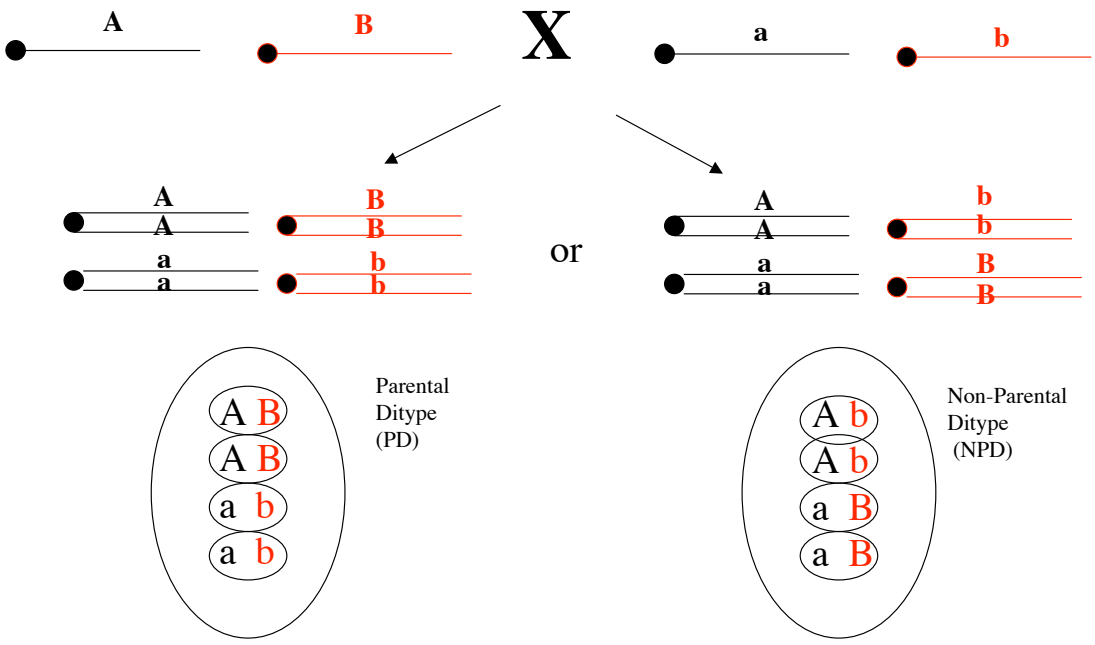


Mendel

1. Segregation: Equal numbers of A and a
   - •The phenotype resulting from a mutation in a single gene will segregate exactly 2A : 2a.

   - •Question in Tetradspeak:
     Does the phenotype segregate2:2?
     Yes. A and a are alleles of a single gene.

HOW DO WE KNOW WHETHER TWO GENES ARE LINKED?



How do you determine linkage?

You cross AB x ab and find in 100 tetrads:

48 PD
52 NPD

Are A and B linked?

Mendel

1. Segregation: Equal numbers of A and a
   - •The phenotype resulting from a mutation in a single gene will segregate exactly 2A : 2a.

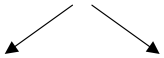
   - •Question in Tetradspeak:
     Does the phenotype segregate 2:2?
     Yes. A and a are alleles of a single gene.

2. Independent Assortment (linkage): AB x ab
   - •Tetradspeak: Are PD = NPD

Two genes are unlinked *Two genes are linked*

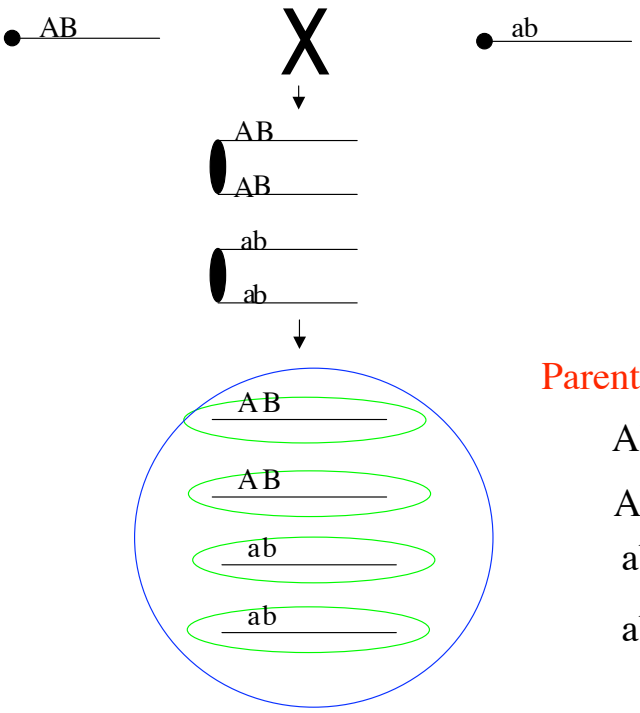
Independent Assortment (linkage): AB x ab

