# Gametic selection, meiotic drive, sex ratio bias, and transitions b/w sex determination systems

Matthew Osmond[2]

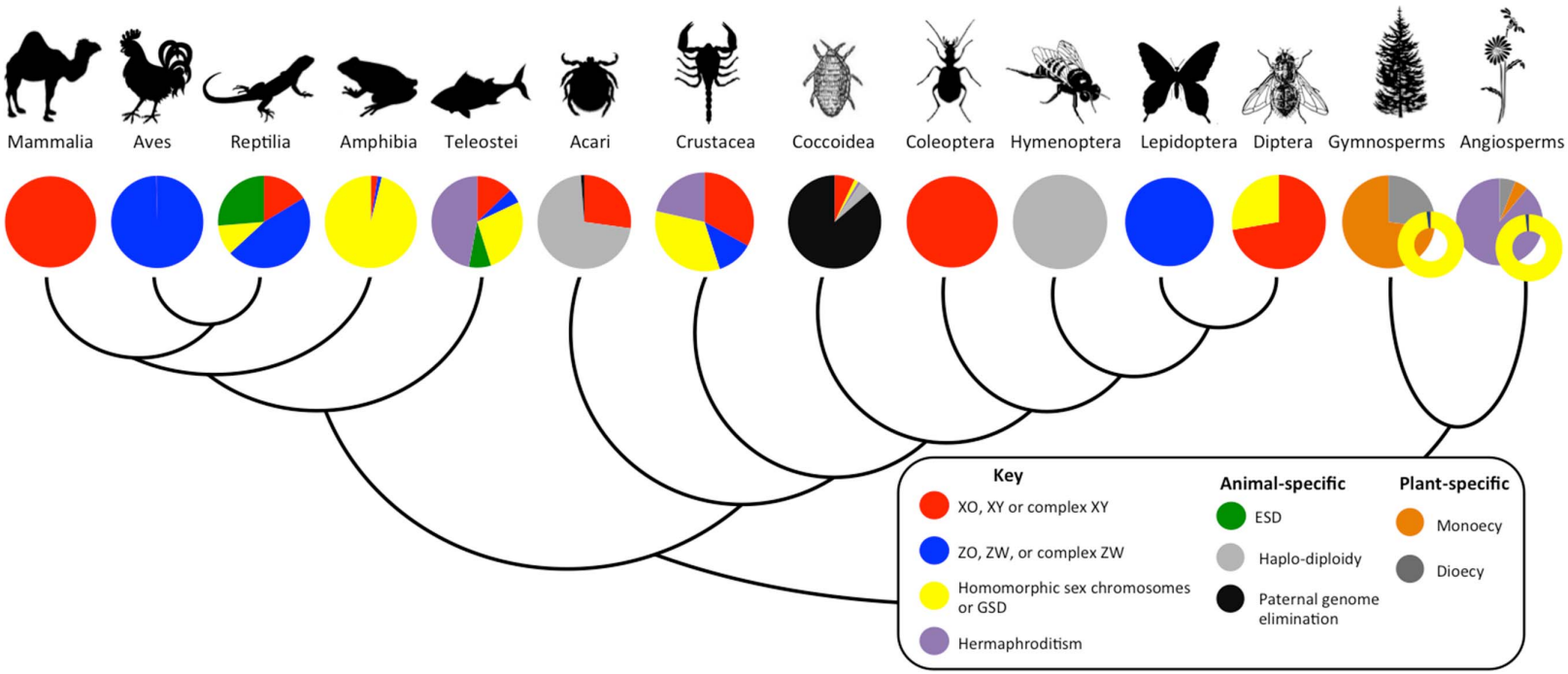
[1]University College London & [2]University of British Columbia

Evolution 2017

Michael Scott[1]

Sally Otto[2]

# Sex determination systems are remarkably dynamic




**Sex Determination: Why So Many Ways of Doing It?**

Bachtrog *et al.* 2014

# Sex determination systems are remarkably dynamic

2 theories

# Theory 1: Turnover caused by sex-ratio selection

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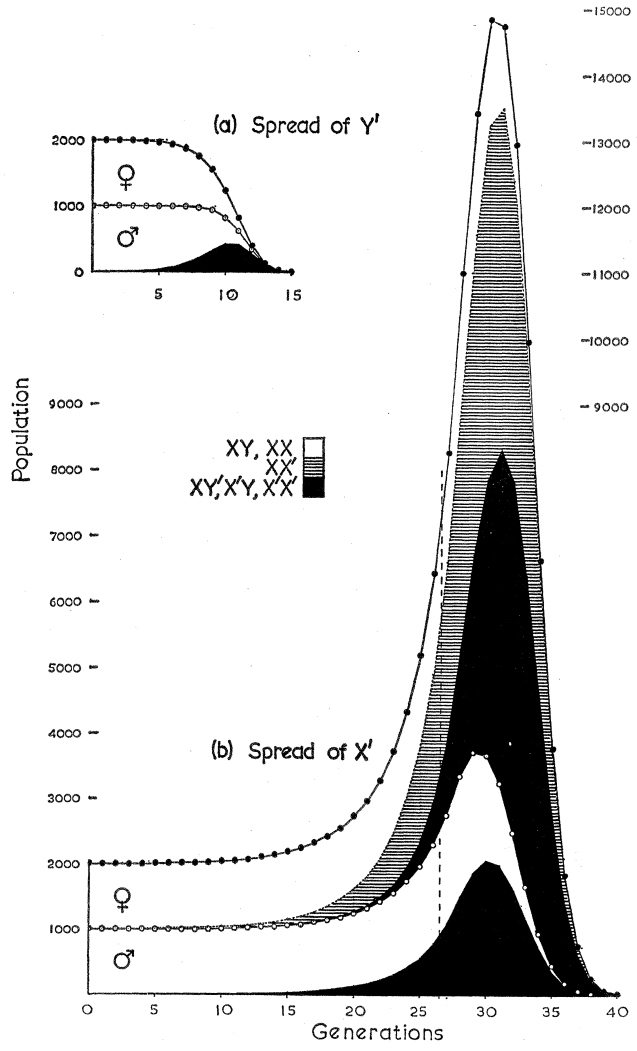
Meiotic-drive for *Y* increases ♂ : ♀




**Extraordinary Sex Ratios**

Hamilton 1967

# Theory 1: Turnover caused by sex-ratio selection

Meiotic-drive for $Y$ increases ♂ : ♀

neo-$W$ restores 1 : 1 sex ratio

$$XY \rightarrow ZW$$

Hamilton 1967

Kozielska *et al.* 2010

# Theory 2: Turnover caused by sex-antagonistic selection

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van Doorn & Kirkpatrick 2010

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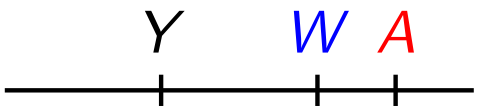


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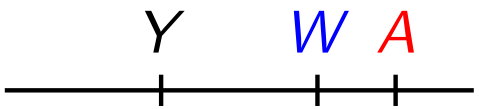


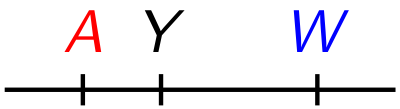


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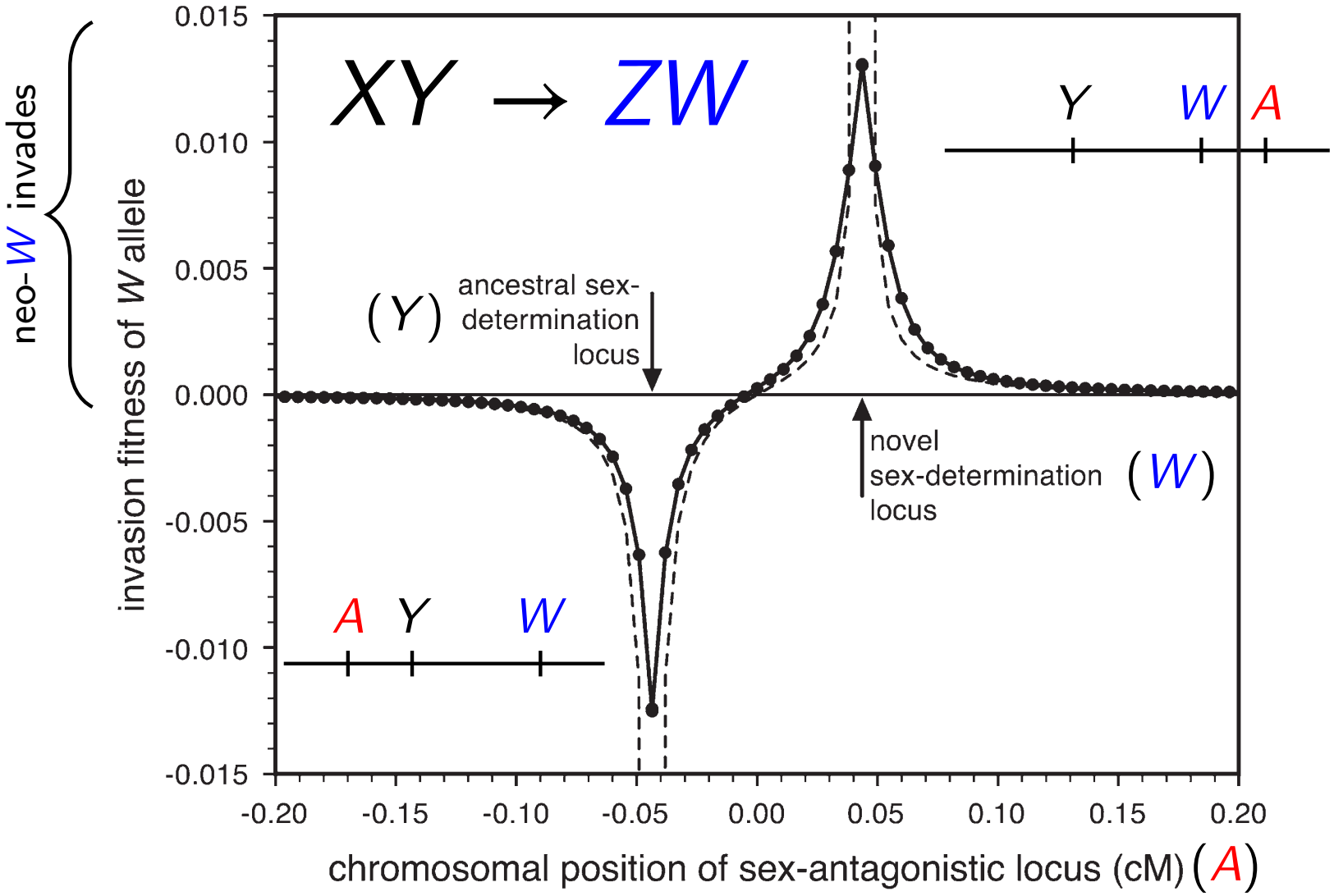


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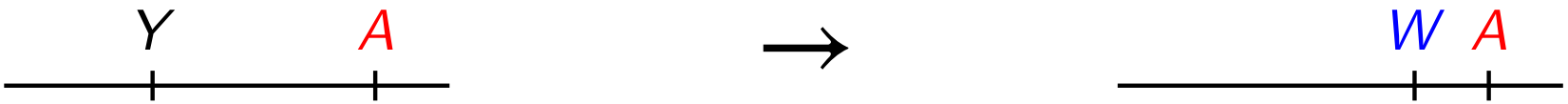
turnover increases sex-linkage

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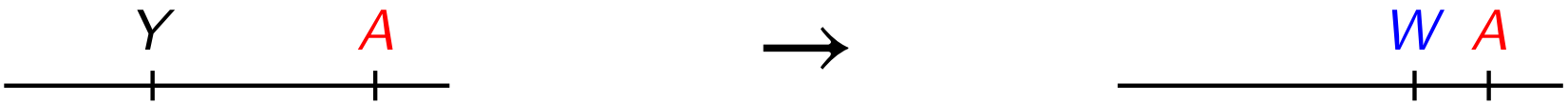


neo-$W$ is a better sex-specialist

van Doorn & Kirkpatrick 2010

# Sex-ratio **vs.** sex-antagonistic selection

# Haploid-diploid life-cycles

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**Haploid selection (gametic competition and meiotic drive)**

