Sexo, por quê?

Sergio Russo Matioli
Departamento de Genética e
Biologia evolutiva
IB - USP

Questões que serão abordadas:

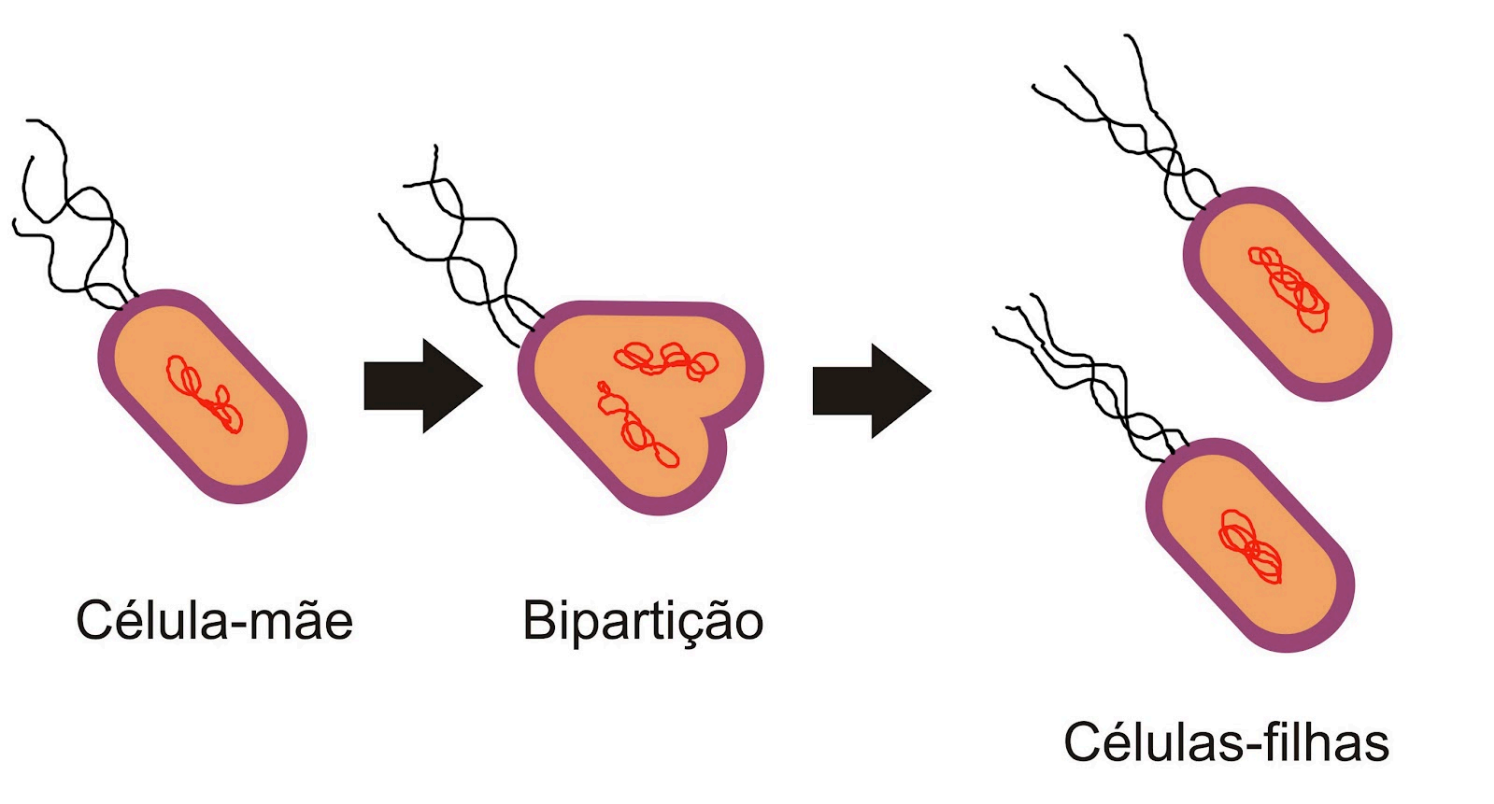
1. Sexo e reprodução.
2. Vantagens e desvantagens da reprodução sexuada.
3. O sonho das amazonas: a partenogênese.
4. Por que sexos diferentes?
5. Por que indivíduos com sexos separados?
6. Por que não três ou mais sexos?
7. Consequências de dois sexos.
8. Diferenças entre sexos: o dimorfismo sexual.
9. Monogamia ou poligamia?
10. Reprodução sexuada: Uma outra hipótese.

Pode haver reprodução sem sexo:

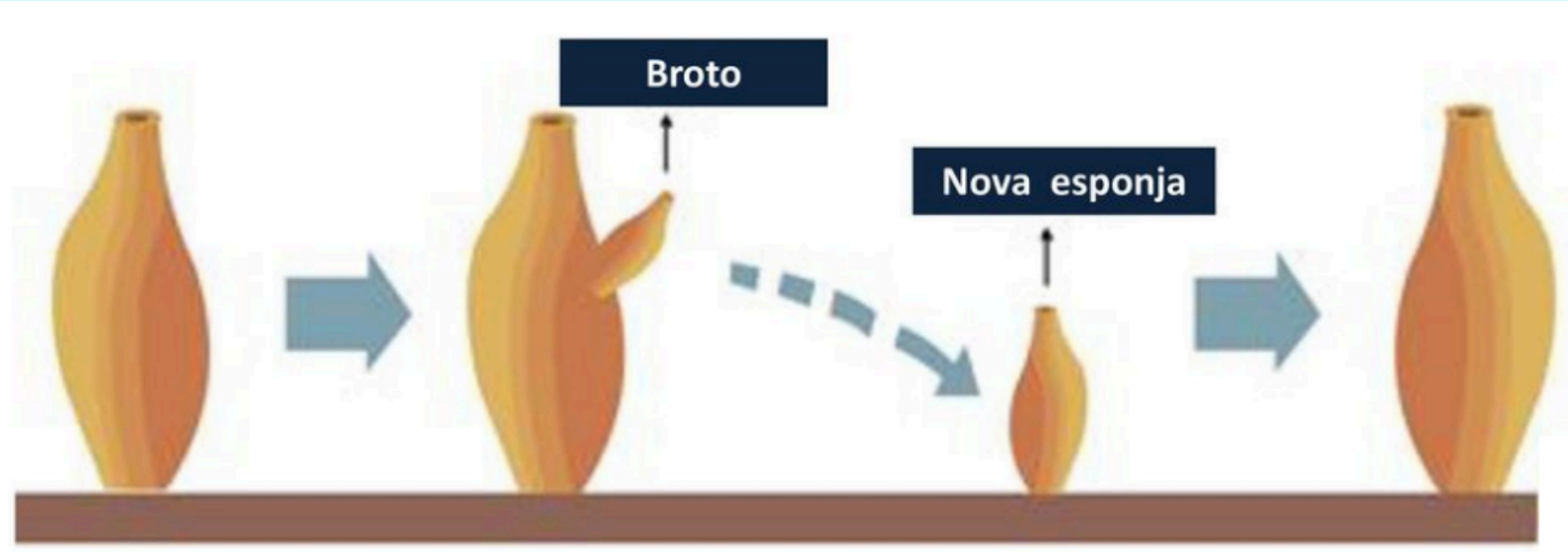
1. Fissão

2. Brotamento

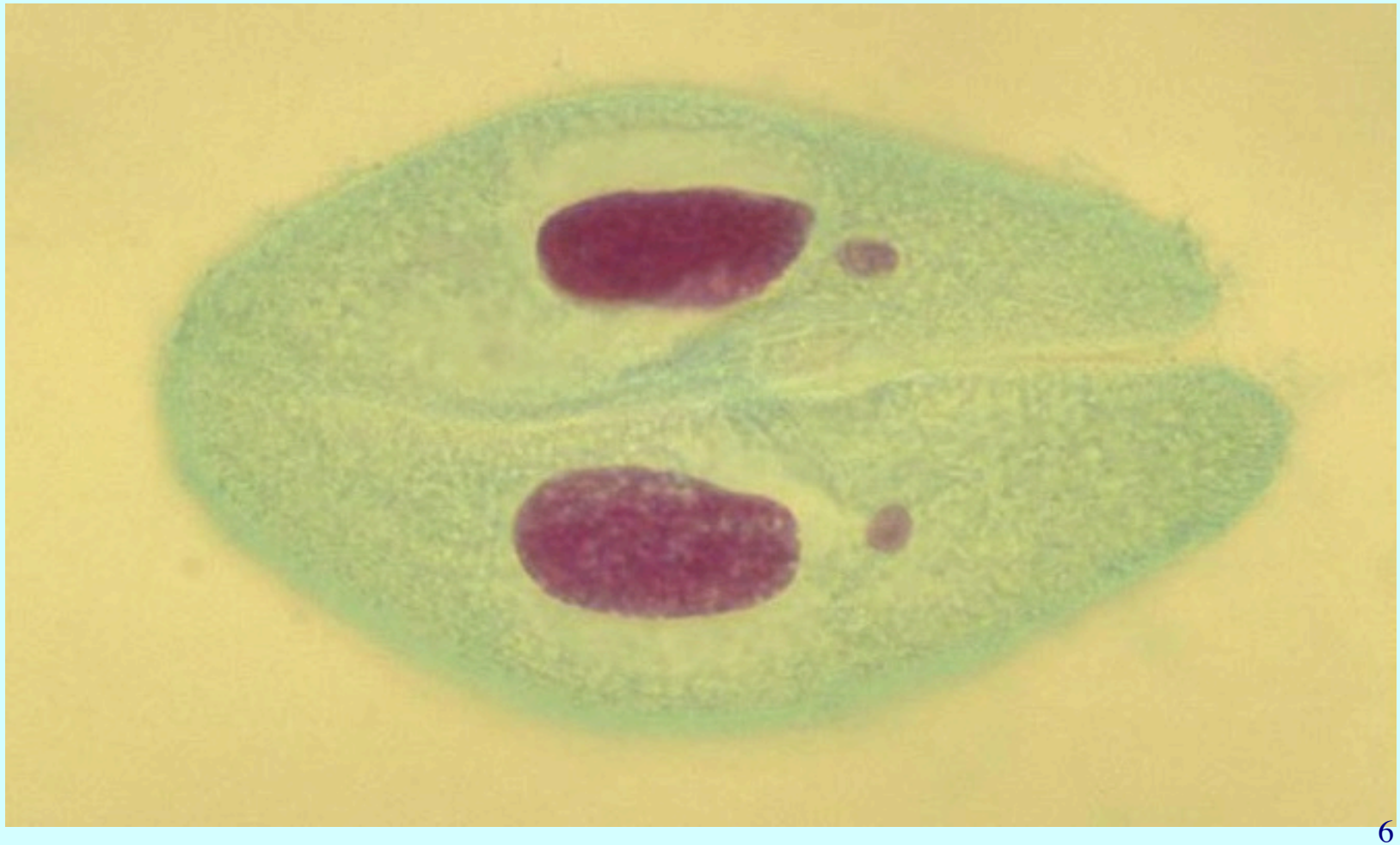
Fissão



Brotamento



Sexo não reprodutivo em *Paramecium*



Sexo não reprodutivo em *Paramecium*

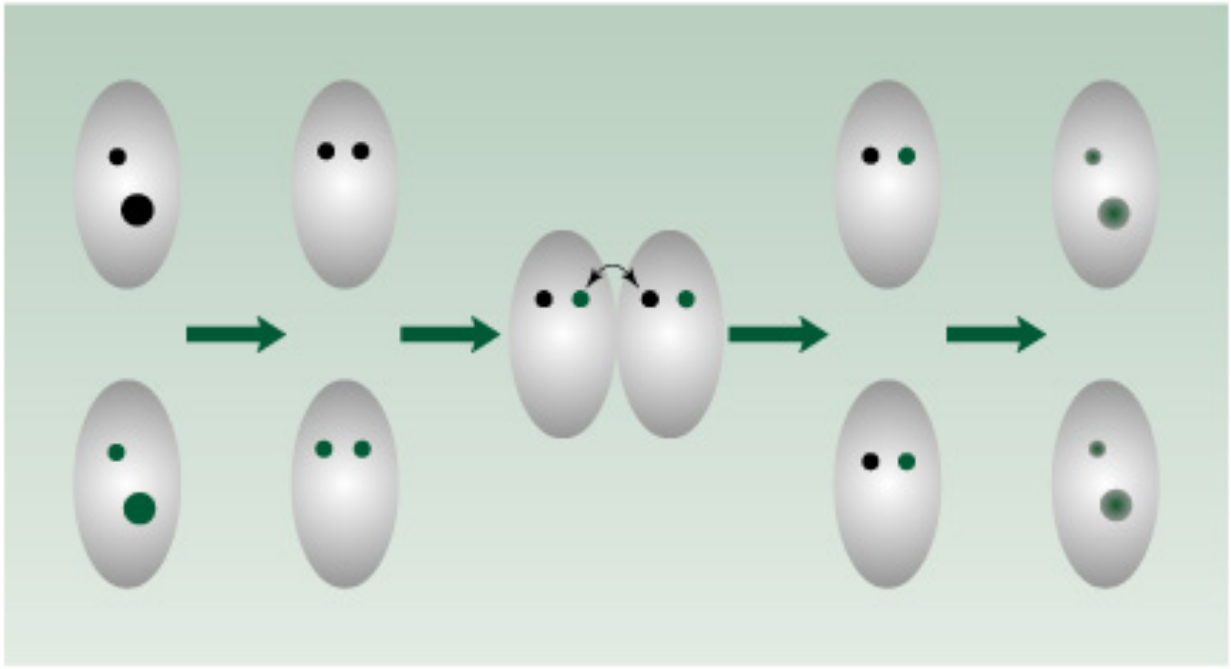
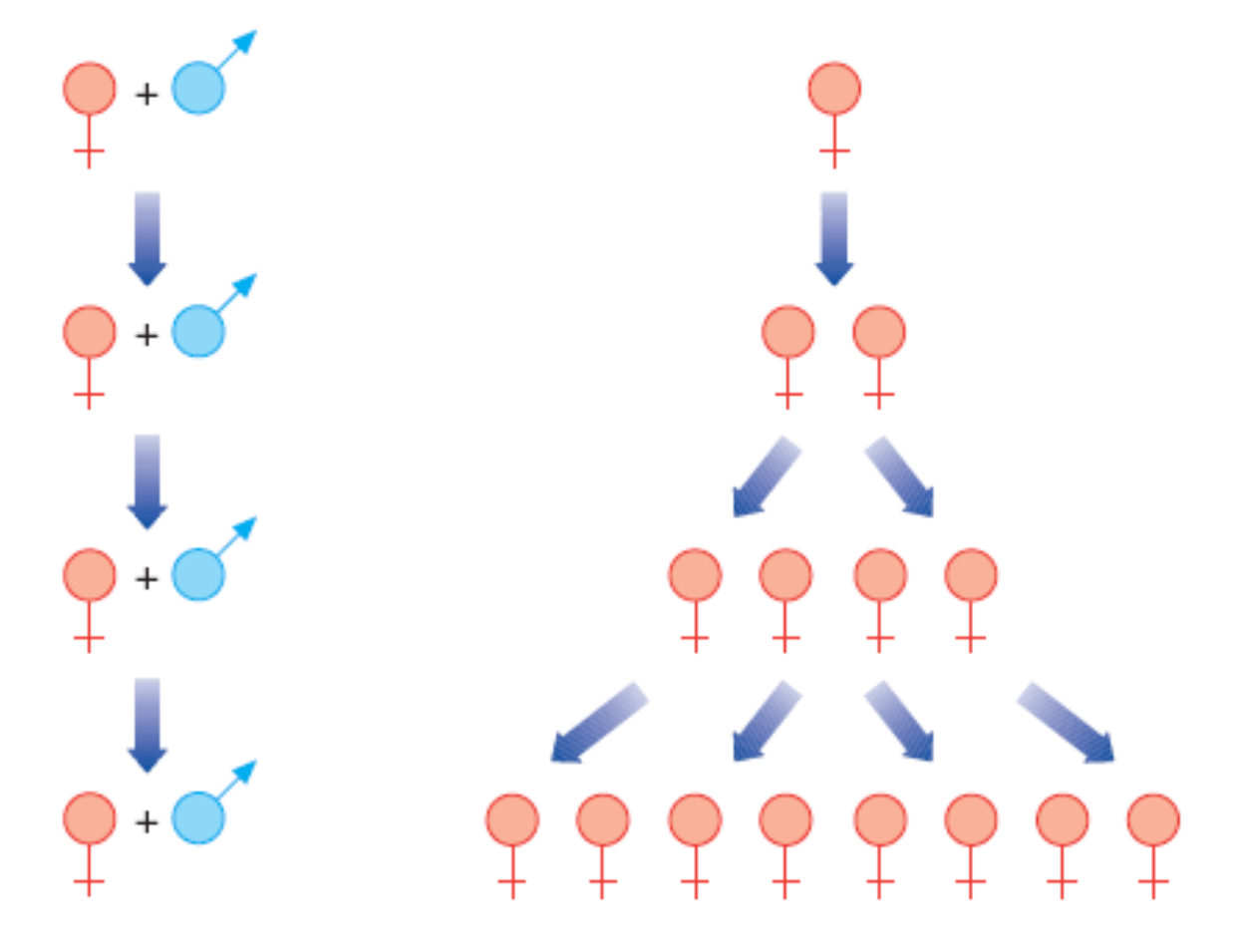
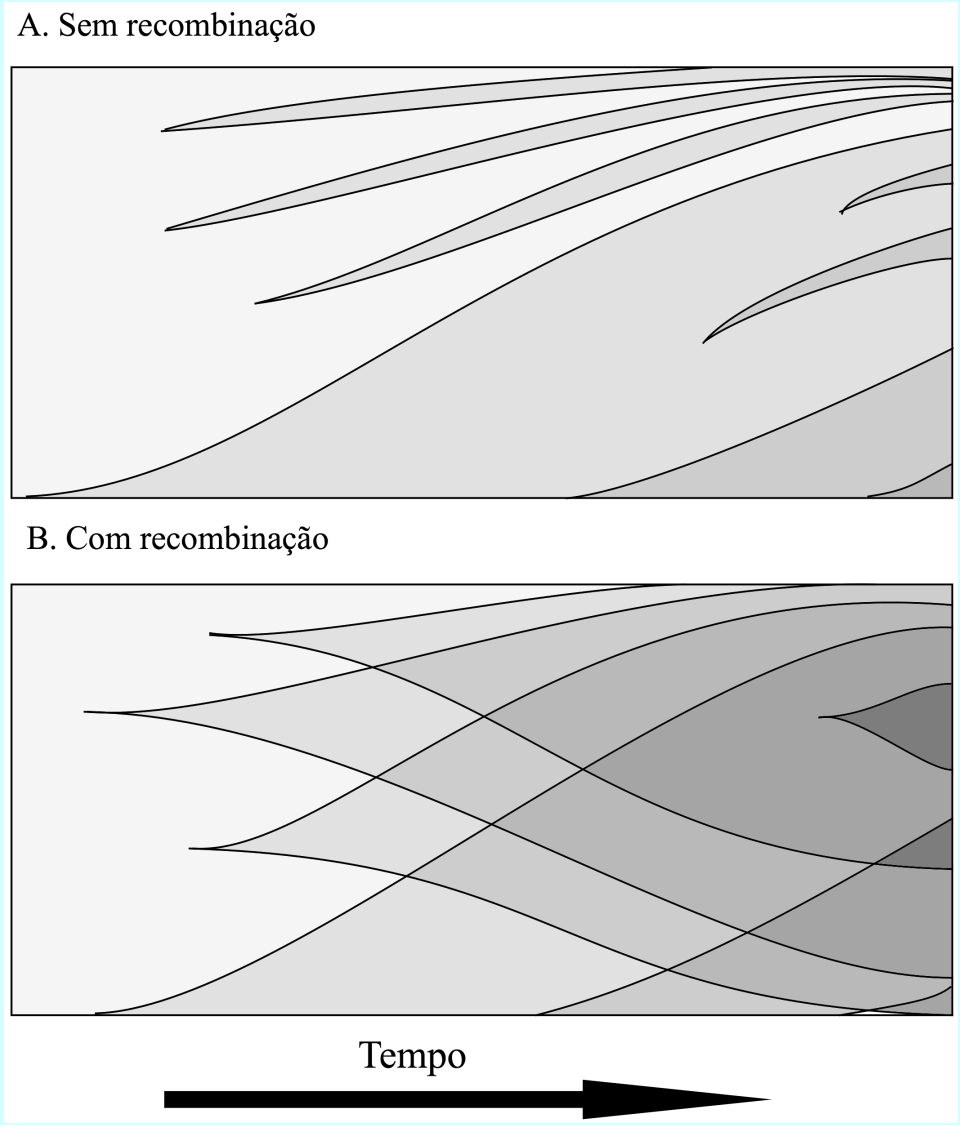


Figure 12.2
Non-reproductive sex in *Paramecium*. *Paramecium* normally contains one micronucleus and one macronucleus. When it prepares for sex, the macronucleus dissolves and the micronucleus is duplicated. Two such cells can then conjugate, swapping one of their micronuclei. Meiosis then occurs within each cell. The sex act is non-reproductive. *Paramecium* cells reproduce by binary fission. Thus, sex and reproduction are not associated in *Paramecium*. The same is true in many single-celled life forms.