•Tetradspeak: Are PD = NPD



Two genes are unlinked *Two genes are linked*

Complete Linkage of Two Genes



Parental ditype

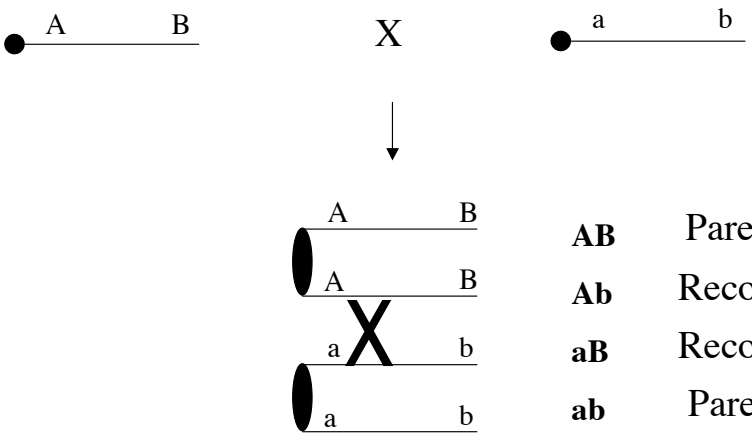
AB

AB

ab

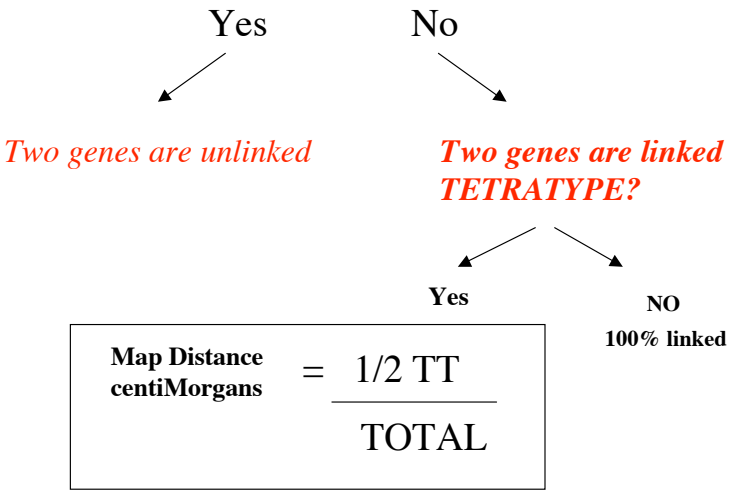
ab

The Products of a Single Crossover



TETRATYPE

2. Independent Assortment (linkage): AB x ab
   - •Tetradspeak: Are PD = NPD



How do you determine linkage?

You cross AB x ab and find in 100 tetrads:

90 PD
10 TT

Are they linked?

90 PD = 90 X4 = 360 Non-Recombinant Progeny
10 TT = 10 x 2 = 20 Recombinant Progeny

$$\text{MD in centimorgans} = \frac{\text{Recombinants}}{\text{Total tetrads}} \times 100$$

MD = 20/400= 5 centiMorgans

$$\textbf{Map Distance centiMorgans} = \frac{1/2\ TT}{TOTAL}$$

Linkage AB x ab
Are PD = NPD?

Yes → *Two genes are unlinked*

No → ***Two genes are linked TETRATYPE?***

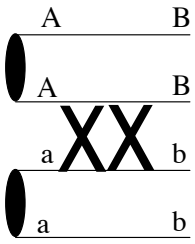
Yes

$$\textbf{Map Distance} = \frac{1/2\ TT}{TOTAL}$$

NO
100% linked

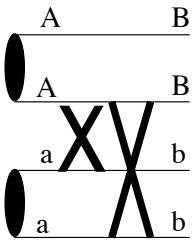
WHAT ABOUT DOUBLE CROSSOVERS?