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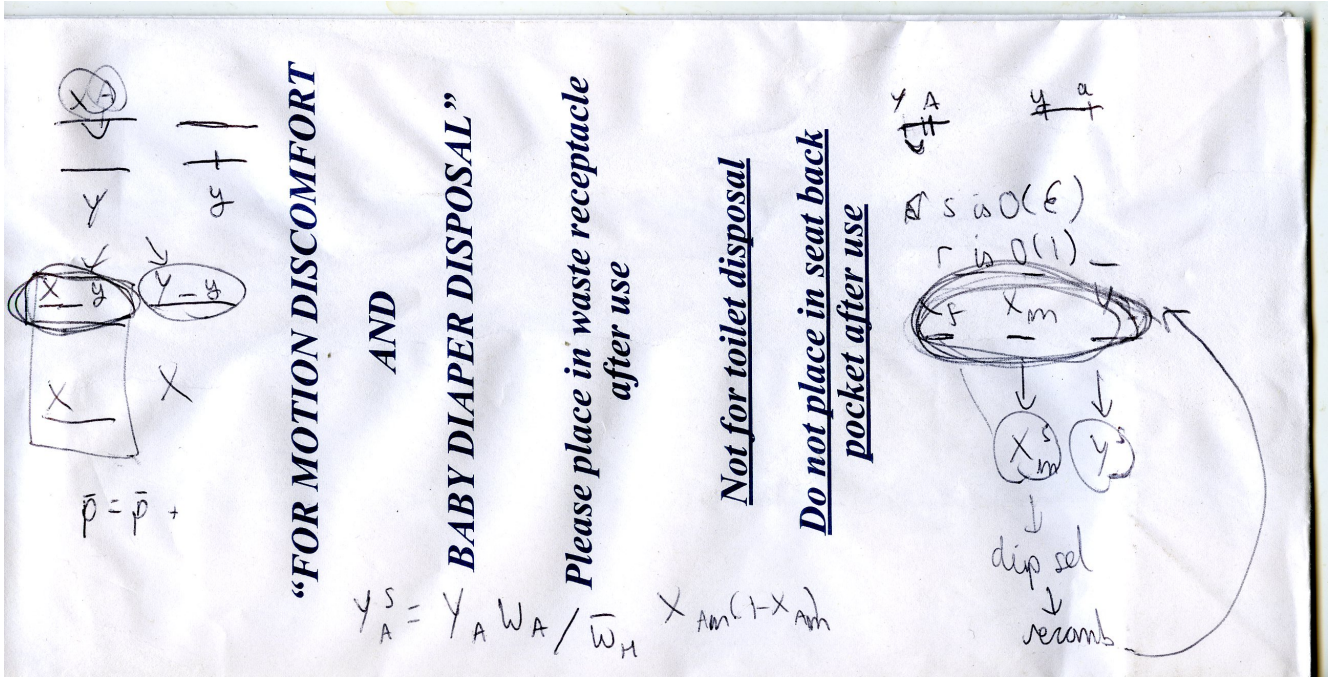
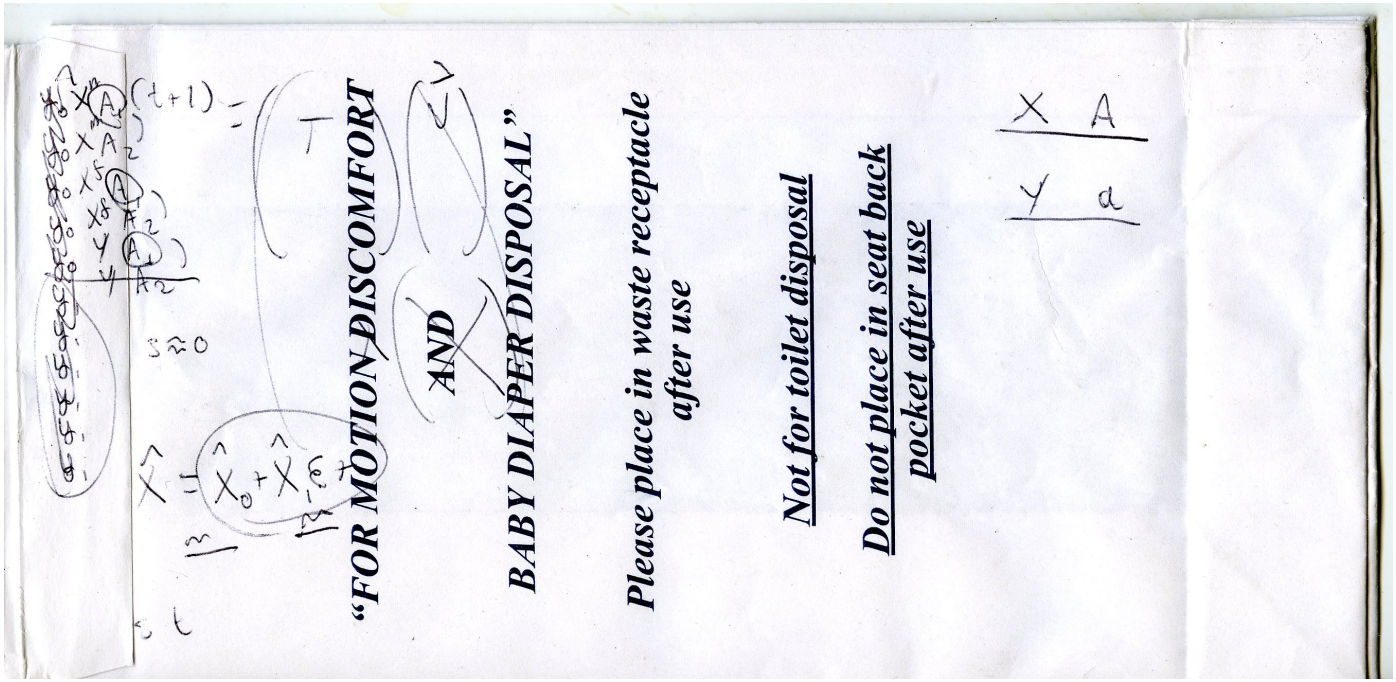
**Question**

How does haploid selection influence sex-determination turnover?

# Model


"FOR MOTION DISCOMFORT
AND
BABY DIAPER DISPOSAL"
Please place in waste receptacle after use
Not for toilet disposal
Do not place in seat back pocket after use
dip sel
recomb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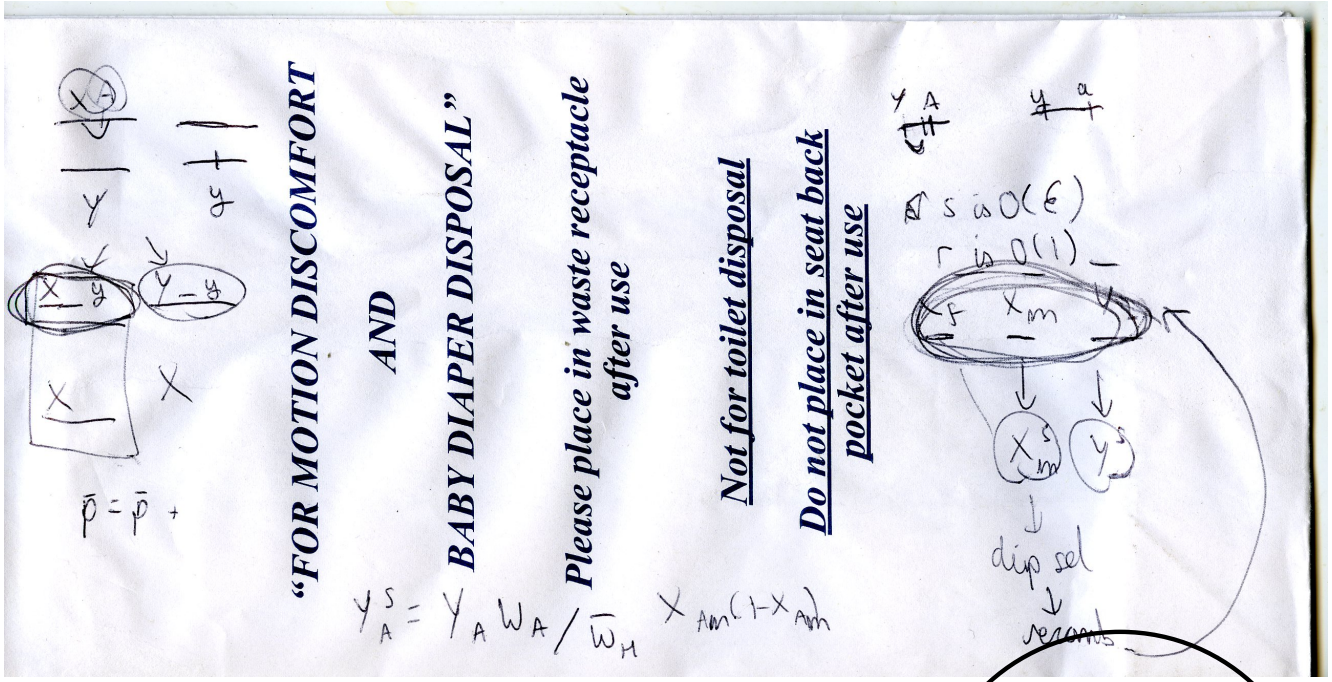
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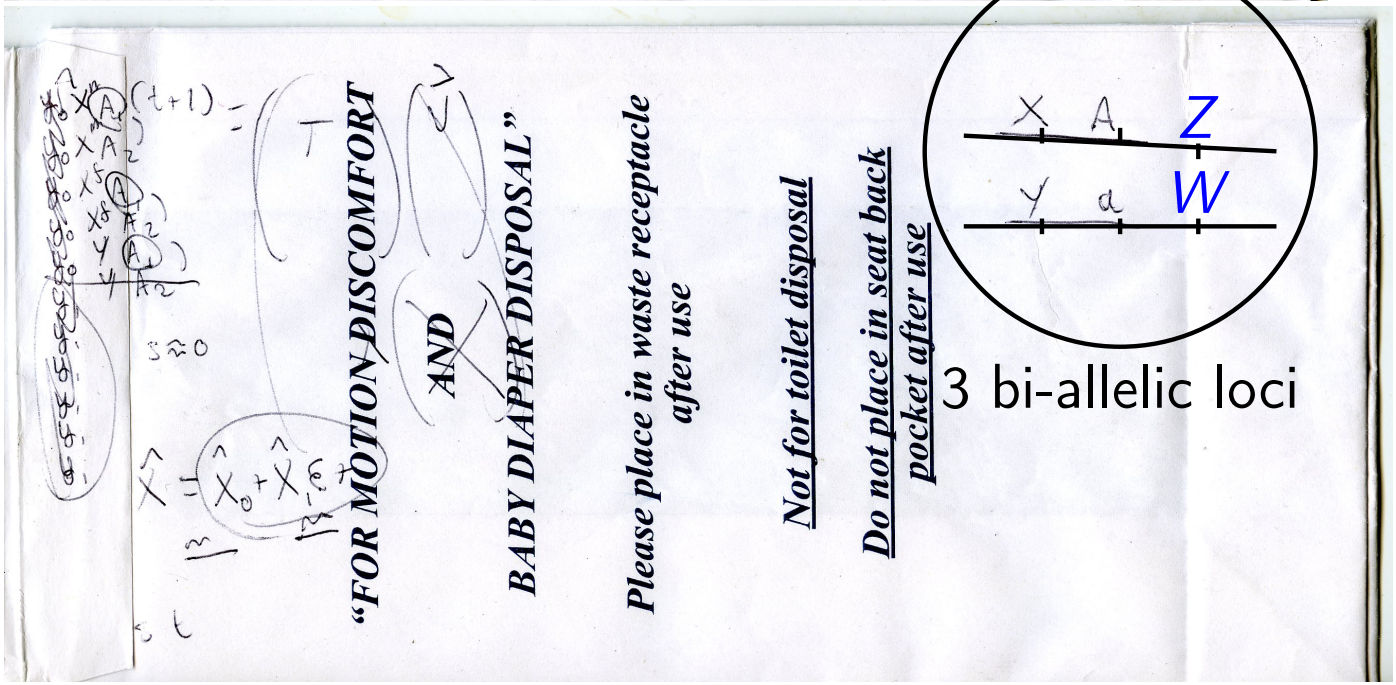
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X A Z
Y a W
3 bi-allelic loci