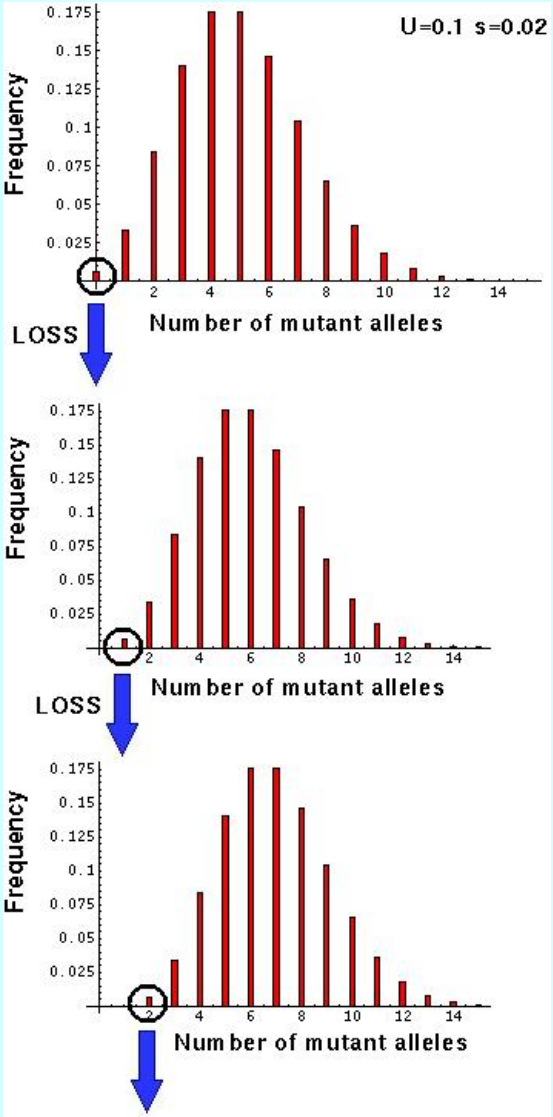
Comparação:
Reprodução sexuada X assexuada

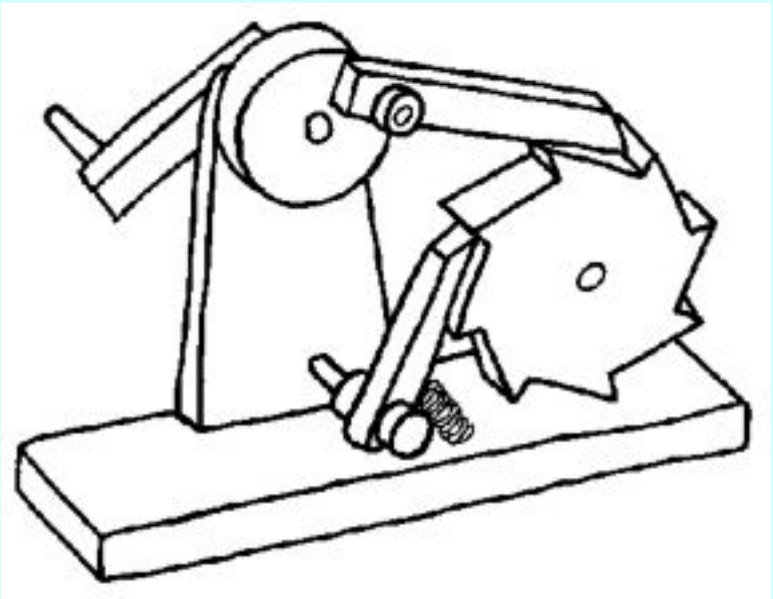


Efeitos da recombinação



A “catraca” de H. Muller





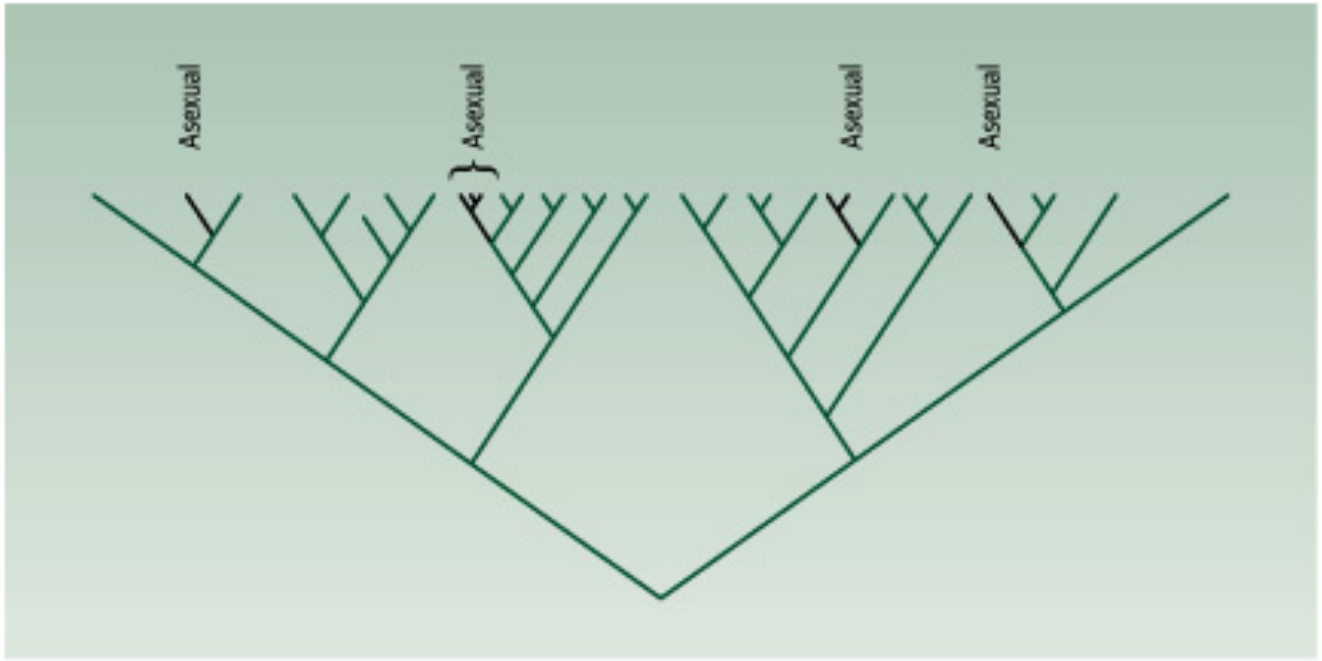
Partenogênese: O sonho das Amazonas



Aspidoscelis tesselata, Espécie de lagarto do Sul dos E.U.A. onde fêmeas produzem fêmeas, sem qualquer intervenção de machos.

Reprodução assexuada secundária

Figure 12.4
The taxonomic distribution of asexual reproduction is spindly and is found in odd isolated taxa.



Viabilidade e mutações

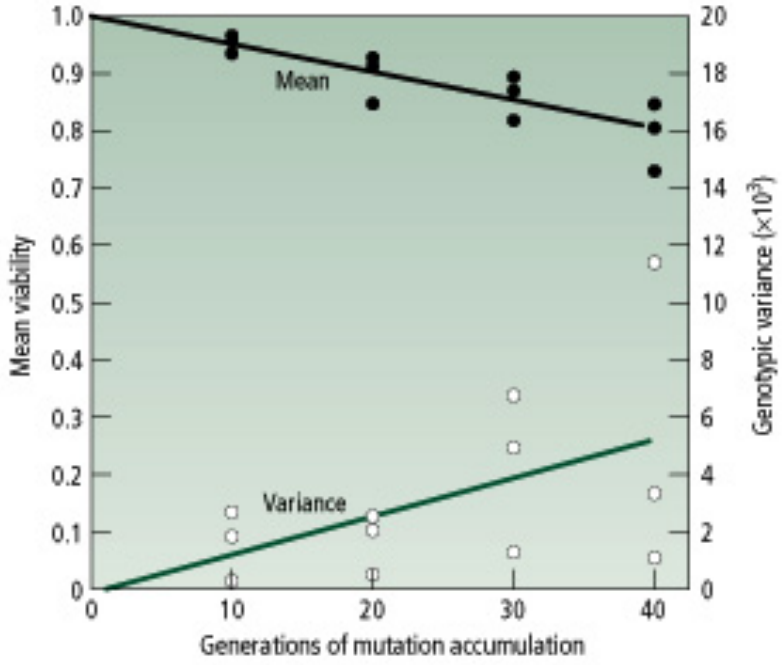


Figure 12.5
The mutational meltdown in fruitflies protected from selection, showing a decrease in viability. Viability is measured in flies that are homozygous for a chromosome that has experimentally accumulated mutations relative to flies that are heterozygous for the same chromosome. The decline is due to the accumulated deleterious mutations. There were 104 lines and the variance in viability among lines increased through time (see Box 9.1, p. 233, for the definition of variance). Redrawn, by permission of the publisher, from Mukai *et al.* (1972).