DOUBLE CROSSOVERS



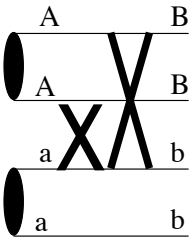
AB
AB
ab
ab

PD



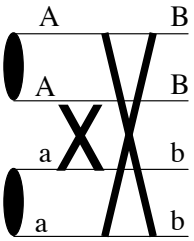
AB
Ab
ab
aB

TT



Ab
AB
aB
ab

TT

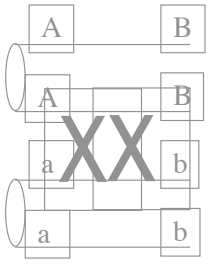


Ab
Ab
aB
aB

NPD

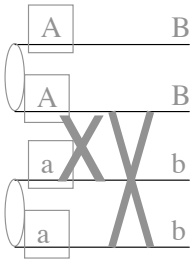
1PD : 1NPD :2TT

CROSSING OVER OCCURS AT THE 4 STRAND STAGE



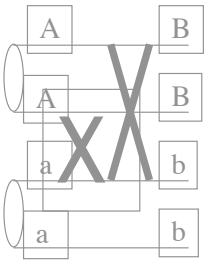
AB
AB
ab
ab

PD



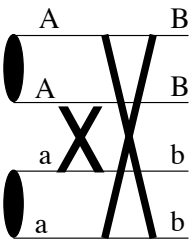
AB
Ab
ab
aB

TT



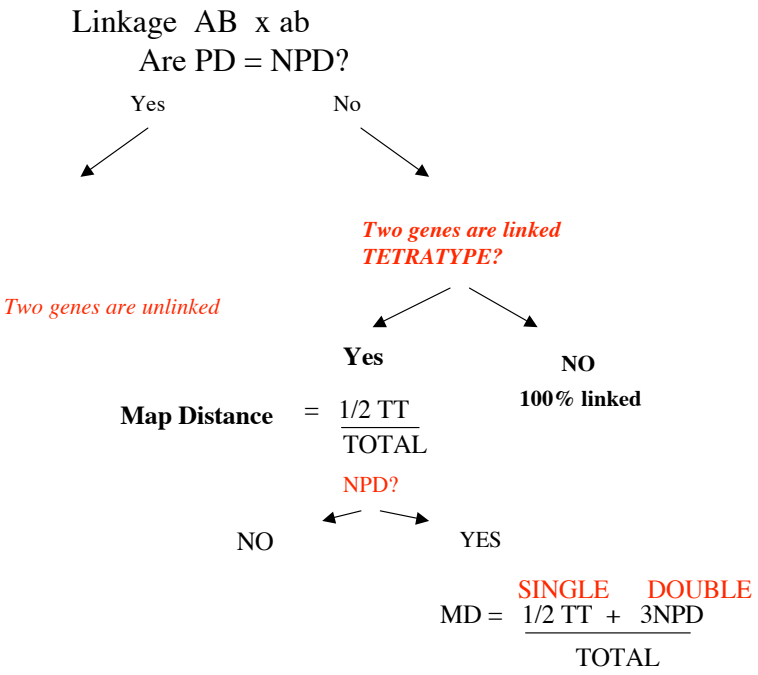
Ab
AB
aB
ab

TT



Ab
Ab
aB
aB

NPD



ESTIMATION OF DOUBLE CROSSOVERS

Singles = TT

Doubles = 1PD :2TT: 1NPD

Single 1/2 (TT-2NPD)

Doubles 4NPD

$$\textbf{MD} = \frac{\textbf{1/2(TT-2NPD) + 4NPD}}{\textbf{Total}}$$

$$\textbf{MD} = \frac{\textbf{SINGLE 1/2 TT + DOUBLE 3NPD}}{\textbf{TOTAL}}$$

How do you determine linkage?

You cross AB x ab and find in 100 tetrads:

70 PD
20TT
10NPD

Count crossover gametes $= \frac{40 + 4\,(10)}{400} \times 100 =$ **20 cM**

Analyze tetrads $= \frac{10 + 30}{100} \times 100 =$ **40 cM**

If we just count crossover gametes we would underestimate the distance.

THE THREE TYPES OF TETRADS

Parental	Non-Parental	Tetratype
A B	A b	A B
A B	A b	A b
a b	a B	a B
a b	a B	a b

NO ONE TETRAD TYPE IS SUFFICIENT.

IT IS THE RELATIONSHIP THAT TELLS ALL