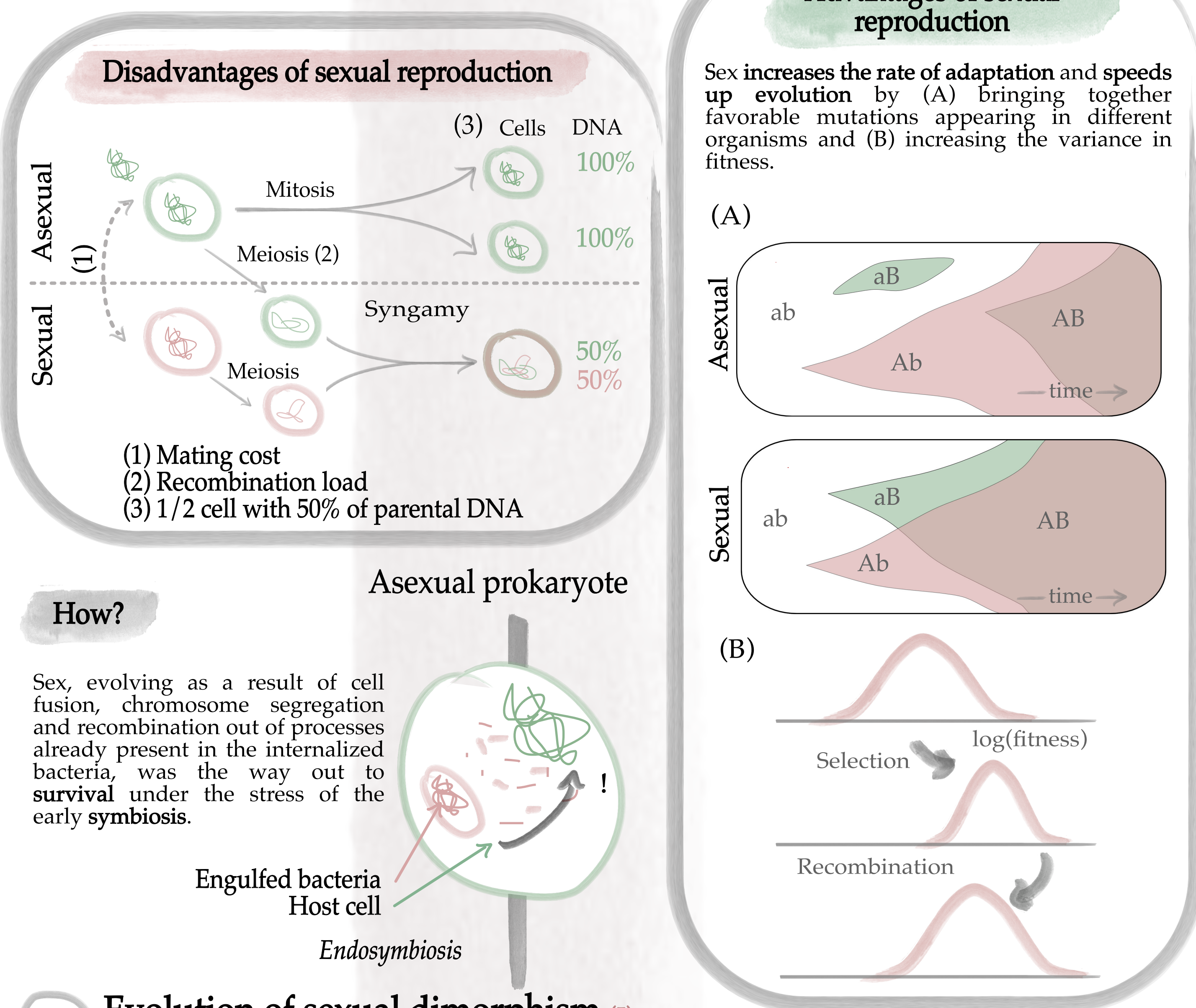


# "Nothing in Biology makes sense except in the light of Evolution"

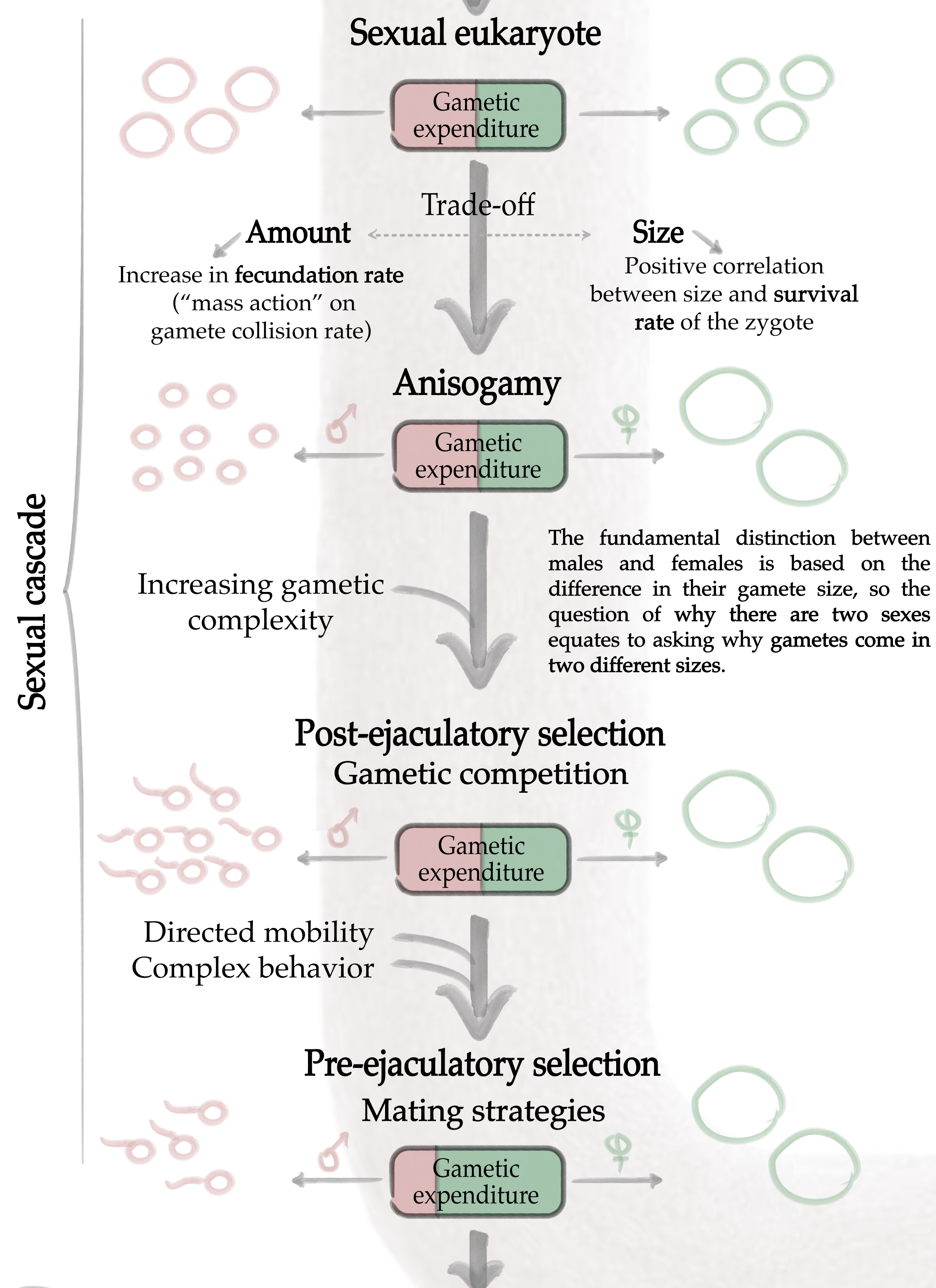
Evolution is to biological diversity what development is to an organism's organizational complexity or sociopolitical history to its current dynamics. As Theodosius Dobzhansky stated already in 1973, "Nothing in biology makes sense except in the light of Evolution": *what* a biological event means cannot be fully understood without the *whys* and *hows* of its evolutionary records. Analyzing sexual dimorphism from this perspective is not only an ideal excuse to illustrate the mechanisms and potential outcomes of an evolutionary process, but also the only way to understand the origin and roles of males and females in biological terms.

The retrospective journey through sexual dimorphism is essential to be able to dig into the most challenging questions about sexuality and sex differences, both in health and society, using the principles that operated in their generation. To base present understanding and future action on past comprehension, this is what we are to learn from the evolutionary approach.