Por quê os sexos são diferentes?

Quem é o macho e quem é a fêmea?









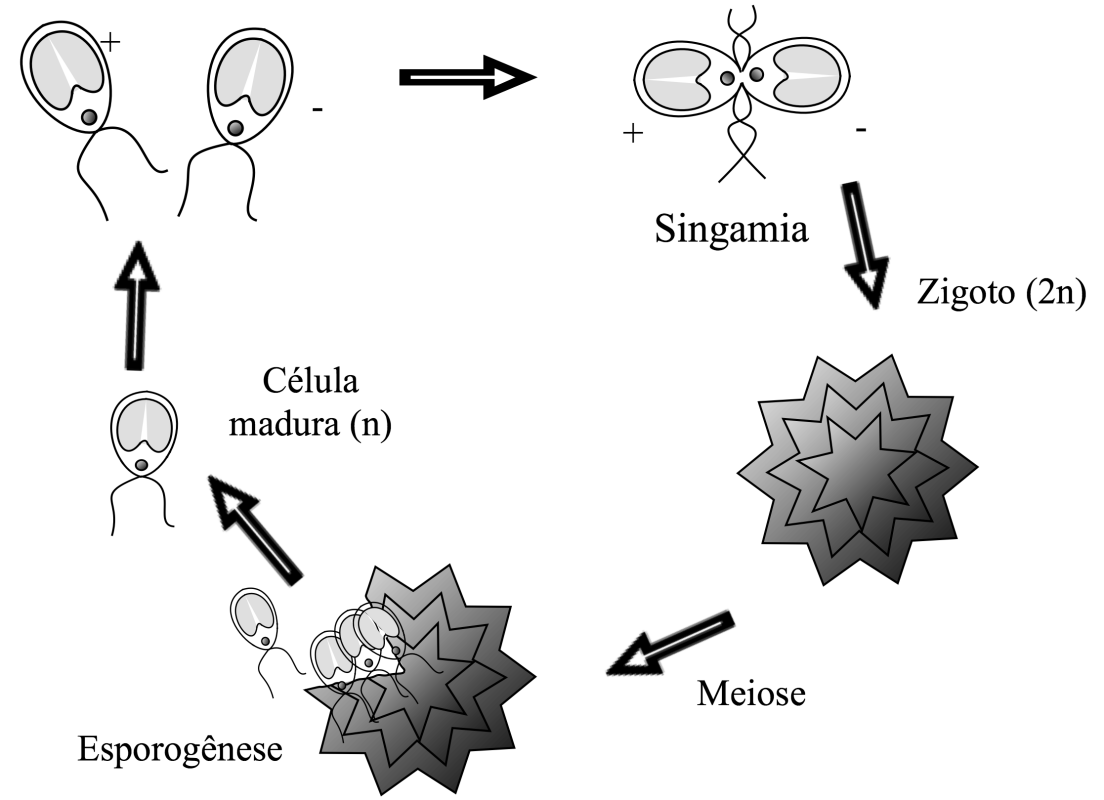




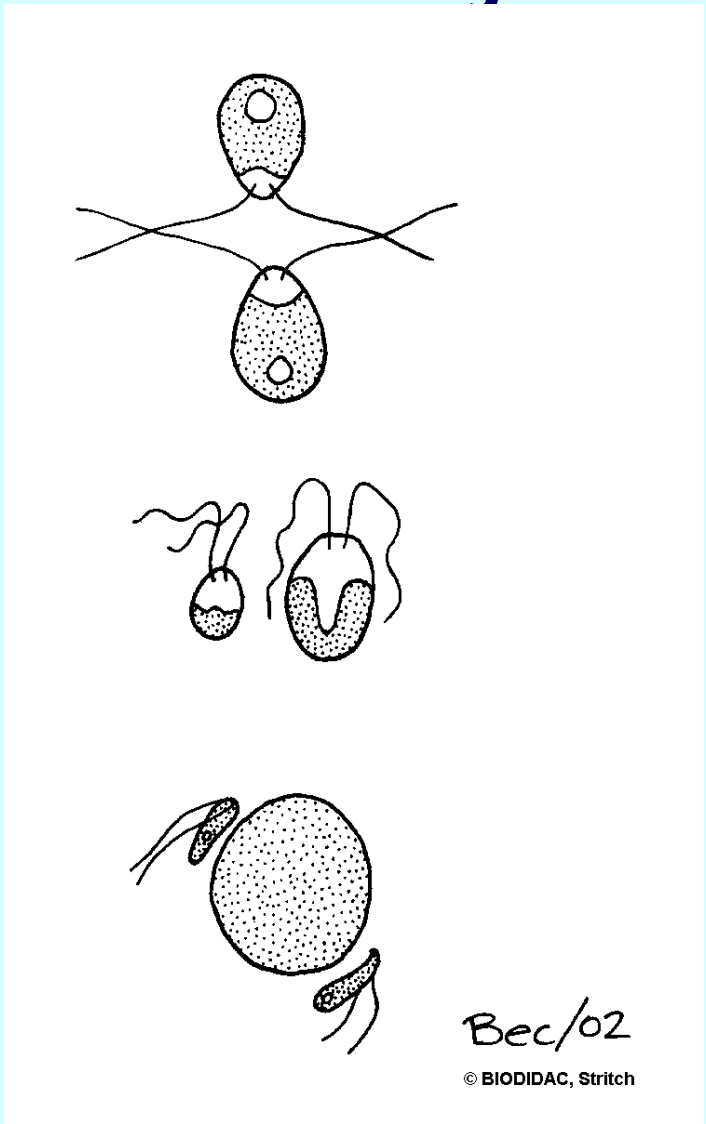




Isogamia em *Chlamydomonas*



Evolução da oogamia



Isogamia

Anisogamia

Oogamia

http://biodidac.bio.uottawa.ca

E por quê não 3 (ou mais) sexos?

E por quê sexos em indivíduos separados?

(Ou por quê não haver simplesmente hermafroditismo?)