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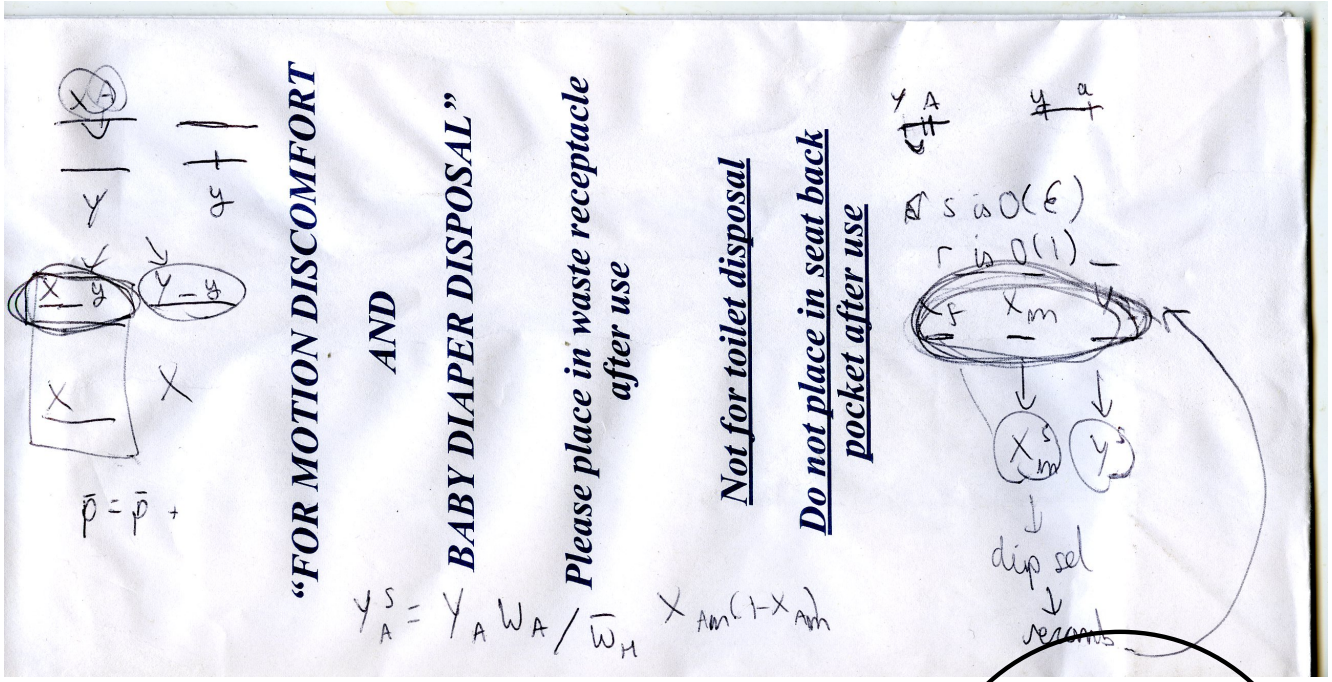
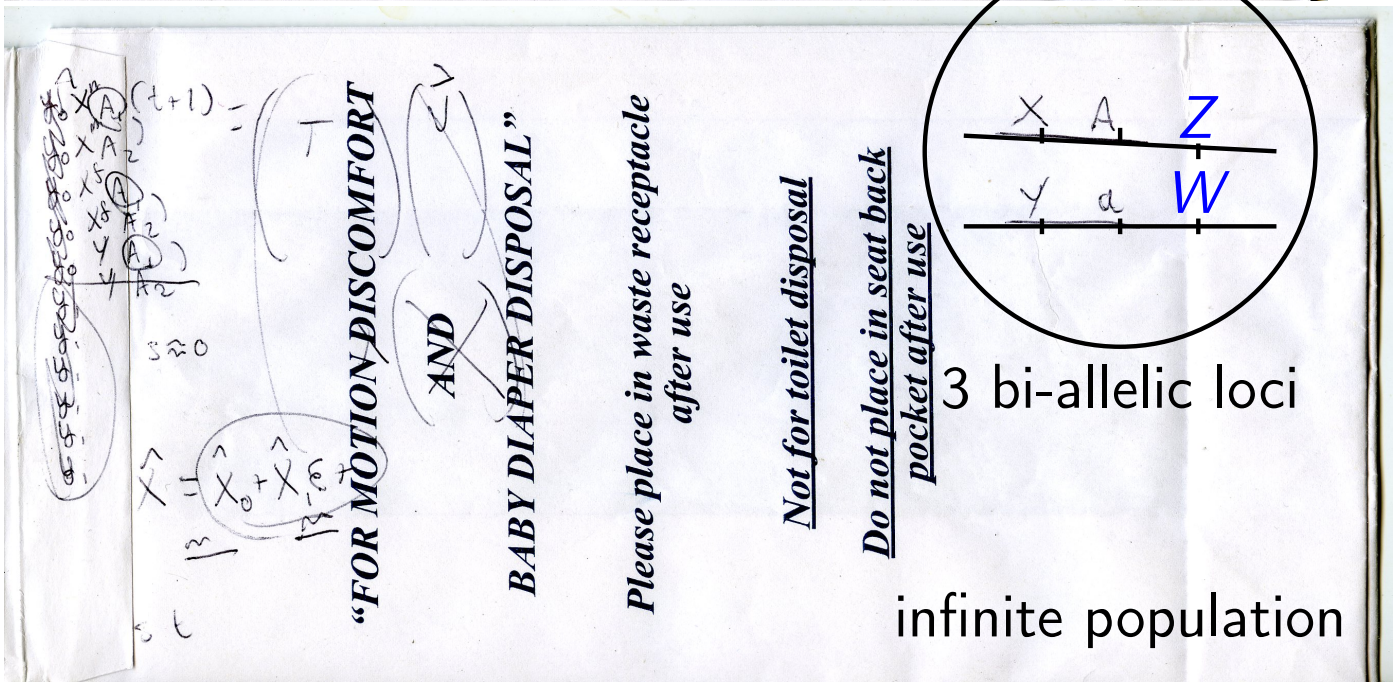



