PARASEXUALITY

B.Sc. BOTANY

First Reported by- *Gudio Pontecorvo* and *J.A.Roper(1952)*

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Parasexuality or Parasexual Cycle :-

- The phenomena was first discovered in 1952 by Pontecorvo and Roper of the University of Glasgow in *Aspergillus nidulans*, the imperfect stage of *Emericella nidulans*
- Generally parasexual cycle occurs in those fungi in which true sexual cycle does not take place
- Parasexuality is defined as a cycle in which Plasmogamy, Karyogamy and Meiosis (Haploidization) take place in sequence but not at a specified time or at specified points in the life cycle of an organism
- Parasexual cycle is also known as Somatic recombination

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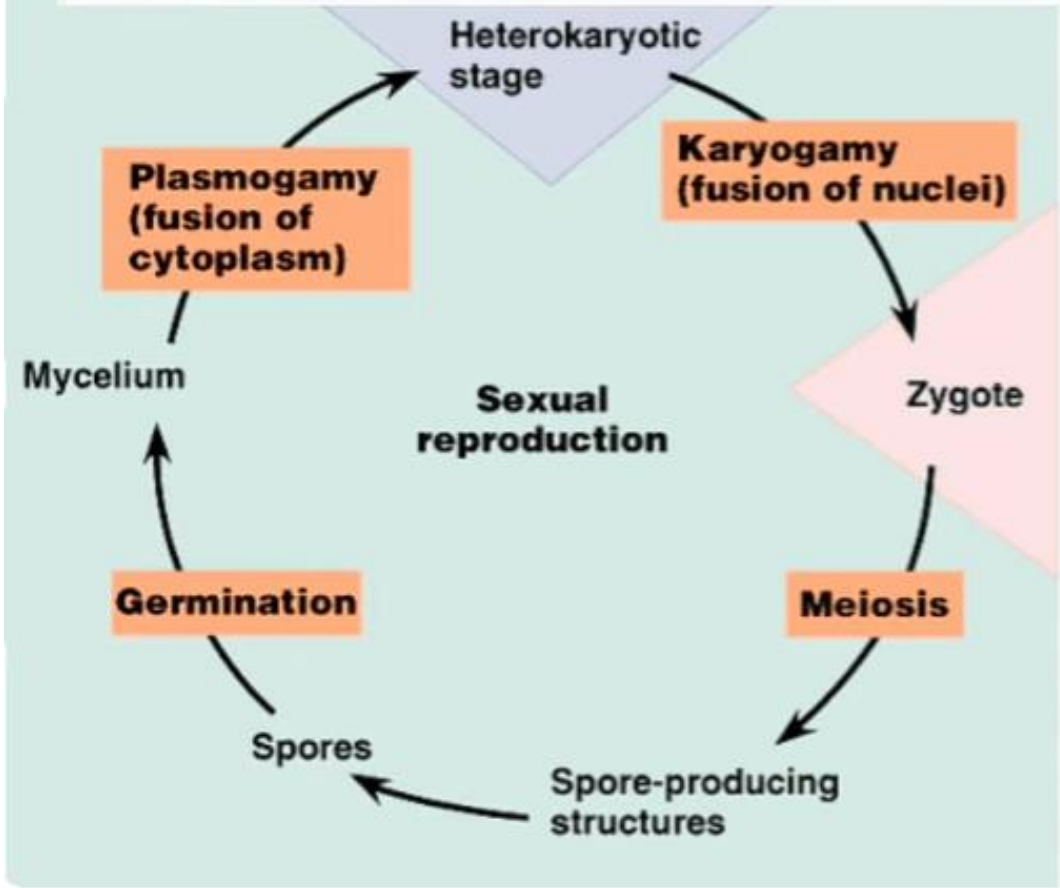
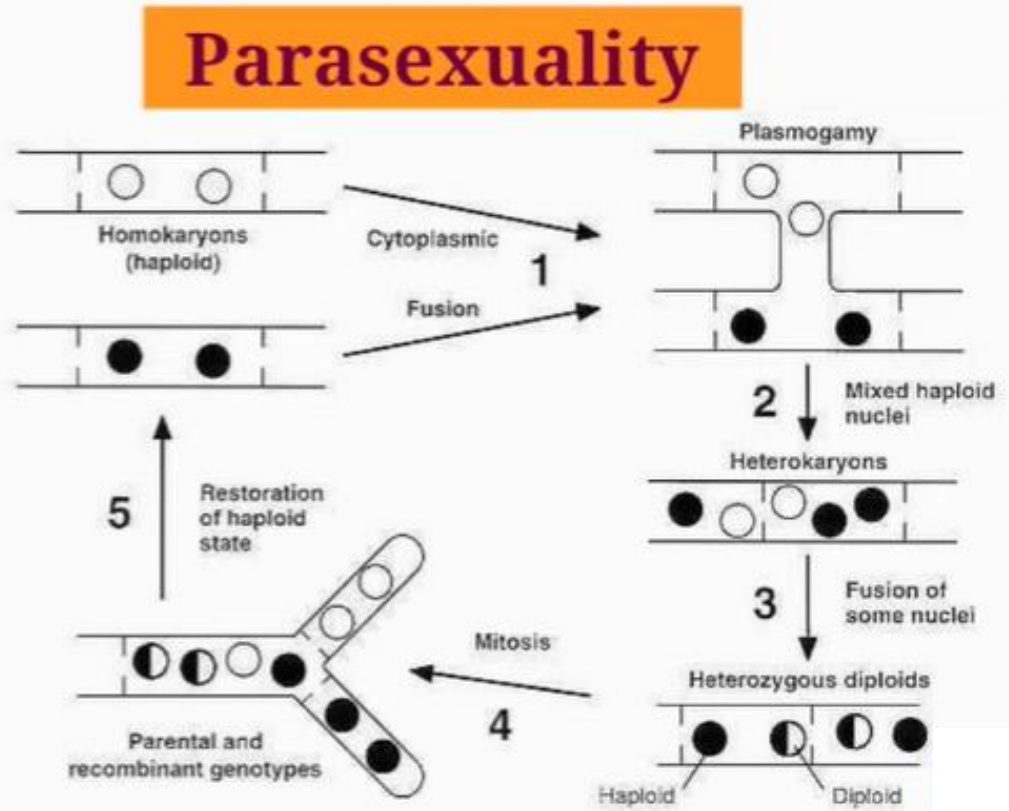
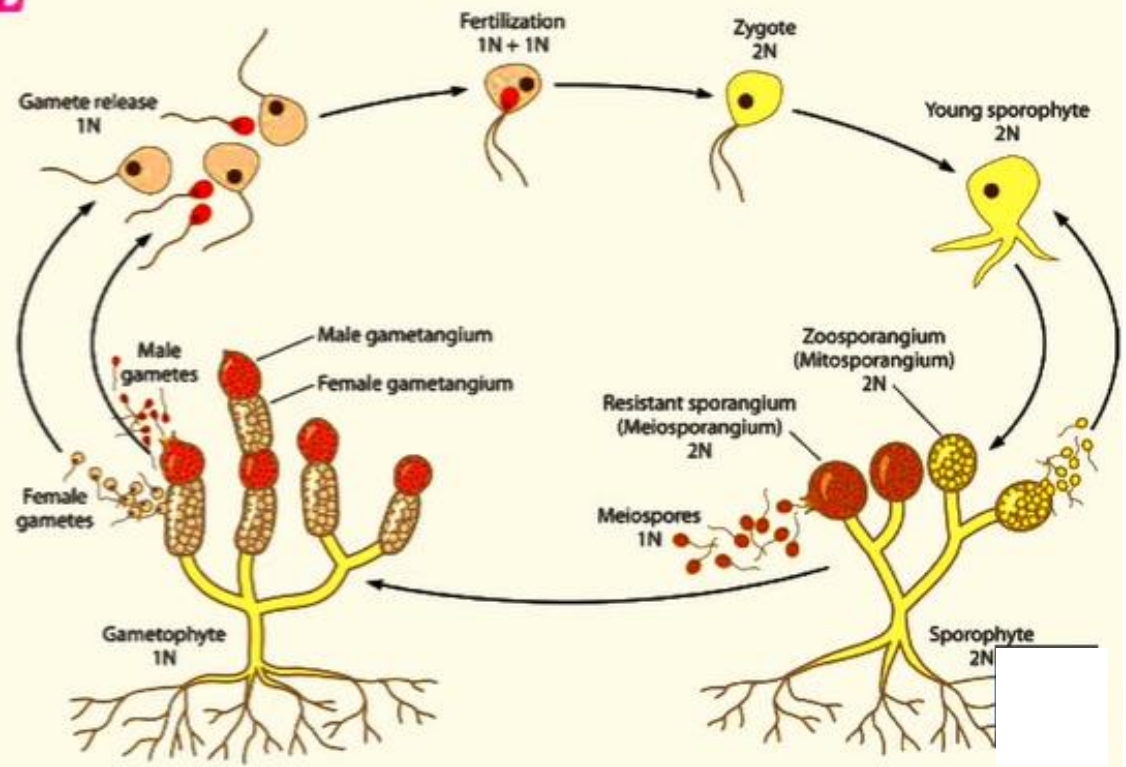




INTRODUCTION

- In some fungi ,true sexual cycle comprising of nuclear fusion and meiosis is absent.
- These fungi derive the benefits of sexuality through a cycle know as ***parasexuaL cycle.***