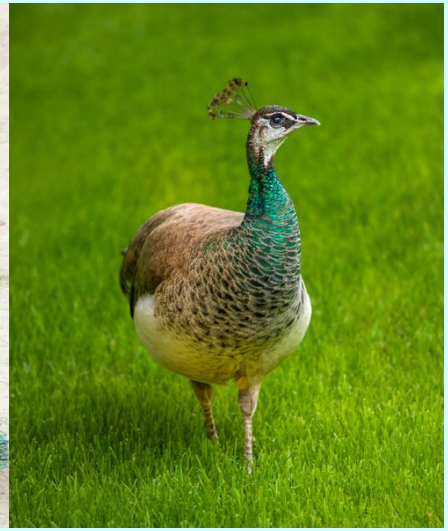
Monóicos (única casa)- dois sexos em um mesmo indivíduo (minhocas, caramujos, diversas plantas)

Dióicos (duas casas) – sexos em indivíduos diferentes (pessoas, mamão)

Dimorfismo sexual





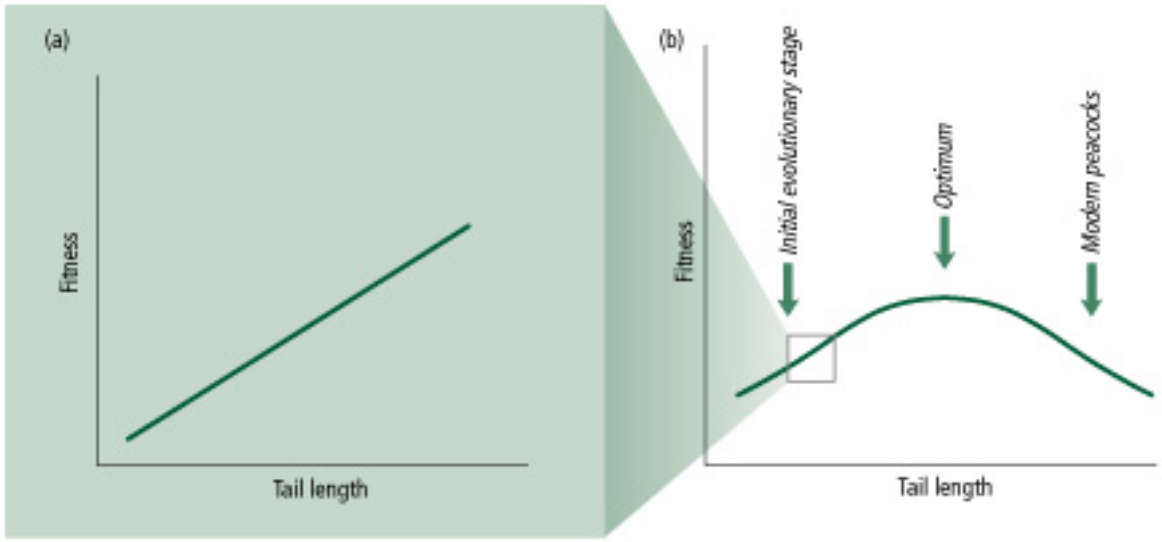


A cauda do pavão



A cauda do pavão

Figure 12.9
(a) The early stage in the evolution of a bizarre character such as the peacock's tail. Before females preferred to mate with long-tailed males, there might have been a positive correlation between tail length (then much shorter than in their descendants) and male fitness. (b) Full relation between degree of exaggeration of character (tail length) and survivorship. There is an intermediate optimum. Modern species like the peacock occur toward the right of the graph.



As caudas das andorinhas



Dimorfismo sexual





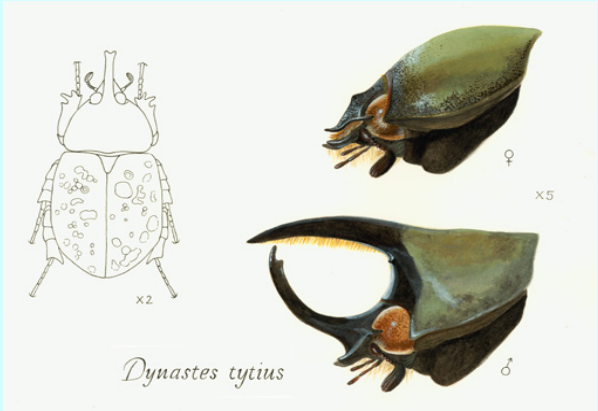














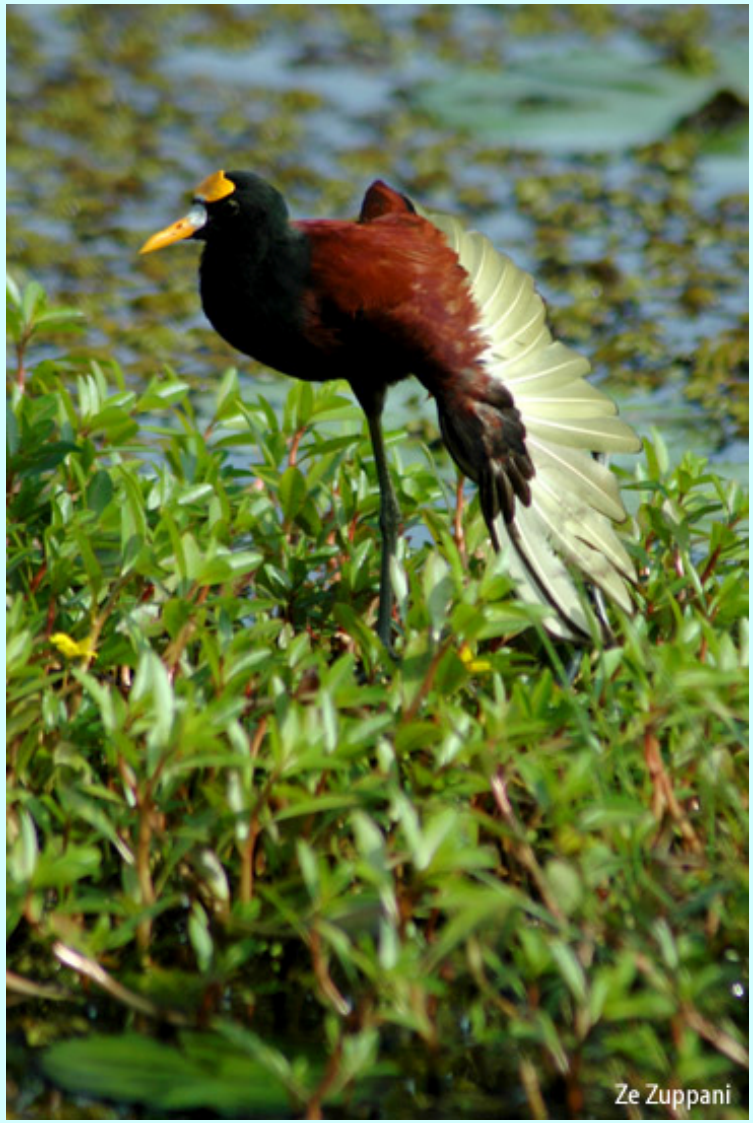
Monogamia X Poligamia



Monogamia X Poligamia



Monogamia X Poligamia



Jaçanã (*Jacana jacana*), encontrado em grande parte do Brasil, habita áreas alagadas, comuns no Pantanal matogrossense. Possui poligamia poliândrica, ou seja, cada fêmea se acasala com vários machos.