3 bi-allelic loci

infinite population

# Model

diploid sel$^n$

↓

segregation

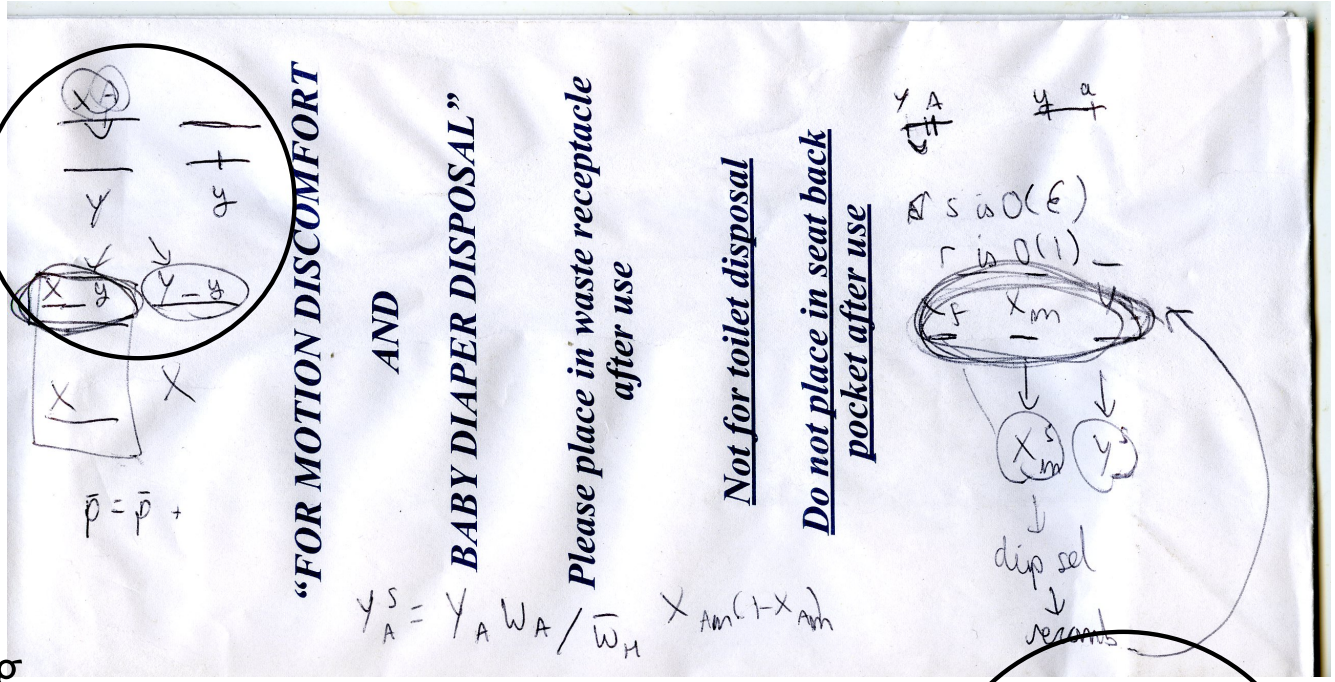
↓

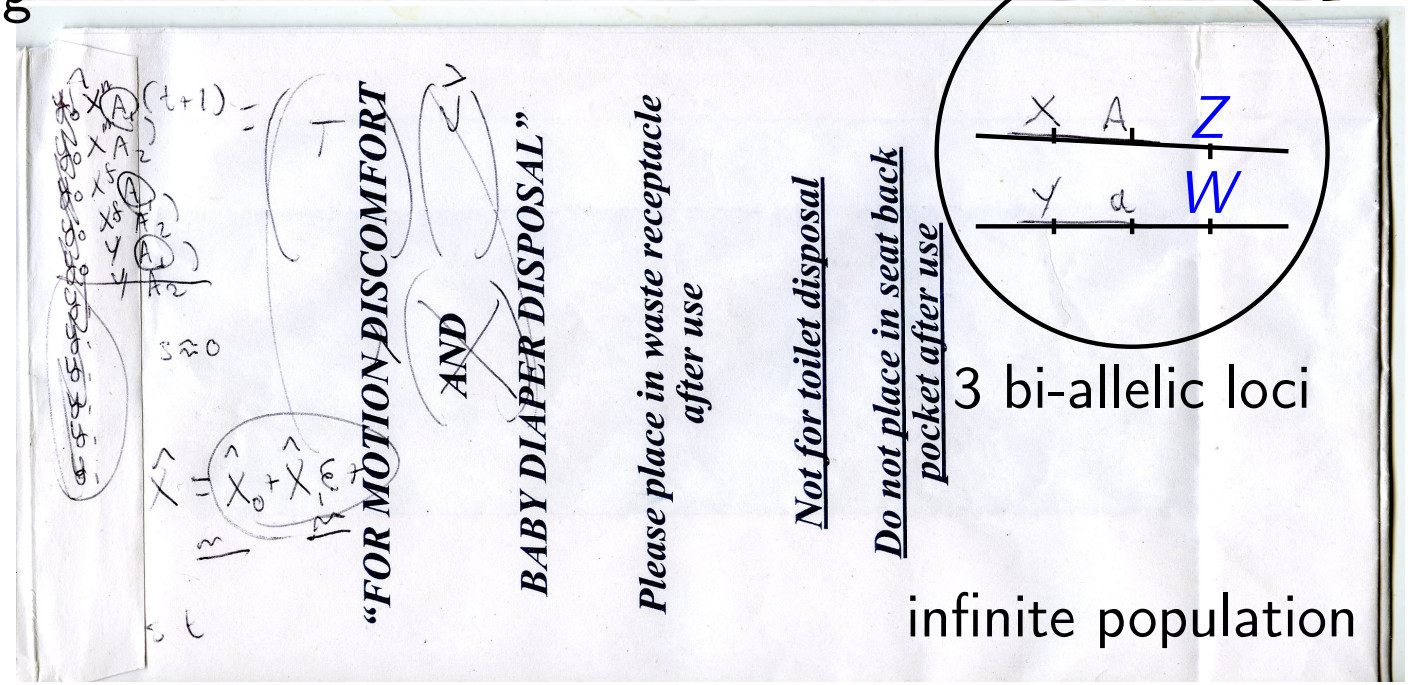
haploid sel$^n$

↓

random mating

↓

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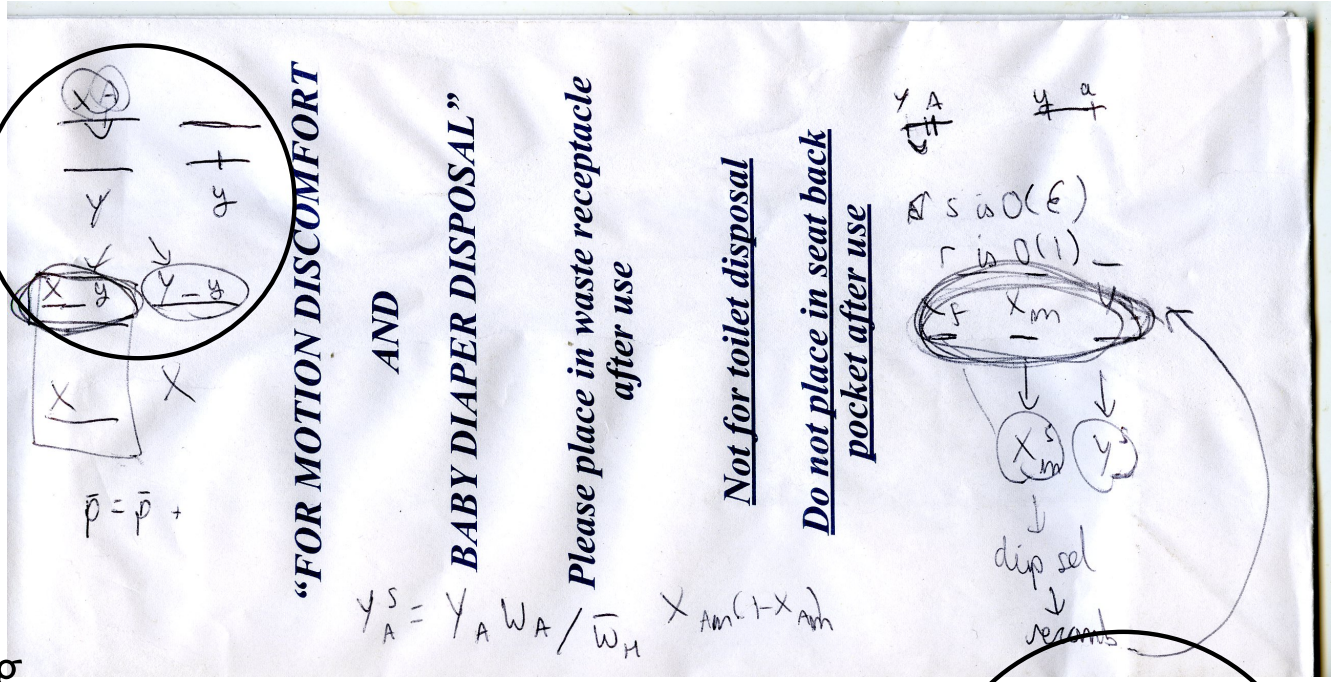


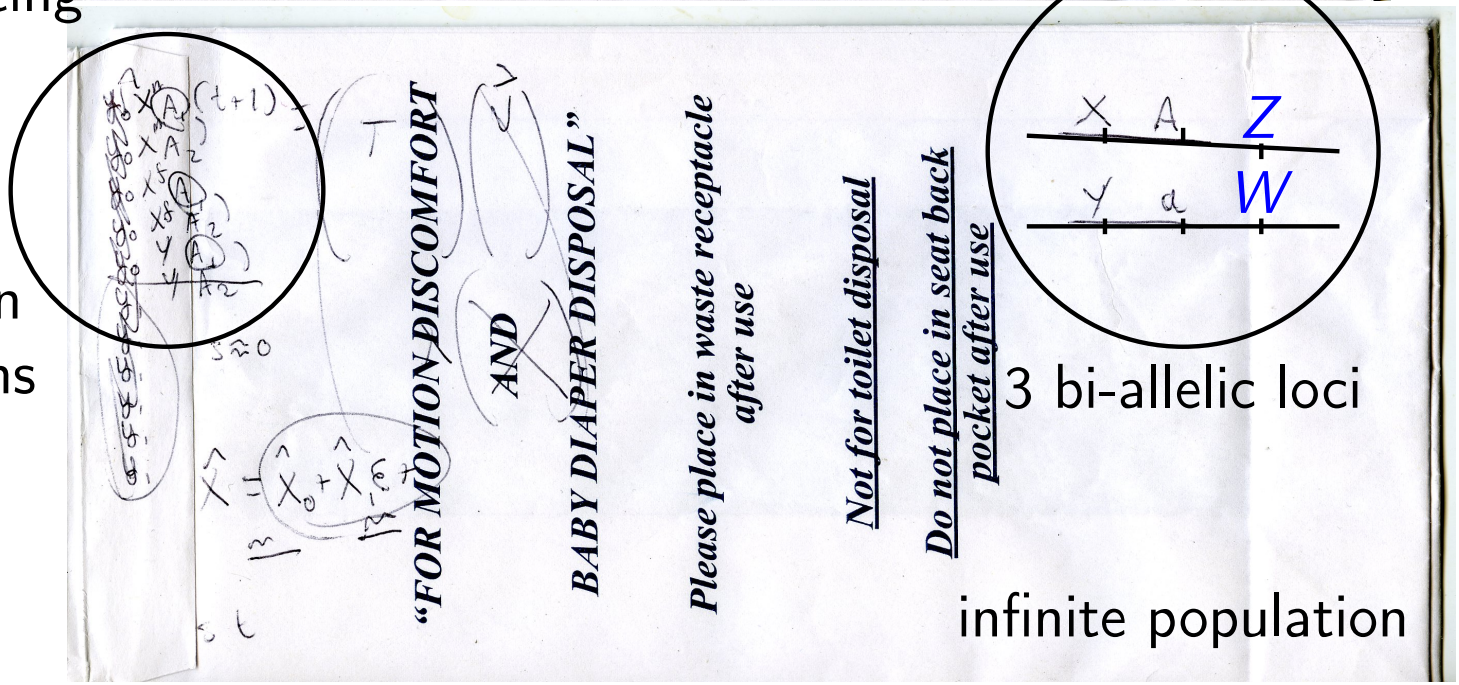


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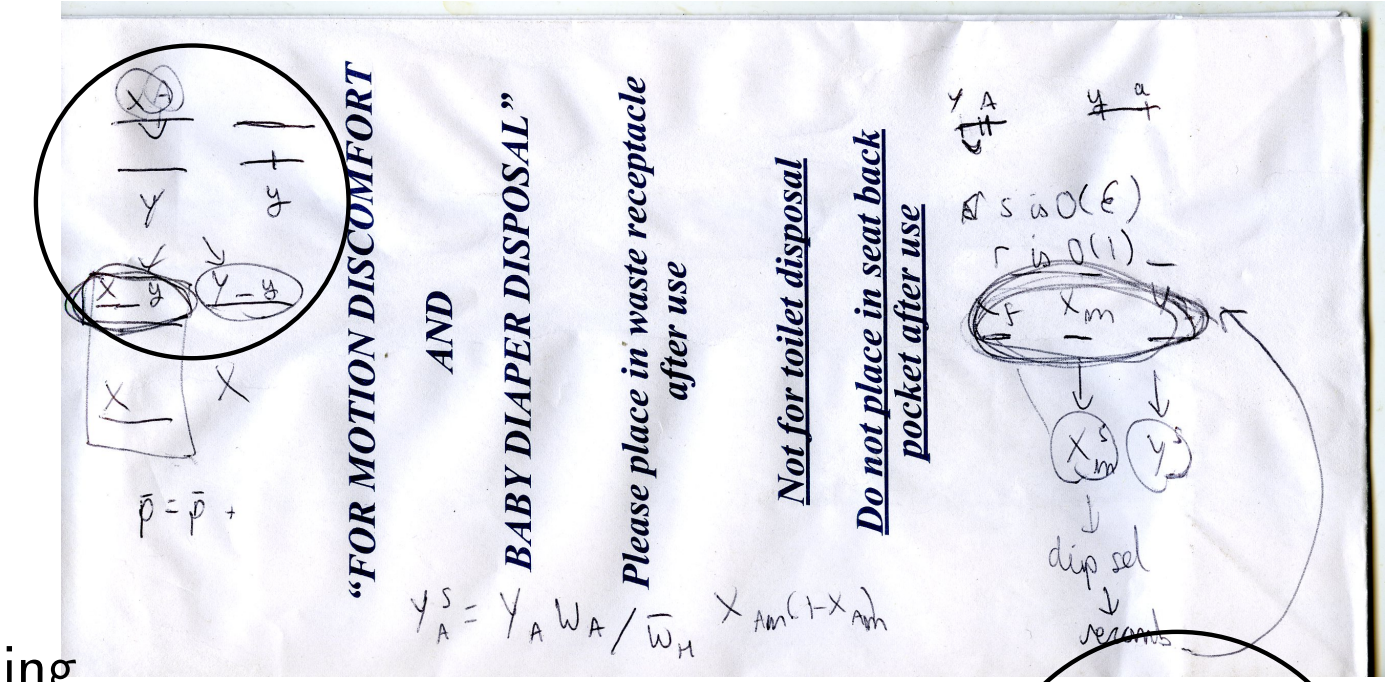
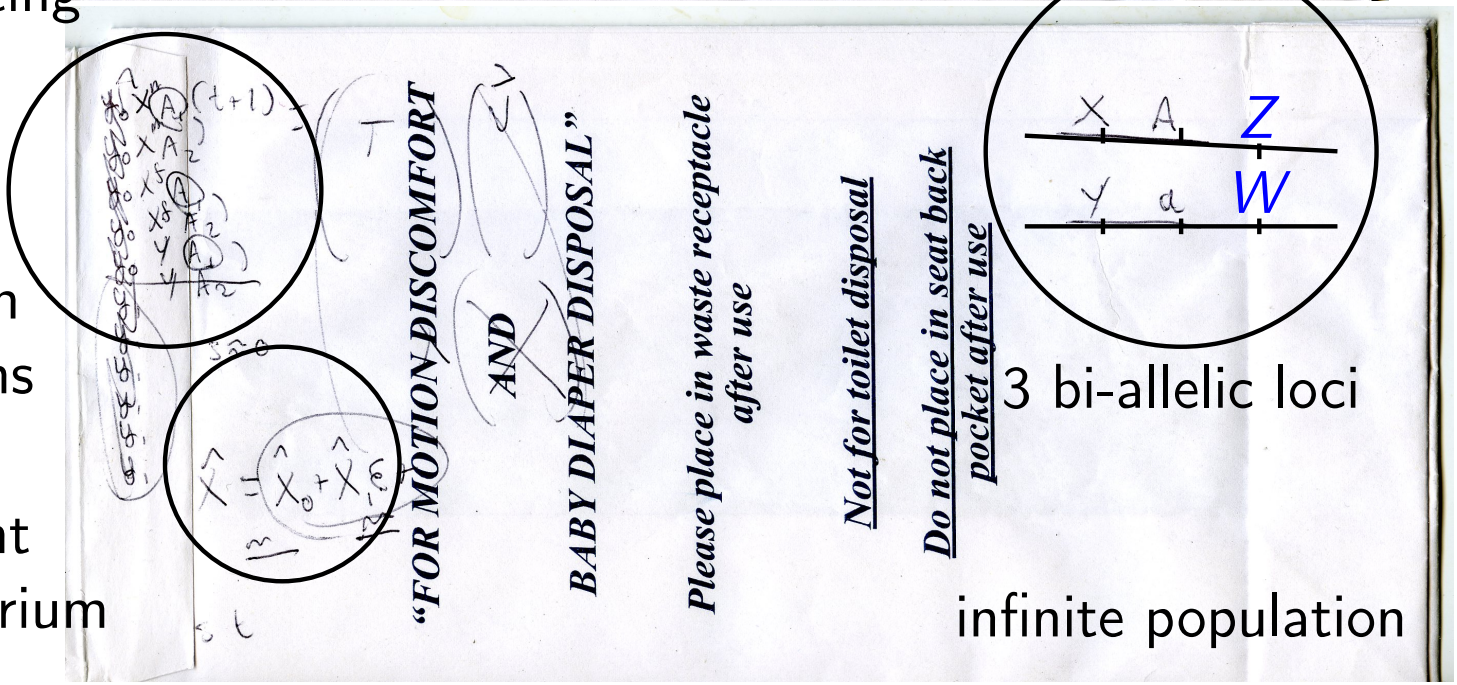
2. resident equilibrium

