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KAPPA PARTICLES IN PARAMECIUM

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Cytoplasmic Inheritance of Kappa Particles in *Paramecium*

Kappa particles in *Paramecium*

One of the most striking and spectacular cases of cytoplasmic inheritance occurs in *Paramecium aurelia*. In 1938, T.M. Sonneborn reported that some strains contain kappa particles

in the cytoplasm and are known as "**killers**". Kappa particles are about 2 μ x in diameter and contain DNA and protein.

Individuals not possessing Kappa particles are "**sensitive**" and are killed by a poison '**paramecin**', which is secreted by Killer individuals. The secretion **paramecin** is harmless to the killers. The different killer strains have different means of killing their victims.

Thus, Kappa particles are found in certain **killer strains** of *Paramecium* and are responsible for production of substance **paramecin,** which is toxic to strains not possessing **kappa** (**sensitive strains**). Most of them do not kill their mates. However, there are some strains that instead of killing from a distance by secretion, kill their mates through close contact. The killer character has a nuclear as well as cytoplasmic basis. The production of kappa particles is dependent on a dominant allele *K,* so that killer strains

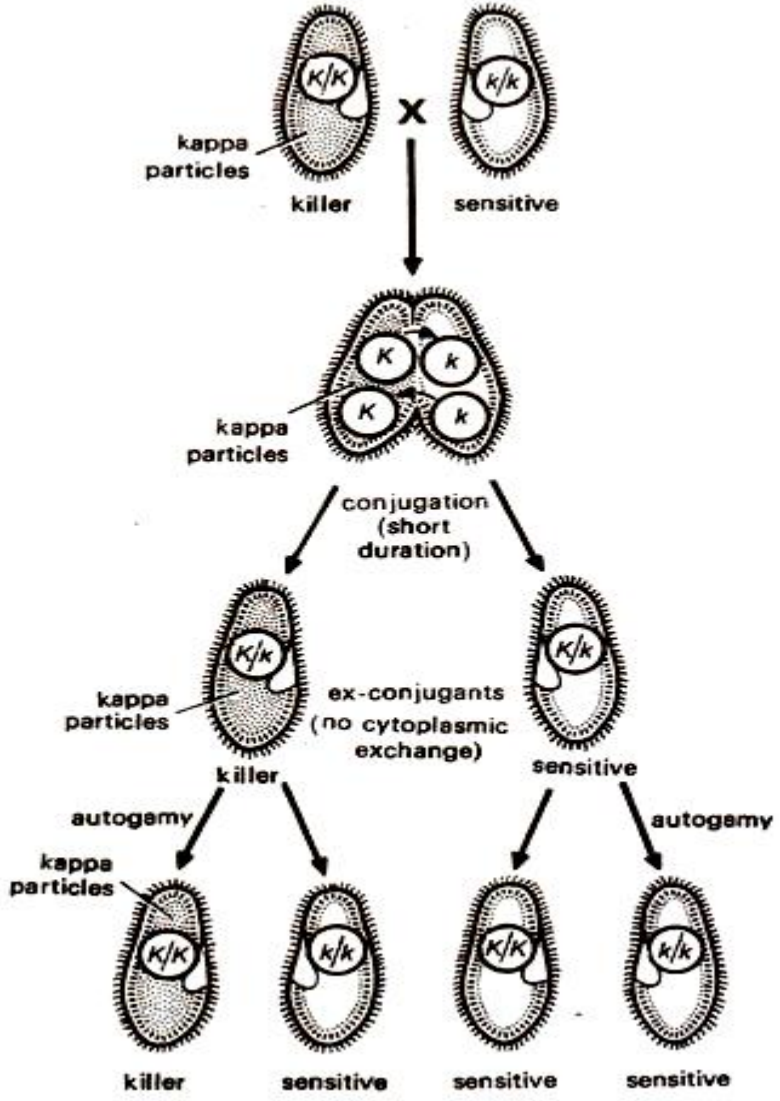
are *KK* or *Kk* and sensitive strains are ordinarily *kk*. In absence of dominant allele *K*, kappa particles cannot multiply and in absence of kappa particles, dominant allele *K* cannot produce them *de novo*. Consequently, sensitive strains with genotypes *KK* or *kk* can be obtained. These will not carry any kappa particles. However, killer strain with genotype *kk* cannot be obtained, because even if kappa particles are present, these would be lost in absence of dominant allele. If *Paramecium* clones with