Monogamia X Poligamia

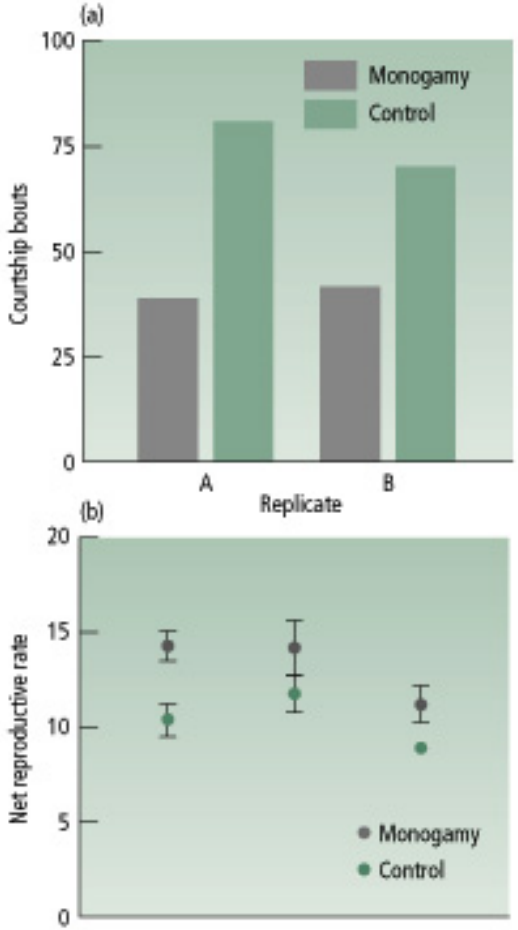
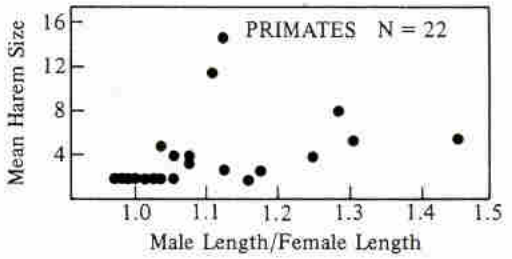


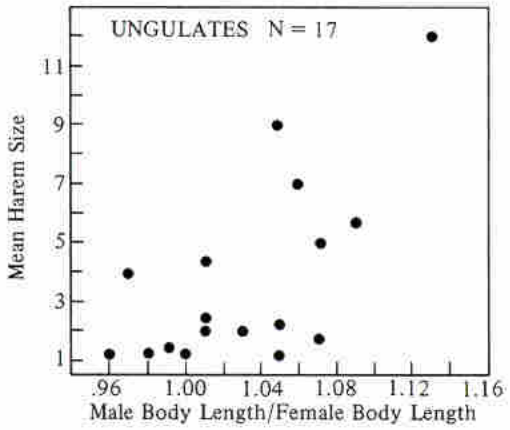
Figure 12.11
Experimentally imposed monogamy causes the evolution of reduced reproductive conflict in fruitflies. (a) Individual males were put with individual females and the amount of courtship behavior was measured. Courtship rates were reduced in the monogamous fruitflies. Results are shown for two replicate lines (A and B) of males sampled from the experimental line after 45 generations of monogamy and from a control line. (b) The total reproductive output per female increased (this was measured as the number of mature progeny per female). It is shown here for the experimental and control lines for the final three generations of the 47-generation experiment. Redrawn, by permission of the publisher, from Holland & Rice (1999).

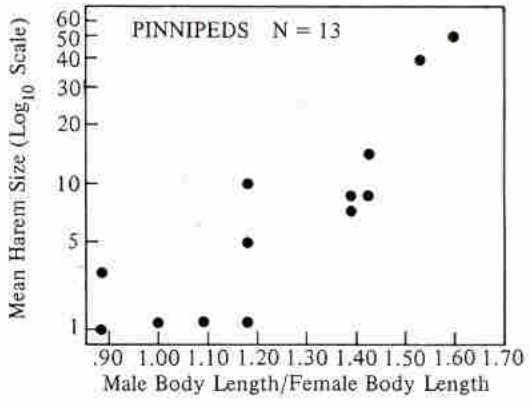
Monogamia X Poligamia

FIGURE 7–3
The relationship between mean harem size and sexual dimorphism in size in pinnipeds, ungulates, and primates



(After Alexander et al., 1978, Figures 15–1, 15–3, 15–5 [12].)





Pinípedes = focas, leões e lobos marinhos, etc.
Ungulados = mamíferos com casco, cavalos, gado, elefantes, baleias, etc.
Primatas = lêmures, símios, macacos, pessoas, etc.

Monogamia: Fenômeno social

Antes de haver testes de paternidade -> 90% fidelidade entre aves “monogâmicas”.

Depois dos testes: Fidelidade é exceção!