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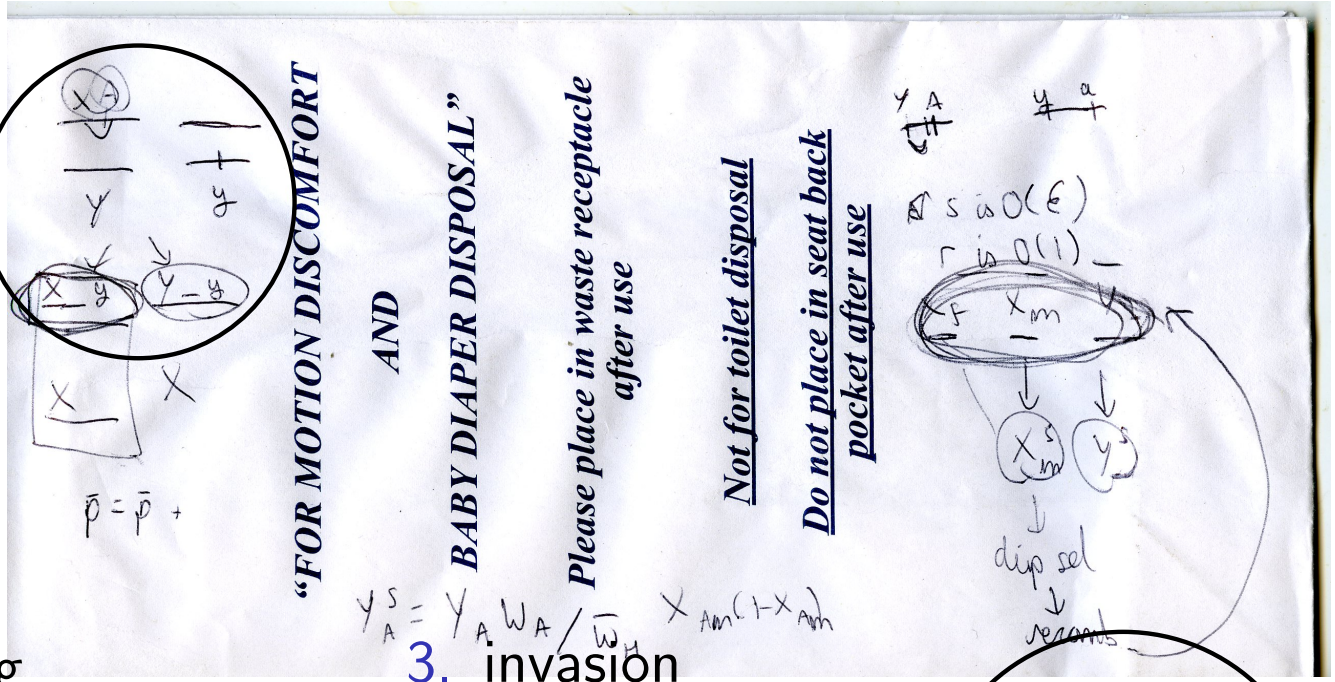
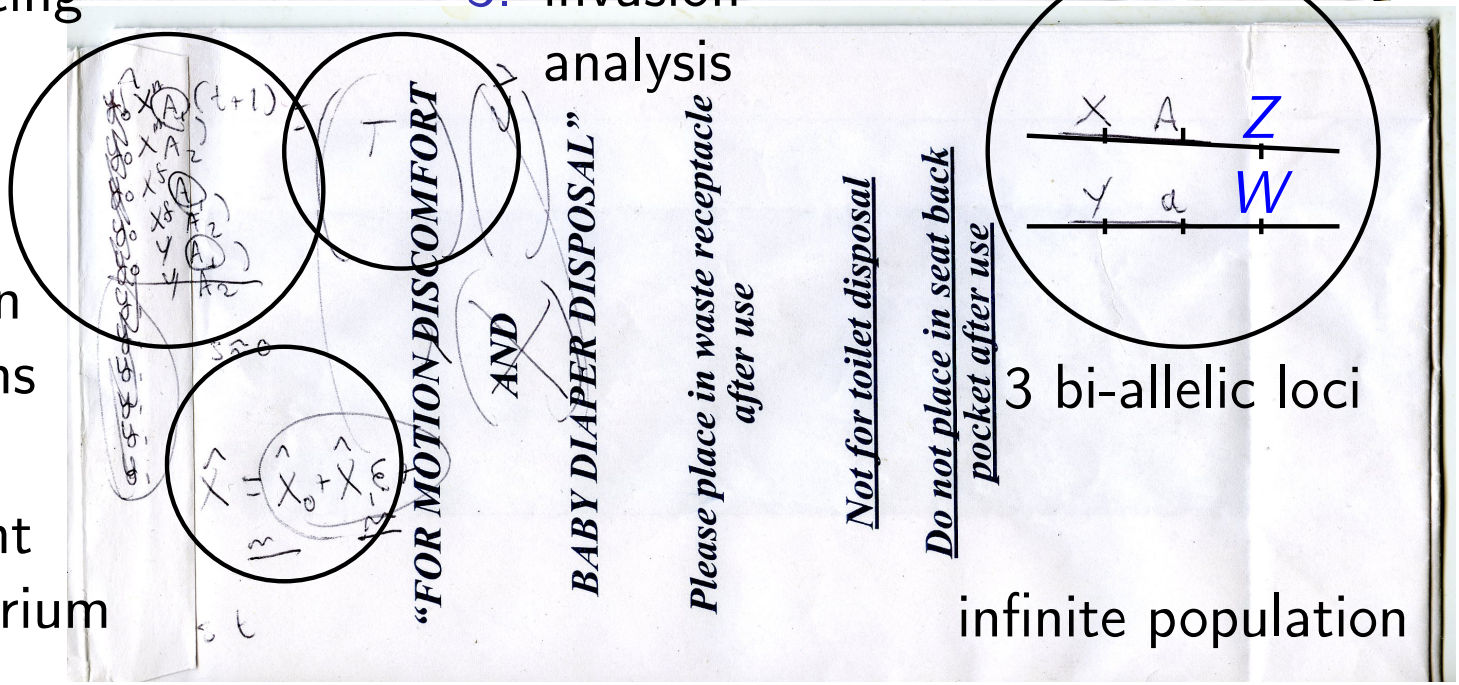



3. invasion analysis

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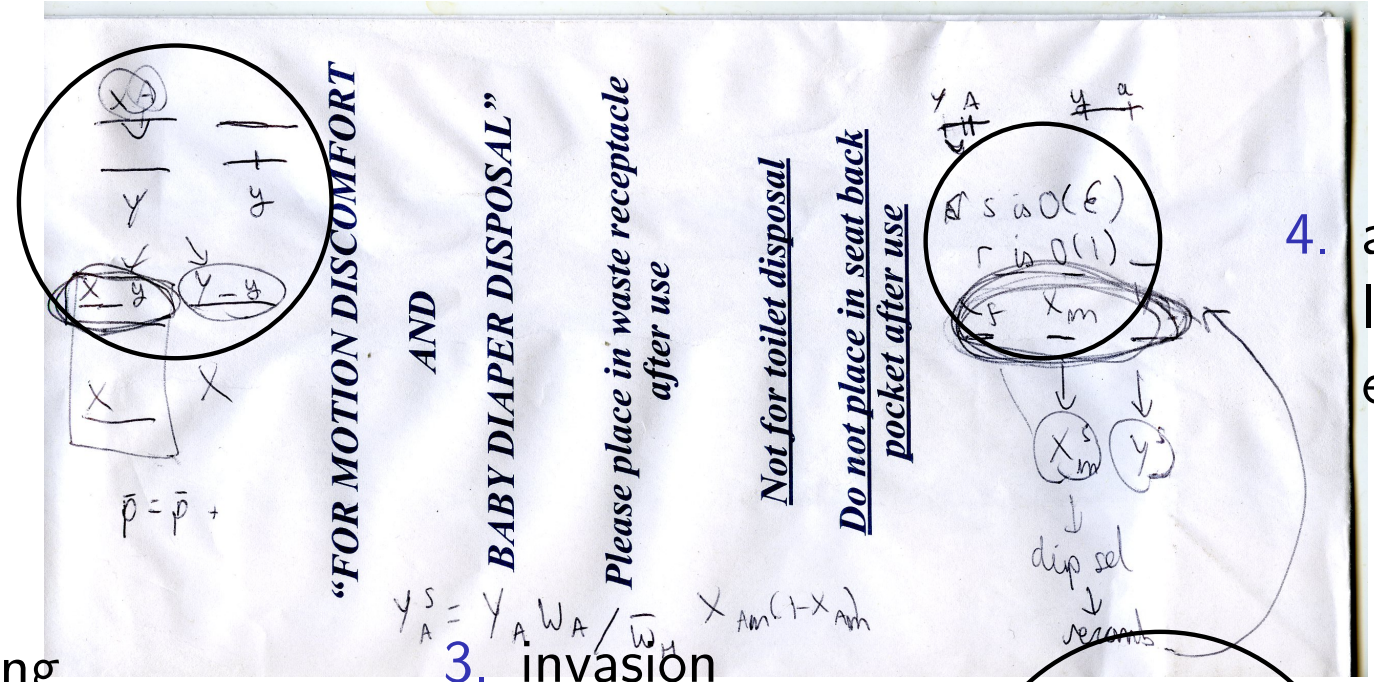


4. approximate leading eigenvalue

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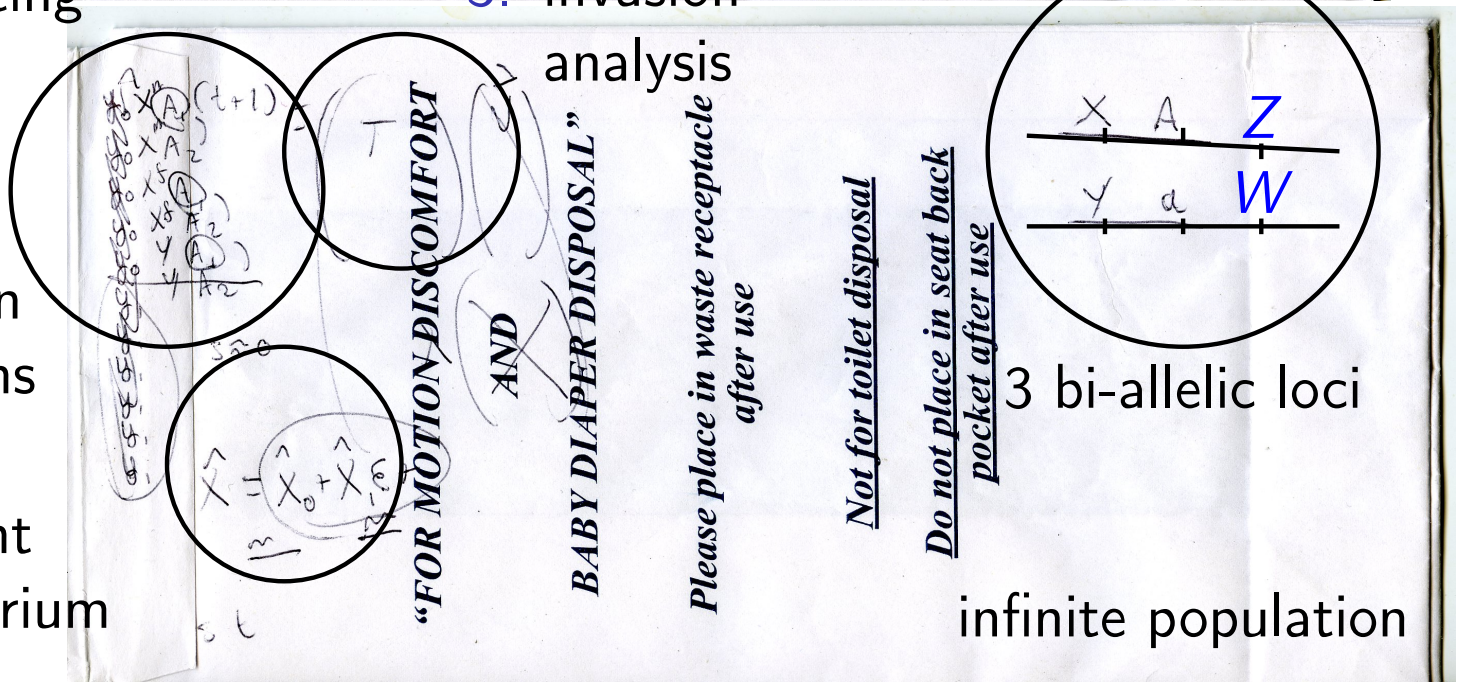


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2 results

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no sex-ratio bias
no antagonism between diploid sexes

