Gene mixing da ricombinazione

VARIAZIONE NELLE POPOLAZIONI NATURALI

LOCI MULTIPLI E L'EFFETTO DEL LINKAGE

Linkage equilibrium:

associazione di alleli a due o più loci che si ritrova con la frequenza
prevista sulla base delle frequenze individuali dei singoli alleli

Linkage disequilibrium:

associazione di alleli a due o più loci che si ritrova più frequentemente,
(o meno) di quanto atteso, sulla base delle frequenze individuali dei
singoli alleli

*Conseguenze: cambiamenti nelle frequenze alleliche ad un locus
possono causare cambiamenti correlati ad altri loci a cui il locus è
associato*
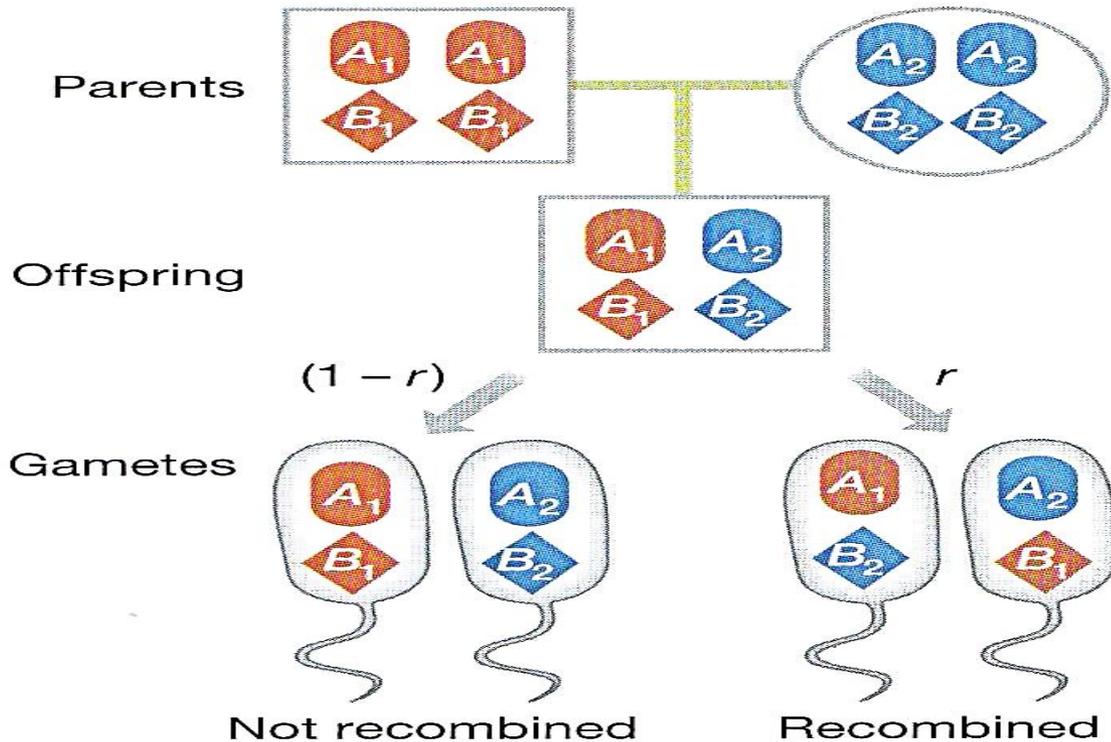
Recombination randomizes the combinations of alleles at two loci. One locus is shown as an oval and the other as a diamond. These loci may be on the same chromosome or on different chromosomes. Two different alleles are indicated by the different colors. The offspring makes two kinds of gametes (sperm): those that have not recombined the alleles inherited from the parents (left), and those that have (right). The recombination rate, r, is the fraction of gametes that have recombined alleles.