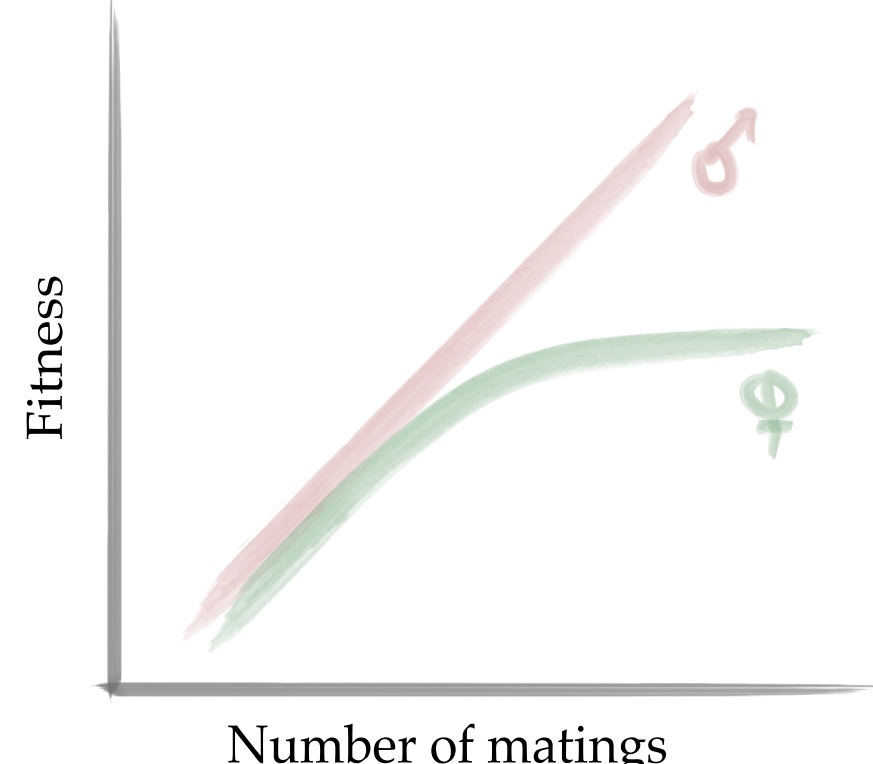
### Avantages, disadvantages and origin of sex



## From isogamic eukaryotes to mating types



## Establishment of the conflict of interests



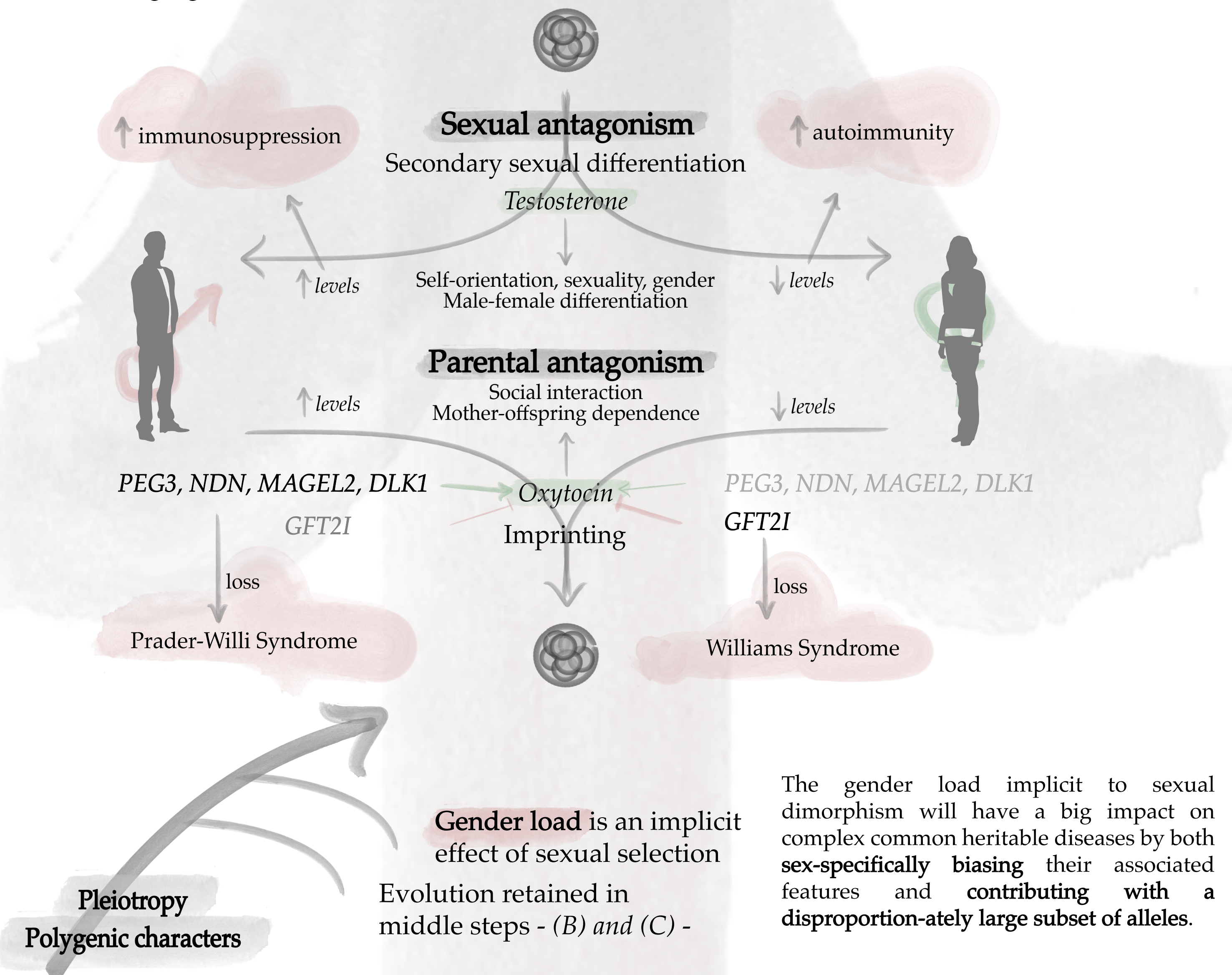
Males will fight for quantity while females will resist for quality, triggering the eternal conflict of *indiscriminating eagerness* vs *discriminating passivity*.