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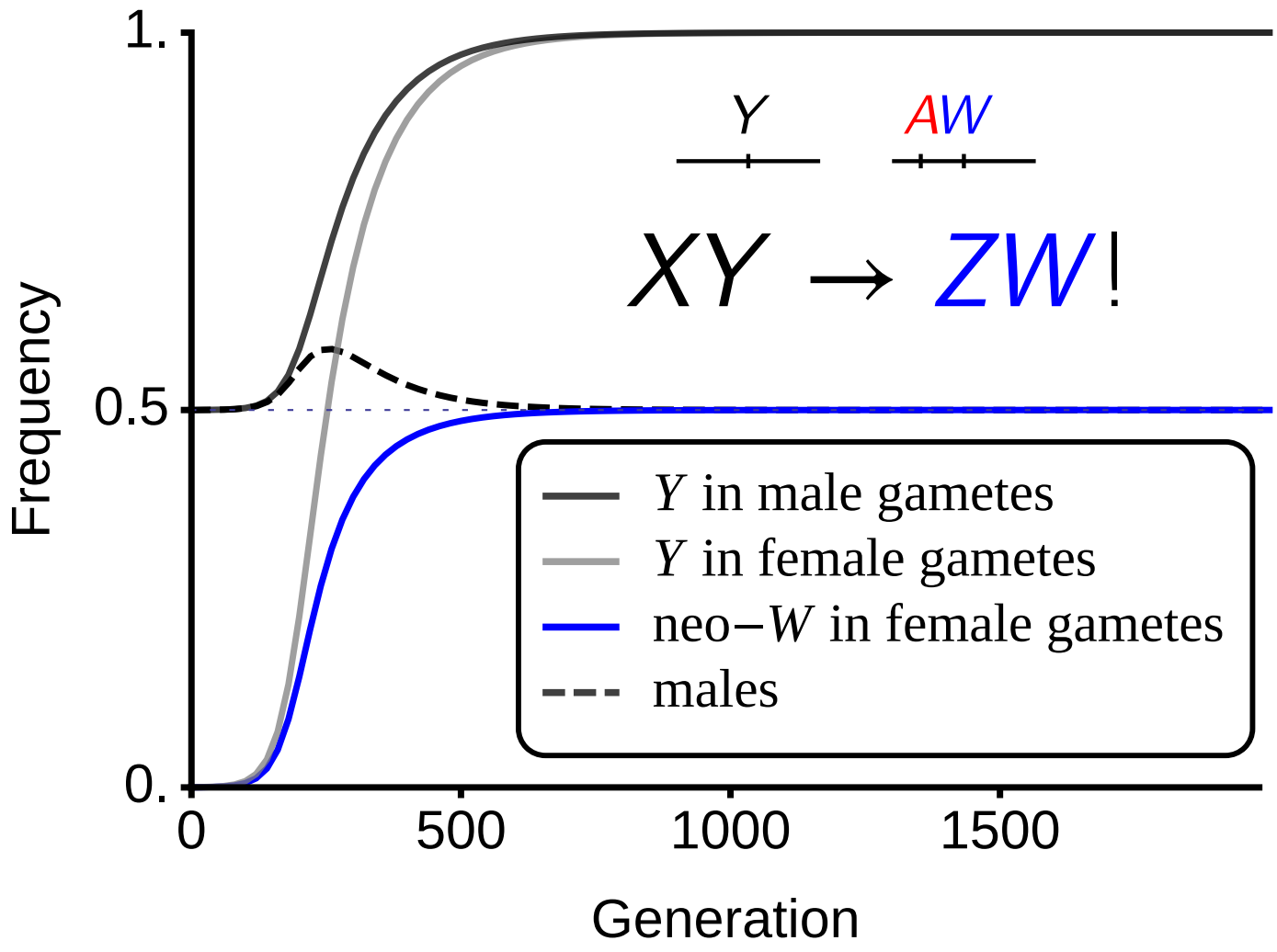

# Result 1: Turnover *regardless* of sex-ratio bias

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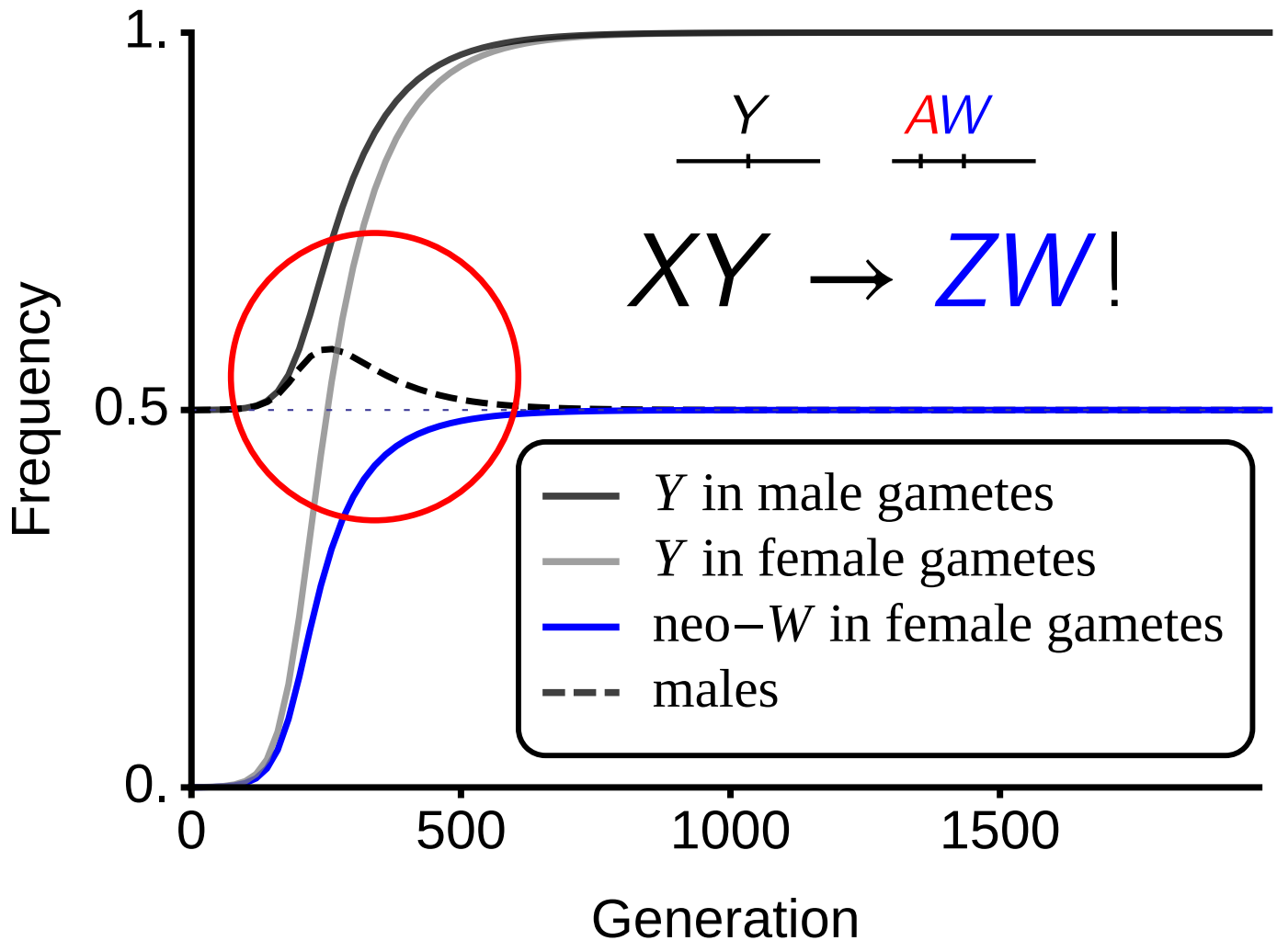

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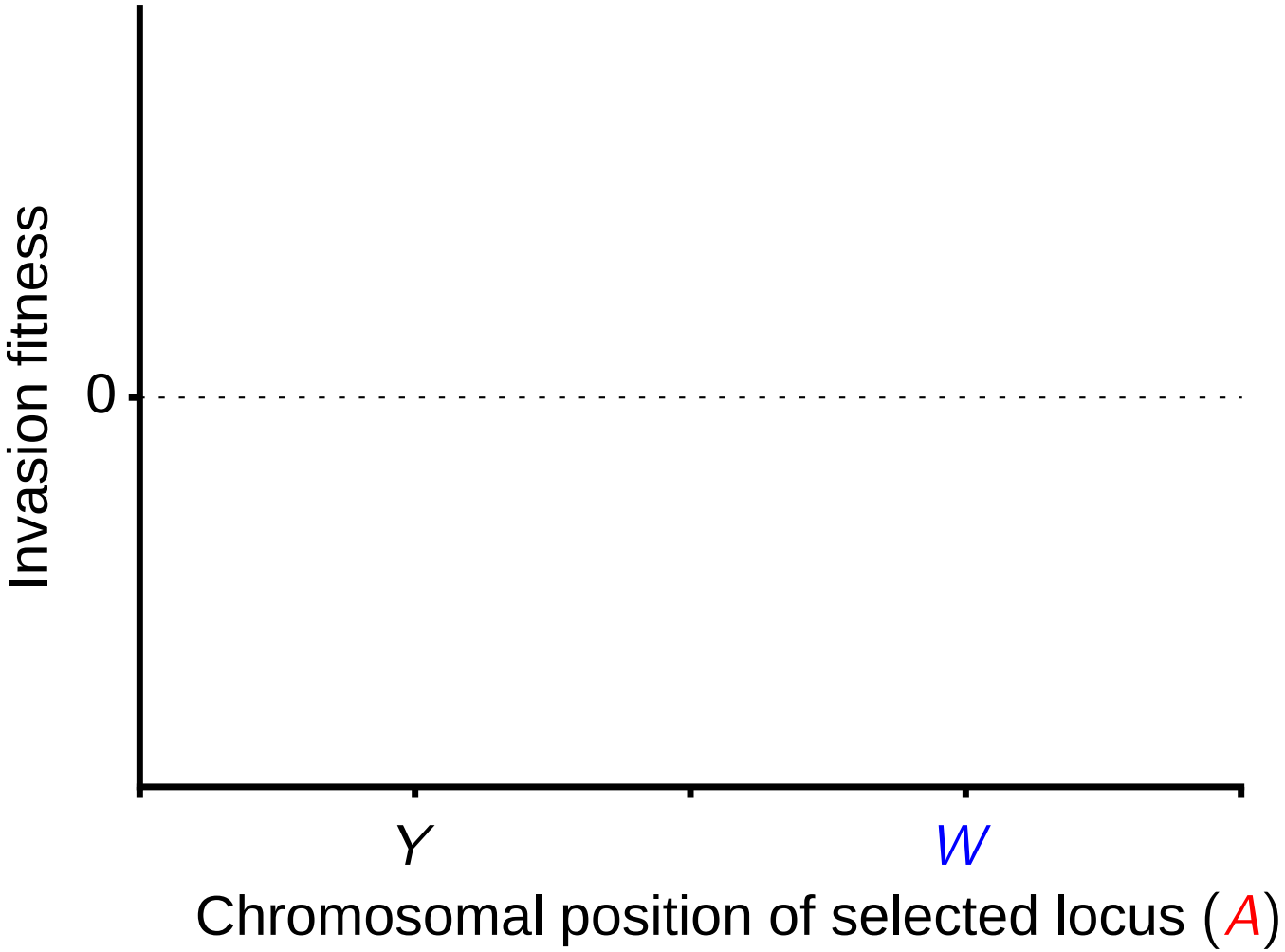

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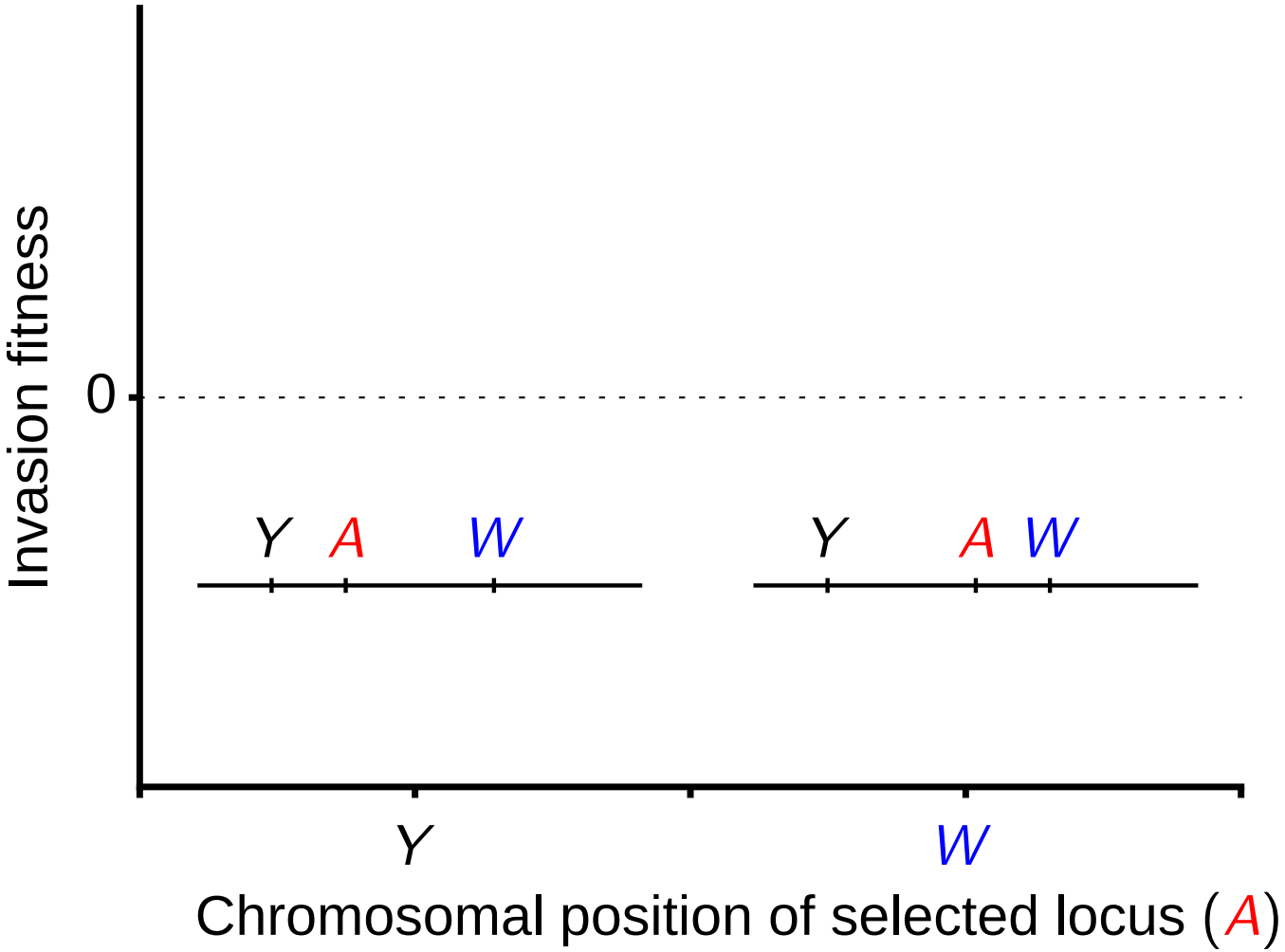