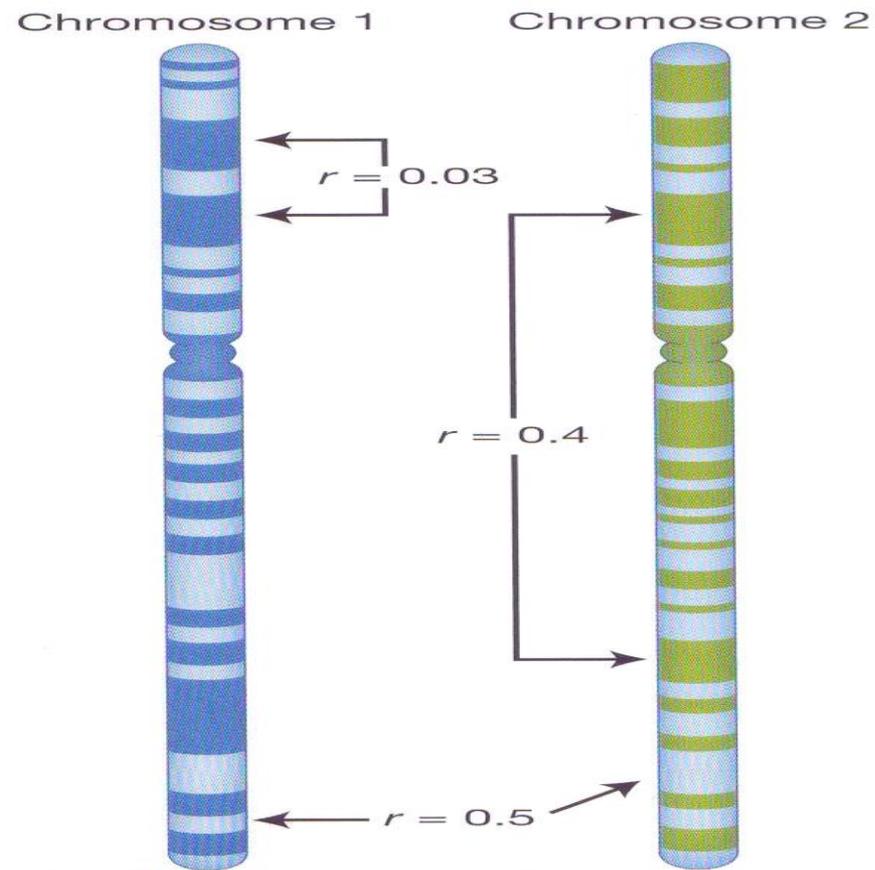
The recombination rates between three pairs of loci. A pair of loci that are close together on the same chromosome have a low recombination rate (here, $r = 0.03$). A pair that is far apart on the same chromosome has a hight recombination rate that approaches 0.5 (here, $r = 0.4$). A pair of loci on different choromosomes has the maximum possible recombianation rate, $r = 0.5$