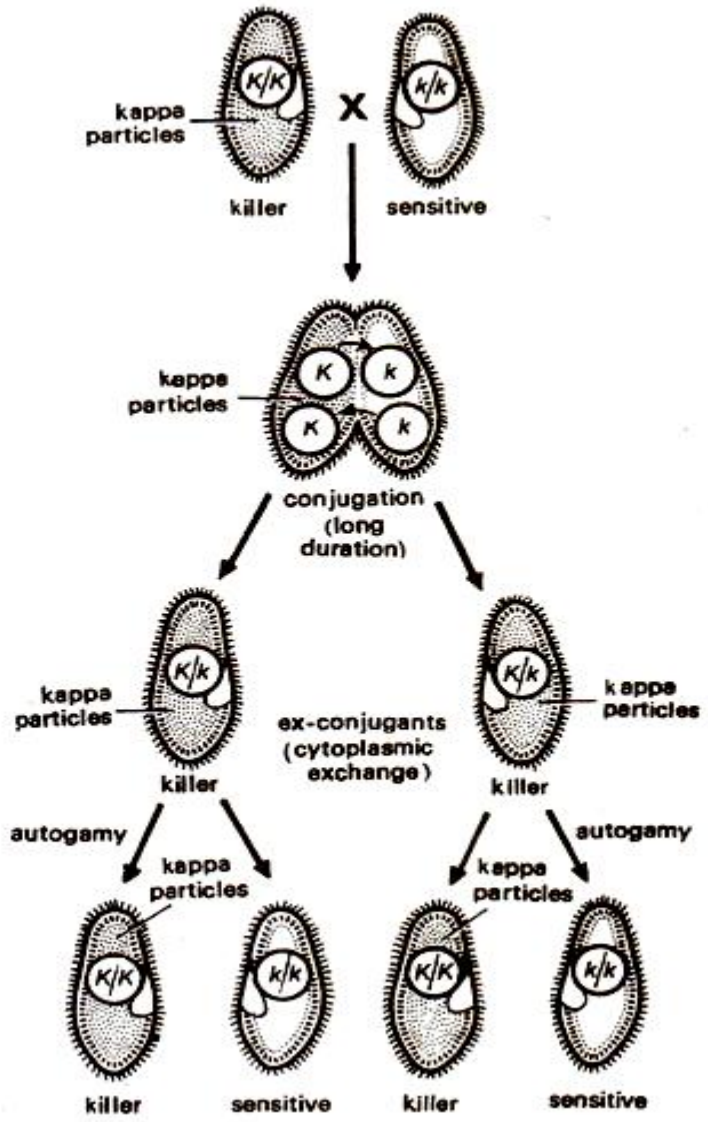
genotypes *KK* or *Kk* are allowed to multiply asexually at such a fast rate, that division of kappa particles cannot keep pace with division of cells, kappa particles will be eventually lost. Consequently sensitive strains with dominant genotype (*KK, Kk*) having no kappa particles would be obtained.

If the killer (*KK*) and sensitive (*kk*) strains are allowed to conjugate, all exconjugants (the cells separating after conjugation) will have same genotype *Kk.* Phenotypes of these

exconjugants will, however, depend upon duration for which conjugation is allowed. If conjugation does not persist long enough for exchange of cytoplasm, heterozygote (*Kk*) exconjugants will only have parental phenotypes. It means that killers will remain killers and sensitive will remain sensitive even after conjugation. If conjugation persists, sensitive strain will receive kappa particles and will become killer, so that exconjugants will be killers having genotype *Kk* . The following figures show the results of a cross between a

killer (KK) and a sensitive (kk) strain of Paramecium, when no cytoplasmic exchange is allowed, and also the results of a cross between a killer (KK)and a sensitive (kk)strain of *Paramecium*, when cytoplasmic exchange is allowed.


K/K
x
k/k
kappa particles
killer
sensitive
K
k
K
k
kappa particles
conjugation (short duration)
K/k
K/k
kappa particles
ex-conjugants (no cytoplasmic exchange)
killer
sensitive
autogamy
autogamy
kappa particles
K/K
k/k
K/K
k/k
killer
sensitive
sensitive
sensitive


kappa particles
K/K
X
k/k
killer
sensitive
kappa particles
K
k
K
k
conjugation (long duration)
kappa particles
K/k
killer
ex-conjugants (cytoplasmic exchange)
K/k
kappa particles
killer
autogamy
kappa particles
autogamy
kappa particles
K/K
k/k
K/K
k/k
killer
sensitive
killer
sensitive

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THANK YOU