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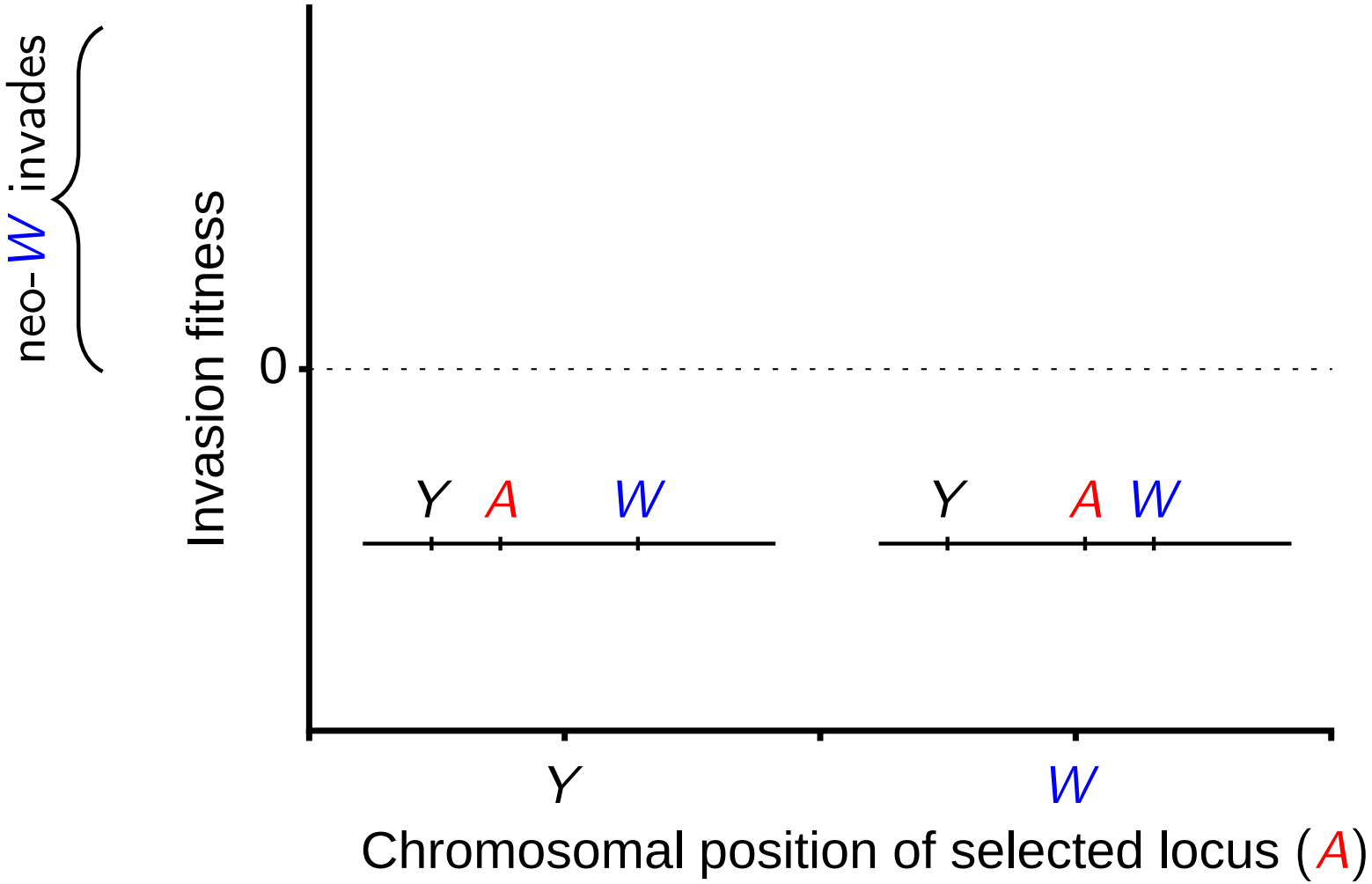

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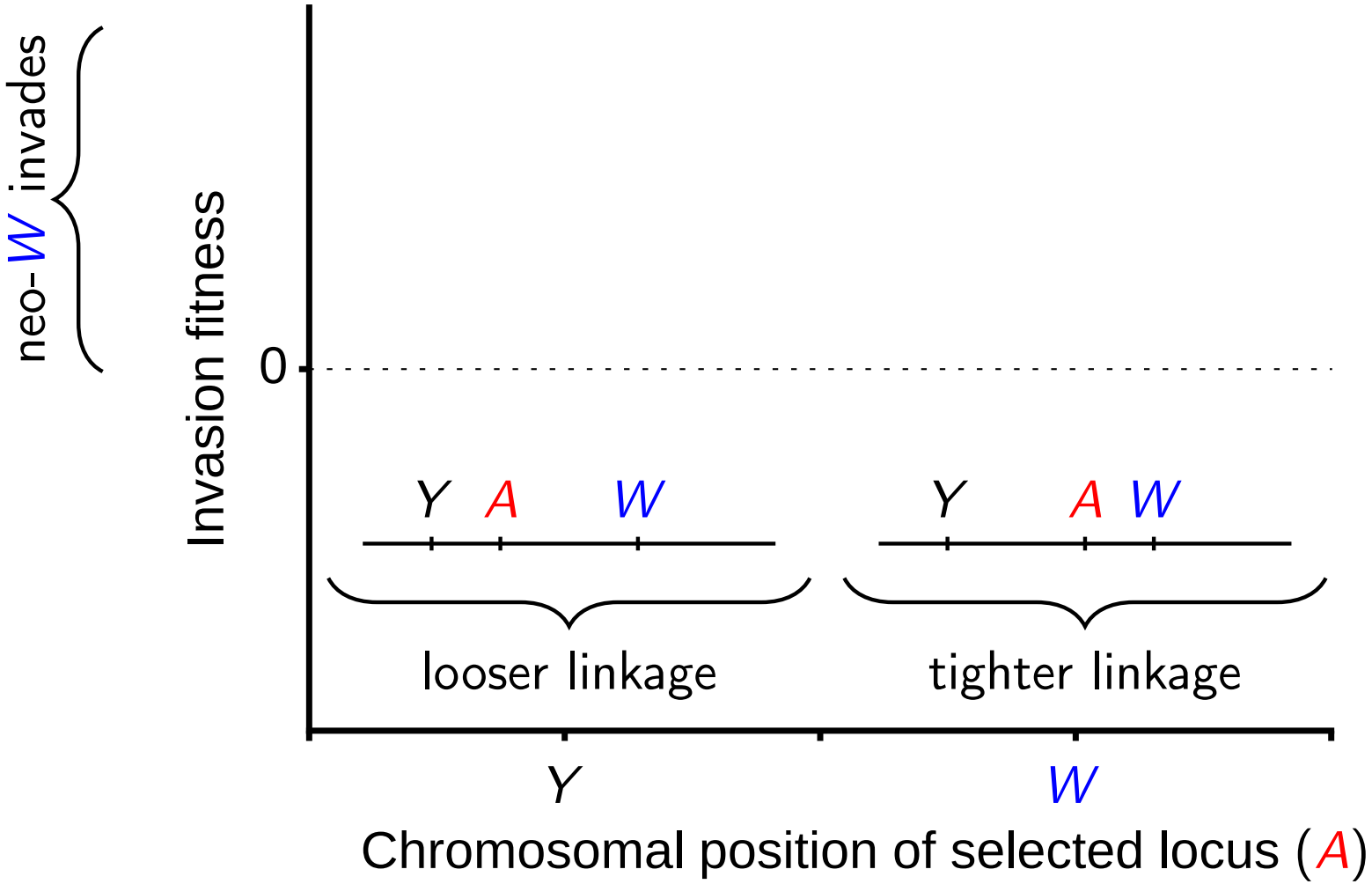

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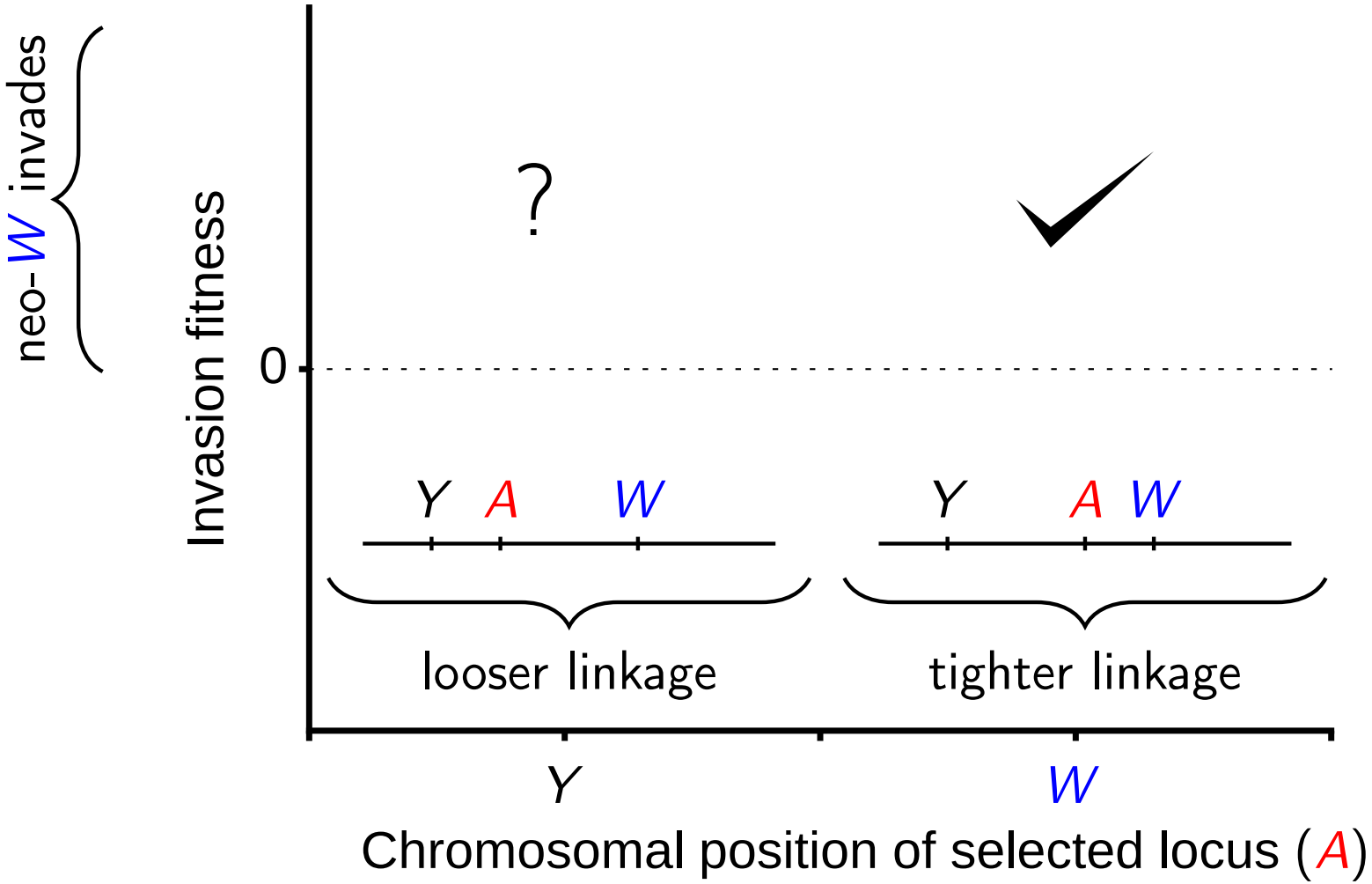