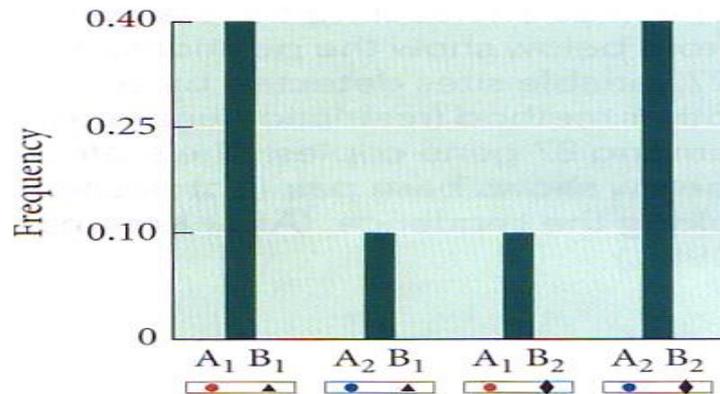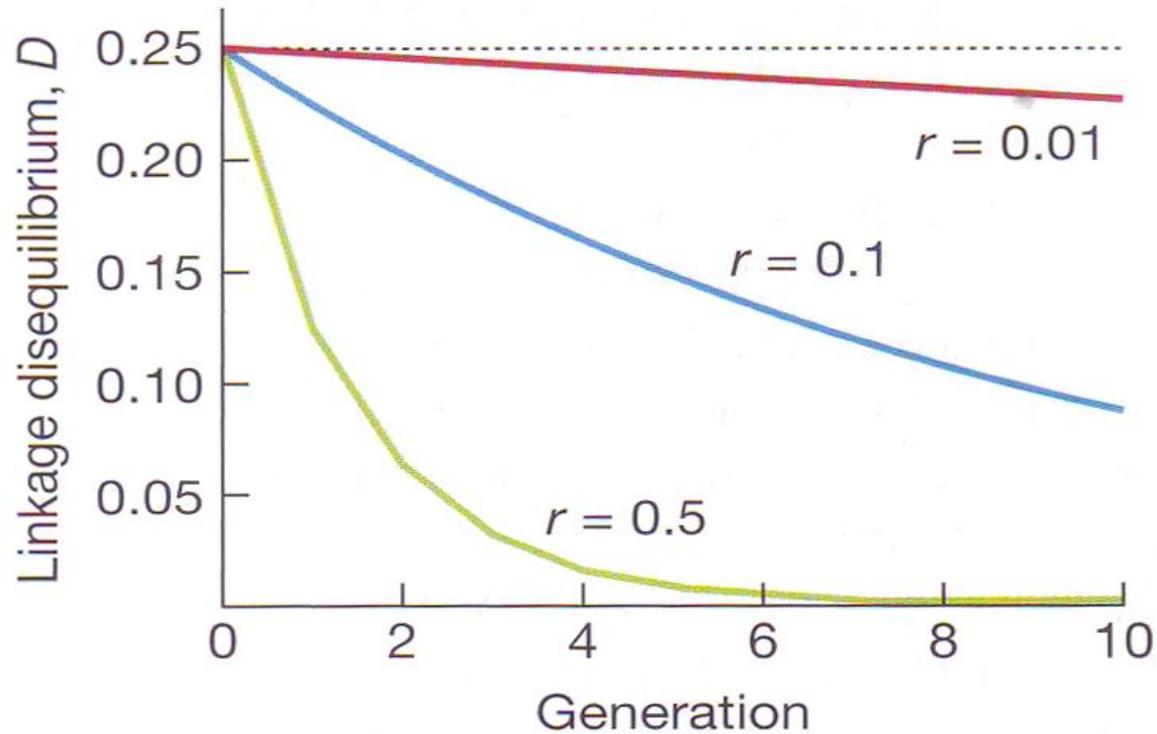
(A) No linkage; linkage equilibrium
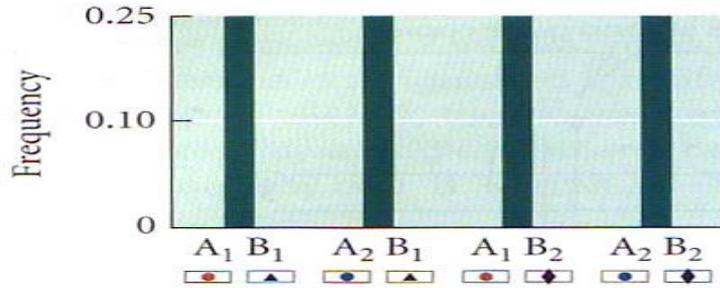
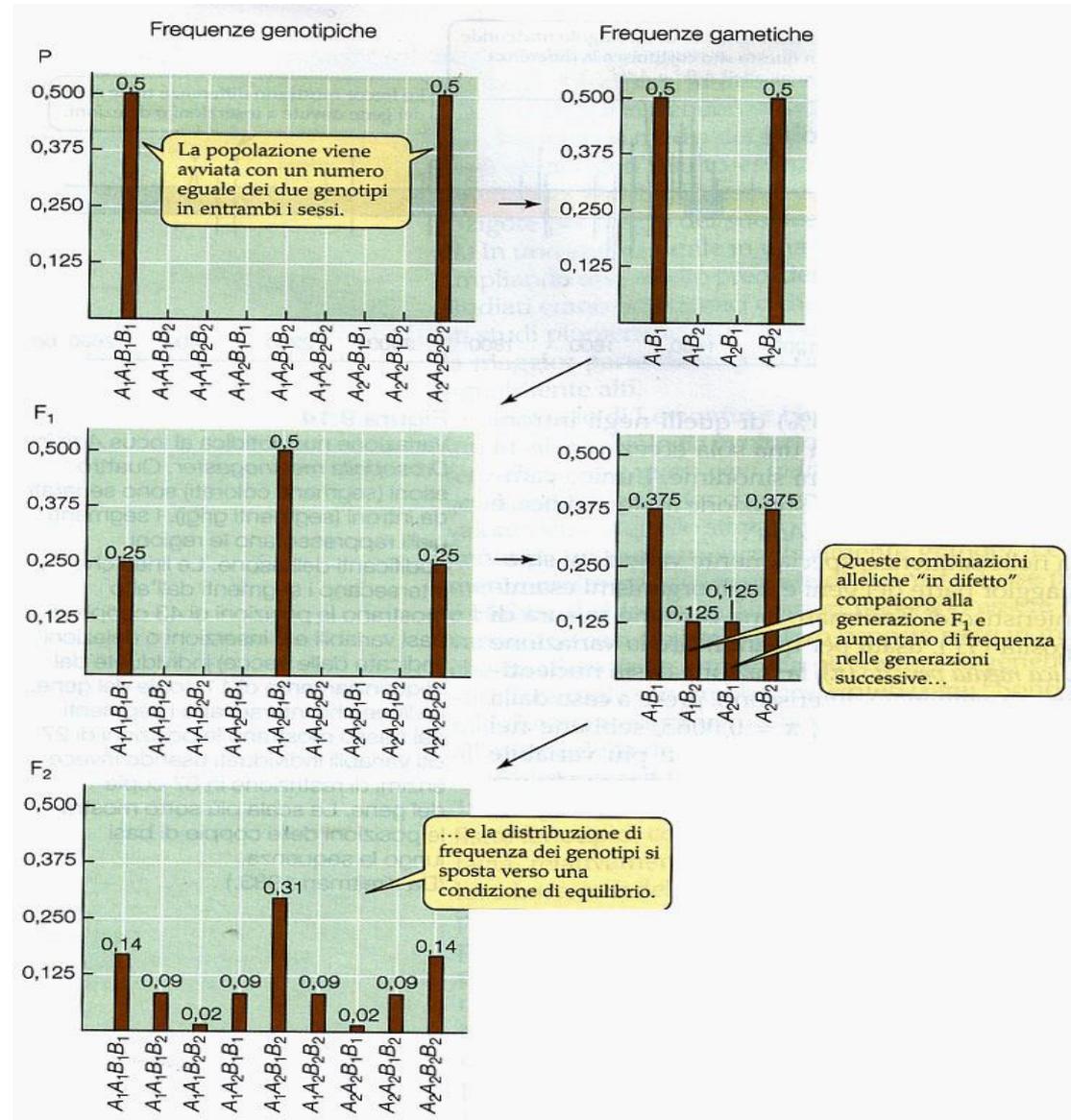(B) Linkage; linkage equilibrium
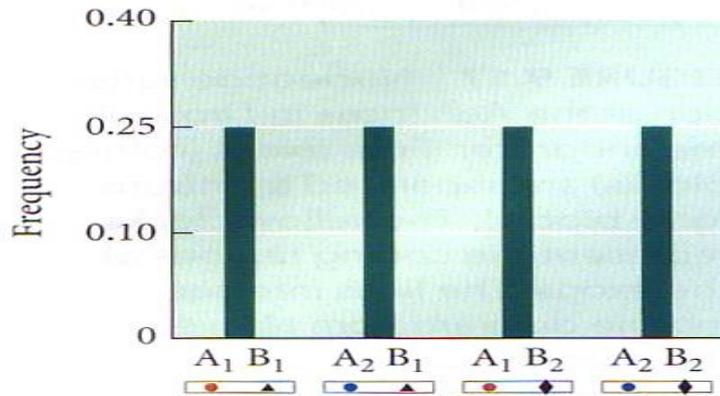
(C) Linkage; linkage disequilibrium

The distinction between linkage and linkage (dis)equilibrium. The frequencies of alleles A_1 and A_2 are each 0.5, and the same for alleles B_1 and B_2. (A) The A and B loci are unlinked (on different chromosomes) and are in linkage equilibrium: each gene combination has frequency 0.5^2, as expected if alleles are not associated. (B) The loci are linked (on the same chromosome), and are in linkage equilibrium. (C) The linked loci are in linkage disequilibrium: A_1 and B_1 are nonrandomly associated, as are A_2 and B_2.