Sexual dimorphism is paradoxical from a genetic point of view because two phenotypes are, on the one hand, generated from a common genetic pool and, on the other hand, under sex specific or antagonistic selection pressures.

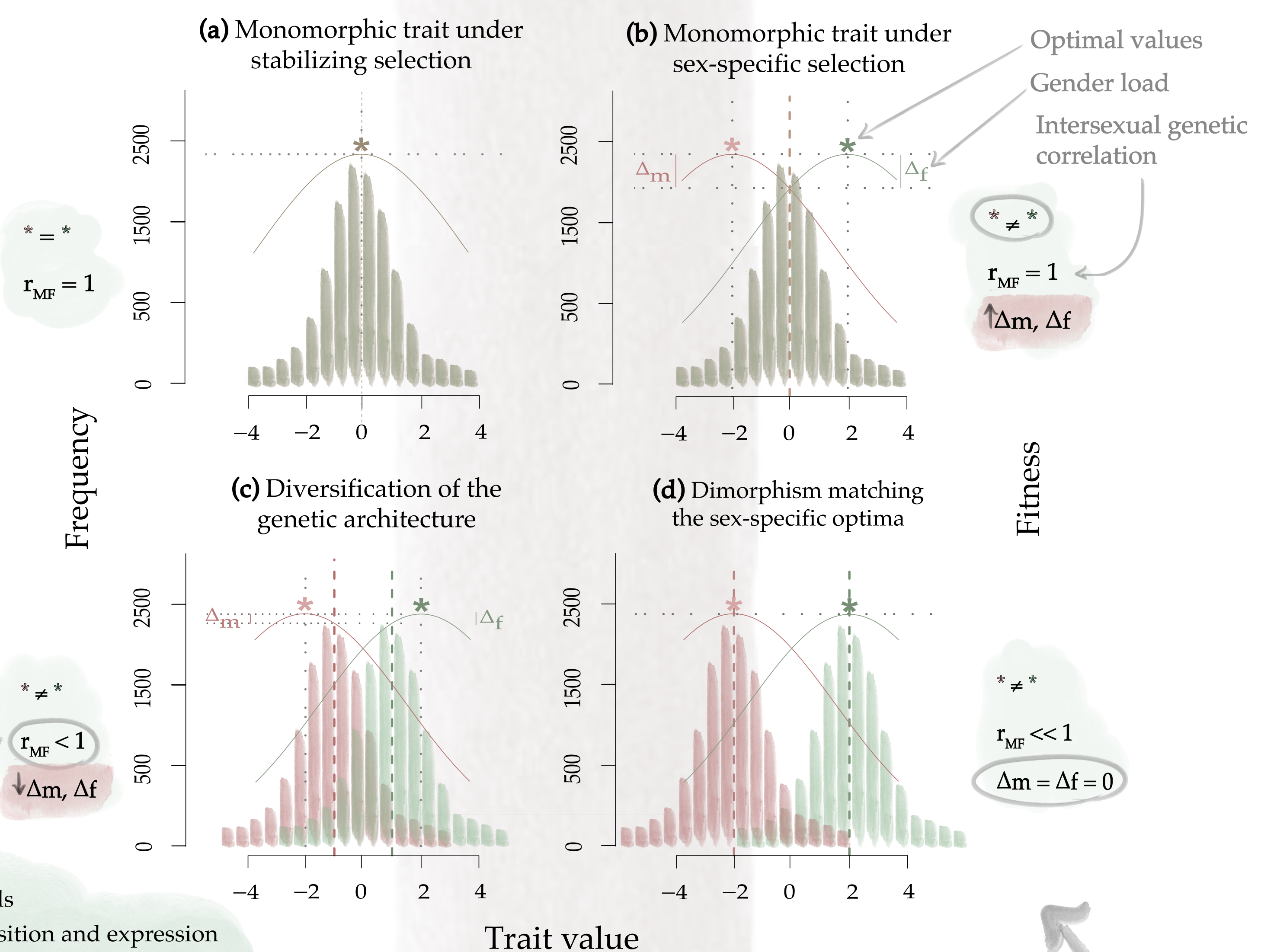
Sexual determination  
Sexual differentiation