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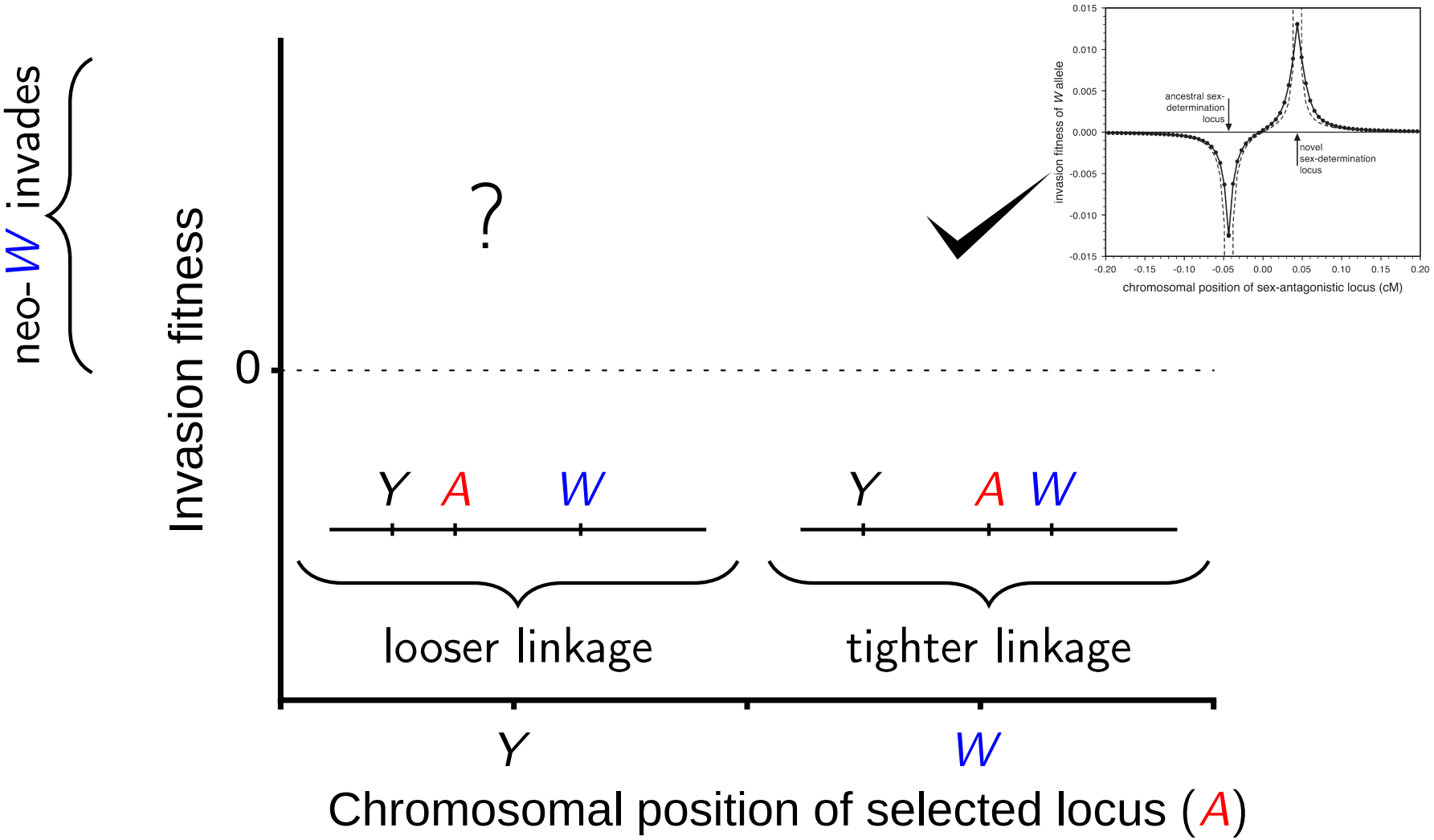

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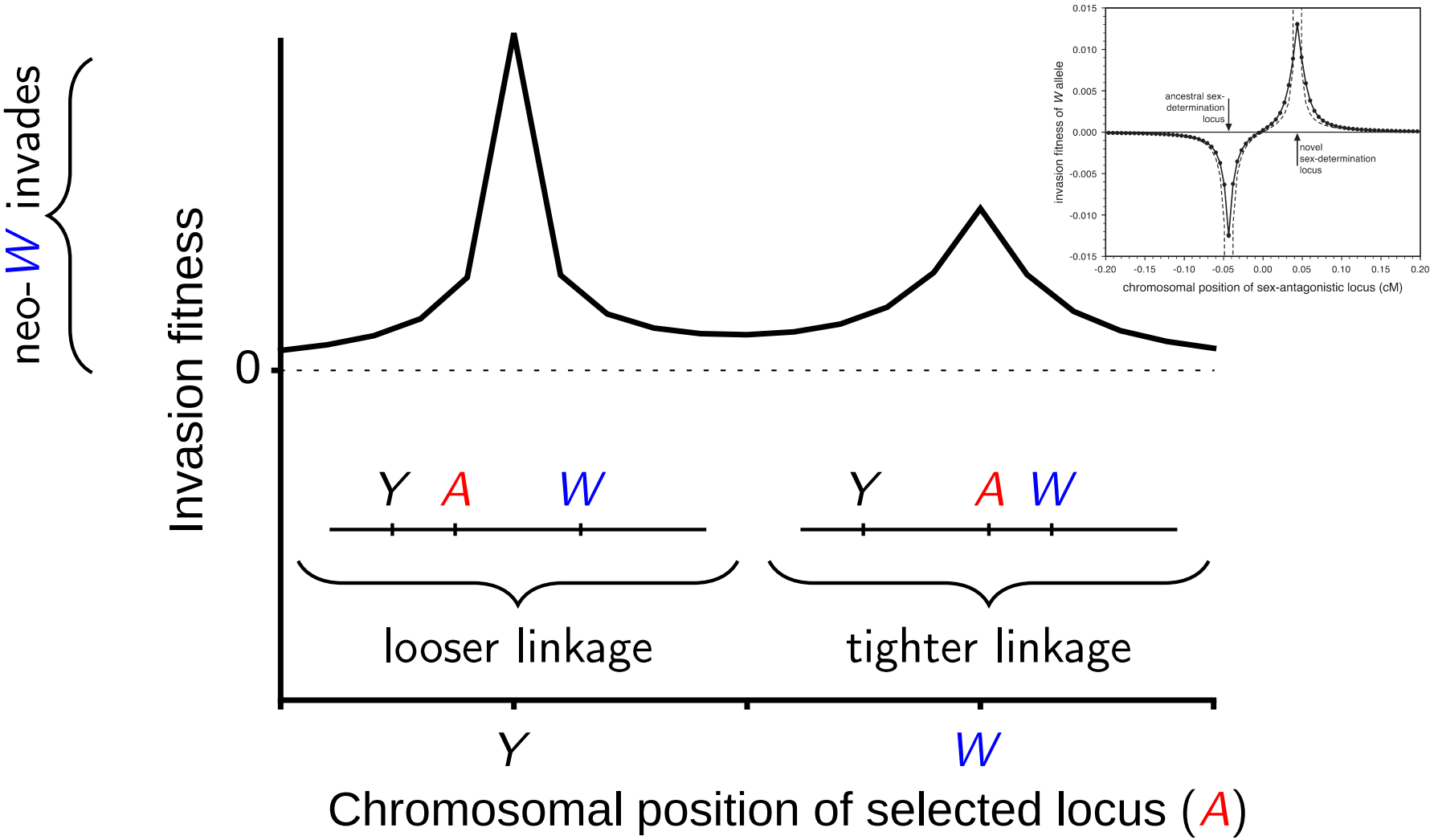

# Result 2: Turnover despite *looser* sex-linkage

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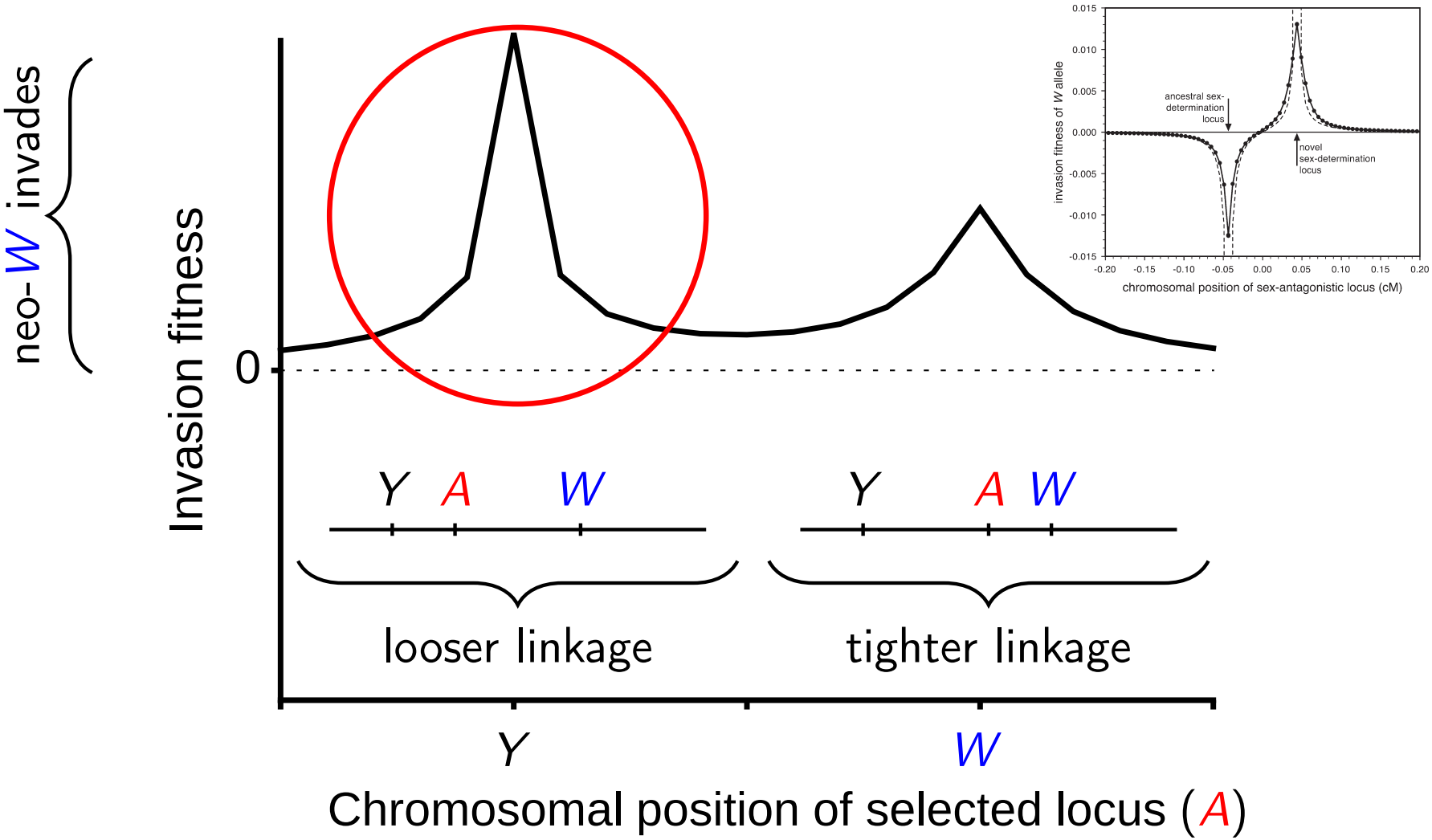

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More turnover in haploid-diploid organisms?

# Thank-you

Michael Scott

Otto lab

Sally Otto

BIODIVERSITY RESEARCH CENTRE

UBC

NSERC CRSNG