Recombination causes linkage disequilibrium to decrease. The value of D declines toward 0 rapidly when the recombination rate is large ($r = 0.5$), and slowly when it is small ($r = 0.01$).
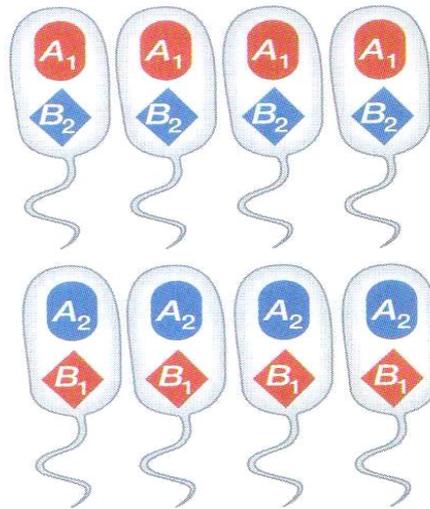
Riduzione progressiva del linkage disequilibrium tra due loci non associati nel corso di generazioni (*ad opera della ricombinazione durante la meiosi)* in una popolazione che presenta due genotipi in numero uguale in entrambi i sessi
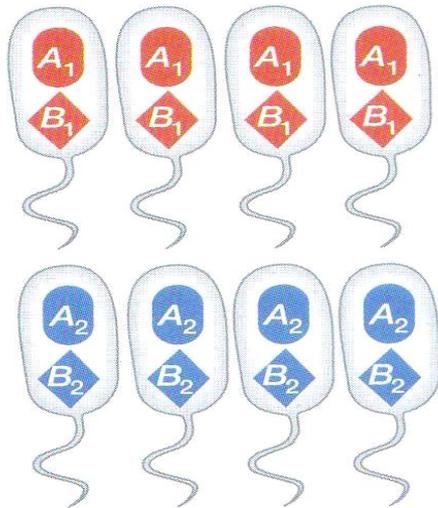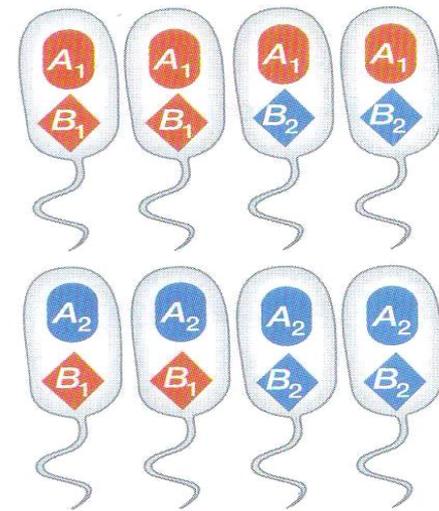
Three populations of eight gametes that have the same allele frequencies ($p_A = p_B = 1/2$) but have different values of linkage disequilibrium. Linkage disequilibrium is defined the same way regardless of whether the two loci are on the same chromosome or on different chromosomes. (A) When the disequilibrium, D, between alleles A_2 and B_2 is positive, those alleles are found together more often than if they were associated at random. When D is at its maximum possible value ($D = 1/4$), a gamete that carries allele A_2 always carries allele B_2. (B) When disequilibrium is at its smallest possible value ($D = -1/4$), a gamete that carries allele A_2 always carries allele B_1. (C) When a population is at linkage equilibrium ($D = 0$), there is no association between alleles at the two loci. If a sperm carries allele A_2, the chance that it also carries allele B_2 is simply the frequency of B_2 in the population.