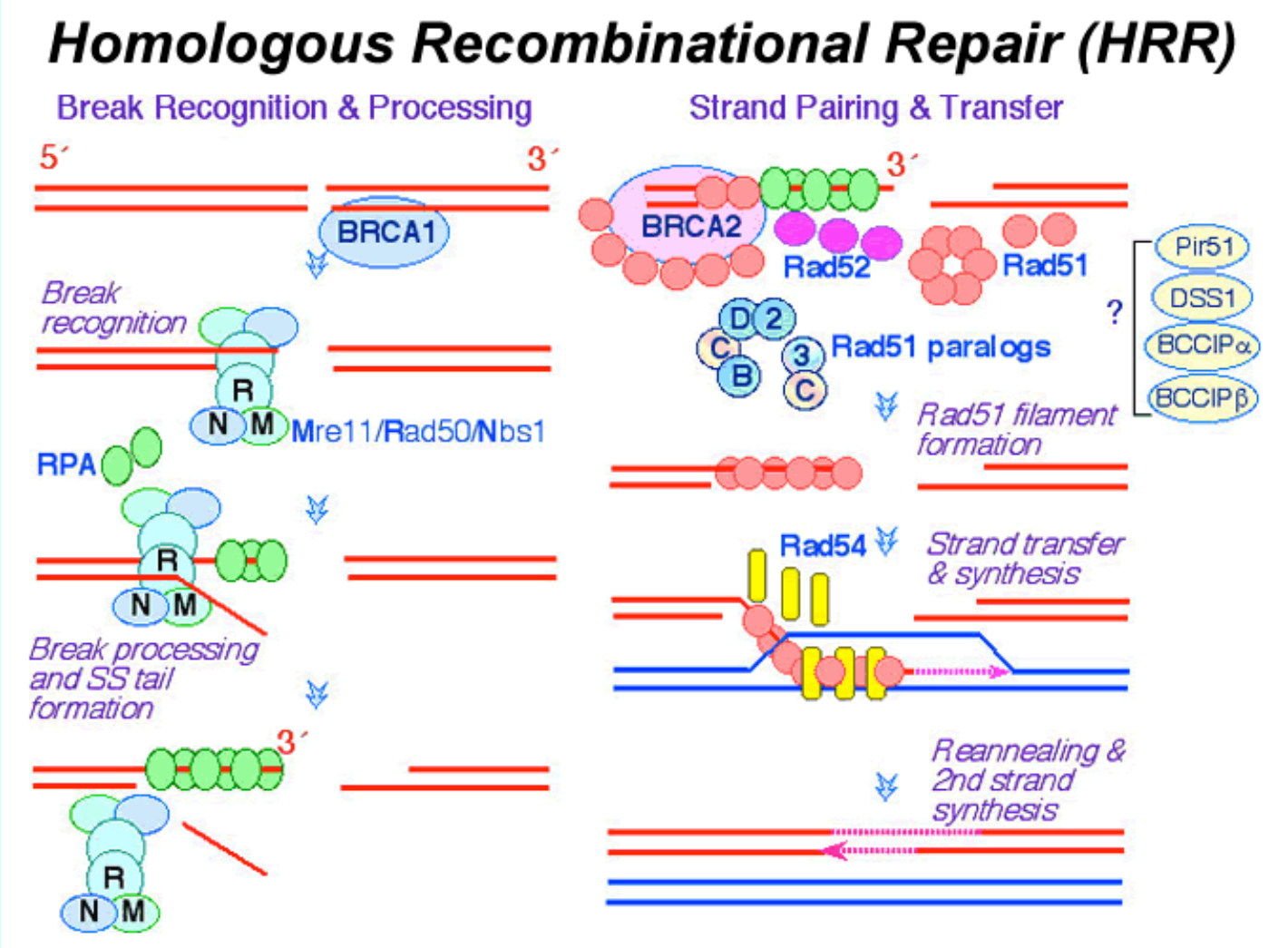






Reprodução sexuada: uma outra hipótese…

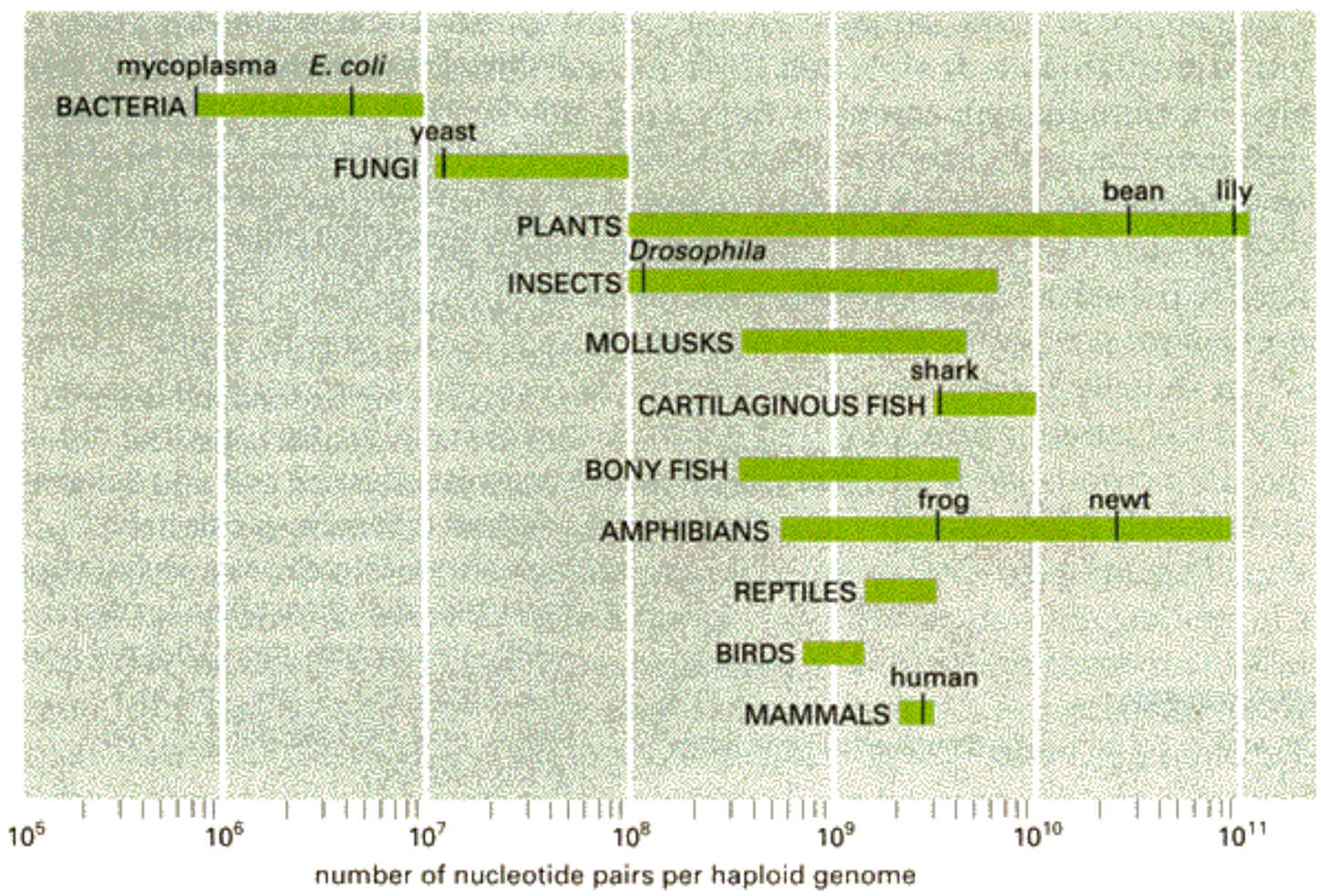
Reparo recombinacional homólogo



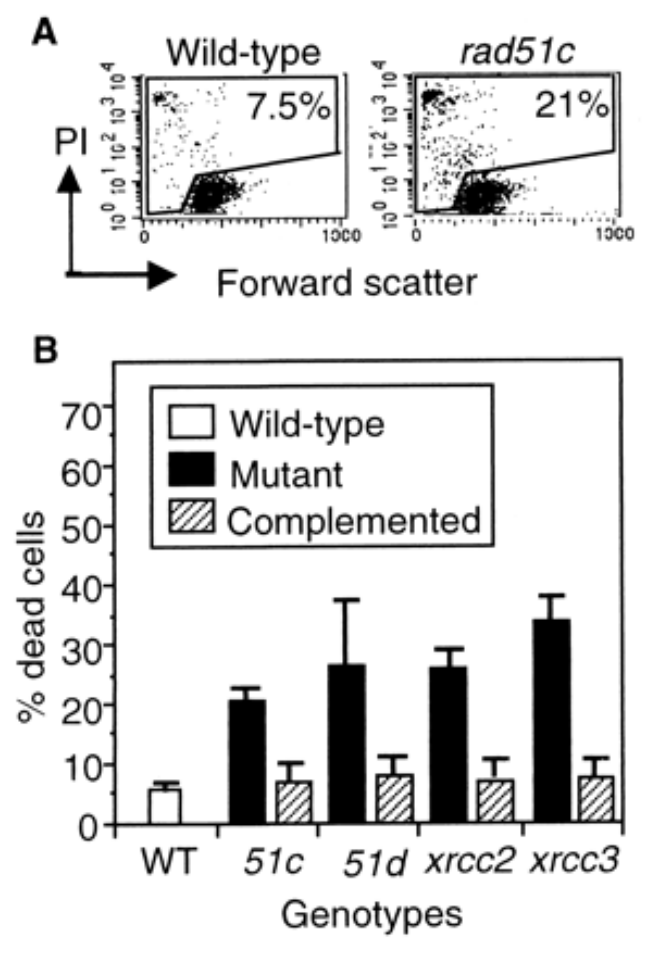
Sexo: preço pago para manter a informação genética?

- Mundo de RNA: informação única
- Mundo de DNA: informação redundante
- Organismos diplóides: informação duplamente redundante
- Organismos de reprodução sexuada: redundância verificada a cada geração

Sexo: preço pago para manter a informação genética?



Sexo: preço pago para manter a informação genética?



Takata M, Sasaki MS, Tachiiri S, Fukushima T, Sonoda E, Schild D, Thompson LH, Takeda S. (2001) Chromosome instability and defective recombinational repair in knockout mutants of the five Rad51 paralogs. Mol Cell Biol. 21(8):2858-66.