## Secondary sexual differentiation and conflict resolution

**Darwinian medicine:** conflicts, constraints, side effects, trade-offs, defense mechanisms and changing environments in disease

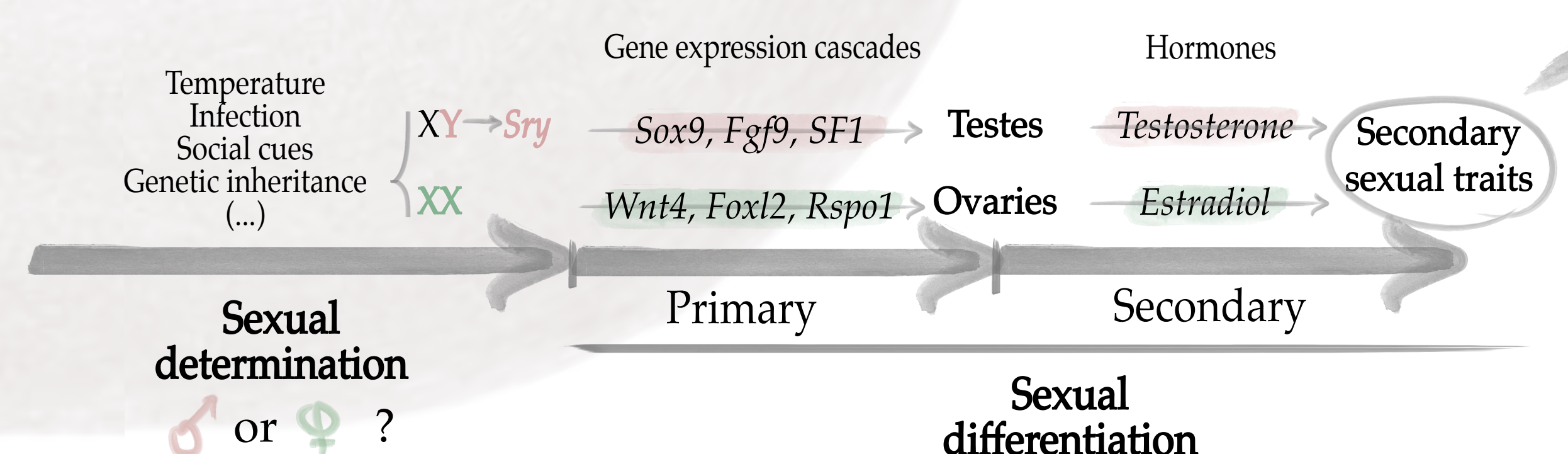


### Molecular resolution of the conflict



The conflict repercuts on **secondary sexual traits**, because they are the ones accounting for reproductive interests. The effect evolution has on their phenotype, and ultimately genotype, occurs indirectly through **developmental modulation**.

## Two phenotypes out of one genetic pool



Key references:  
(1) **Barton, N.H., Charlesworth, B.** 1998. Why sex and recombination? *Science* 281:1986-1990. (2) **Lane, N.** 2009. Life Ascending: the Ten Great Inventions of Evolution. *WW Norton & Co.* Chapt. 5: Sex. (3) **Mokkonen, M., Crespi, B.J.** 2015. Genomic conflicts and sexual antagonism in human health: insights from oxytocin and testosterone. *Evol Appl* 8:307-325. (4) **Morrow, E.H.** 2015. The evolution of sex differences in disease. *Biol Sex Differ* 6(5) **Parker, G.A.** 2014. The sexual cascade and the rise of pre-eculatory (Darwinian) sexual selection, sex roles, and sexual conflict. *Cold Spring Harb Perspect Biol* 6:a0117509. (5) **Rigby, N., Kulathinal, R.J.** 2015. Genetic Architecture of Sexual Dimorphism in Humans. *J Cell Physiol* 203:2304-2310.