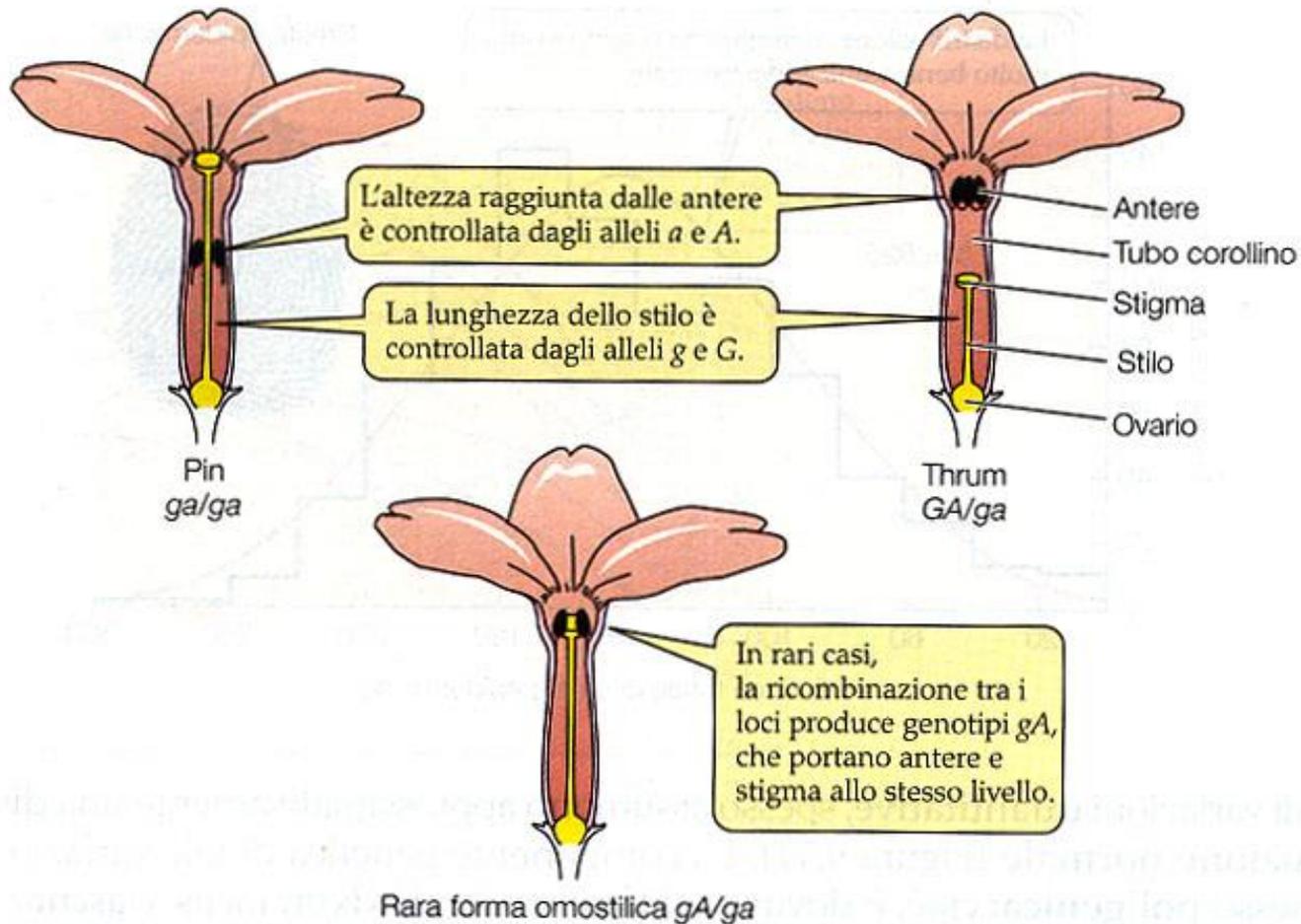
Eterostilia nella primula (Primula vulgaris) In natura le piante hanno stilo lungo e   stami corti (fenotipo "pin", spillo) o stilo corto e stami lunghi (fenotipo "thrum", tamburo). Rare sono le piante omostiliche (basso successo nell'impollinazione)