Comparison Between Sexual Cycle and Parasexuality

Sexual Cycle	Parasexual Cycle
• Nuclear fusion in specialized structures	• No nuclear fusion in vegetative structure
• Zygote persist one nuclear generation	• Zygote persists through many mitosis
• Recombination by meiosis crossing over and reduction of chromosome number	• Recombination by rare mitosis or mitotic crossing over and random assortment of chromosomes
• Products readily recognised and isolated	• Recognised only by suitable markers

Steps Involved in Parasexual Cycle:

According to Pontecarvo (1958), parasexual cycle in A. nidulans involves the following steps:

(i) Formation of heterokaryotic mycelium

(ii) Fusion between two nuclei (Karyogamy)

(a) Fusion between like nuclei

(b) Fusion between unlike nuclei

(iii) Multiplication of diploid nuclei

(iv) Occasional Mitotic crossing over.

(v) Sorting out of diploid nuclei

(v) Occasional haploidisation of diploid nuclei, a

(vii) Sorting of new haploid strains.

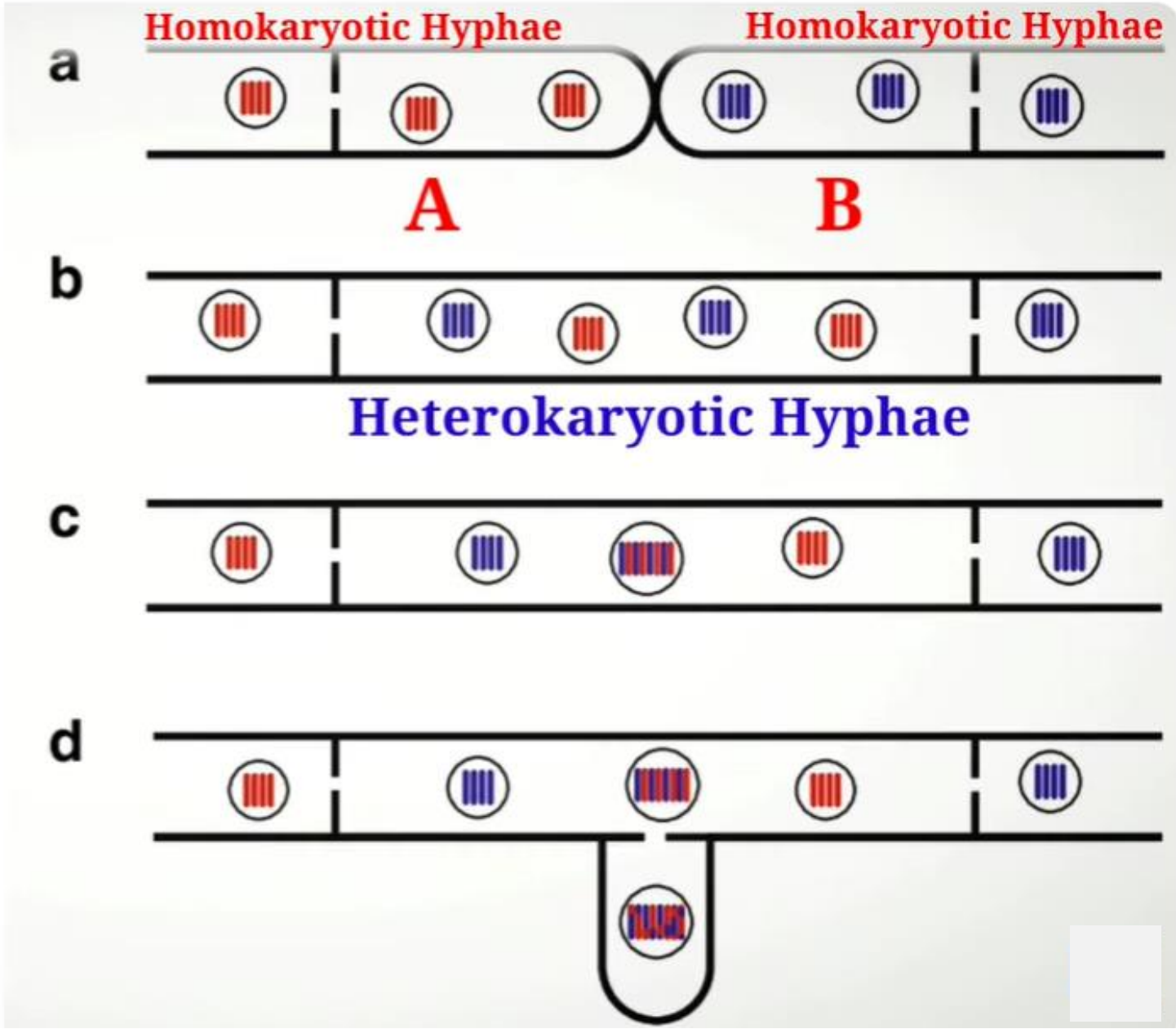
1. Formation of heterokaryotic mycelium

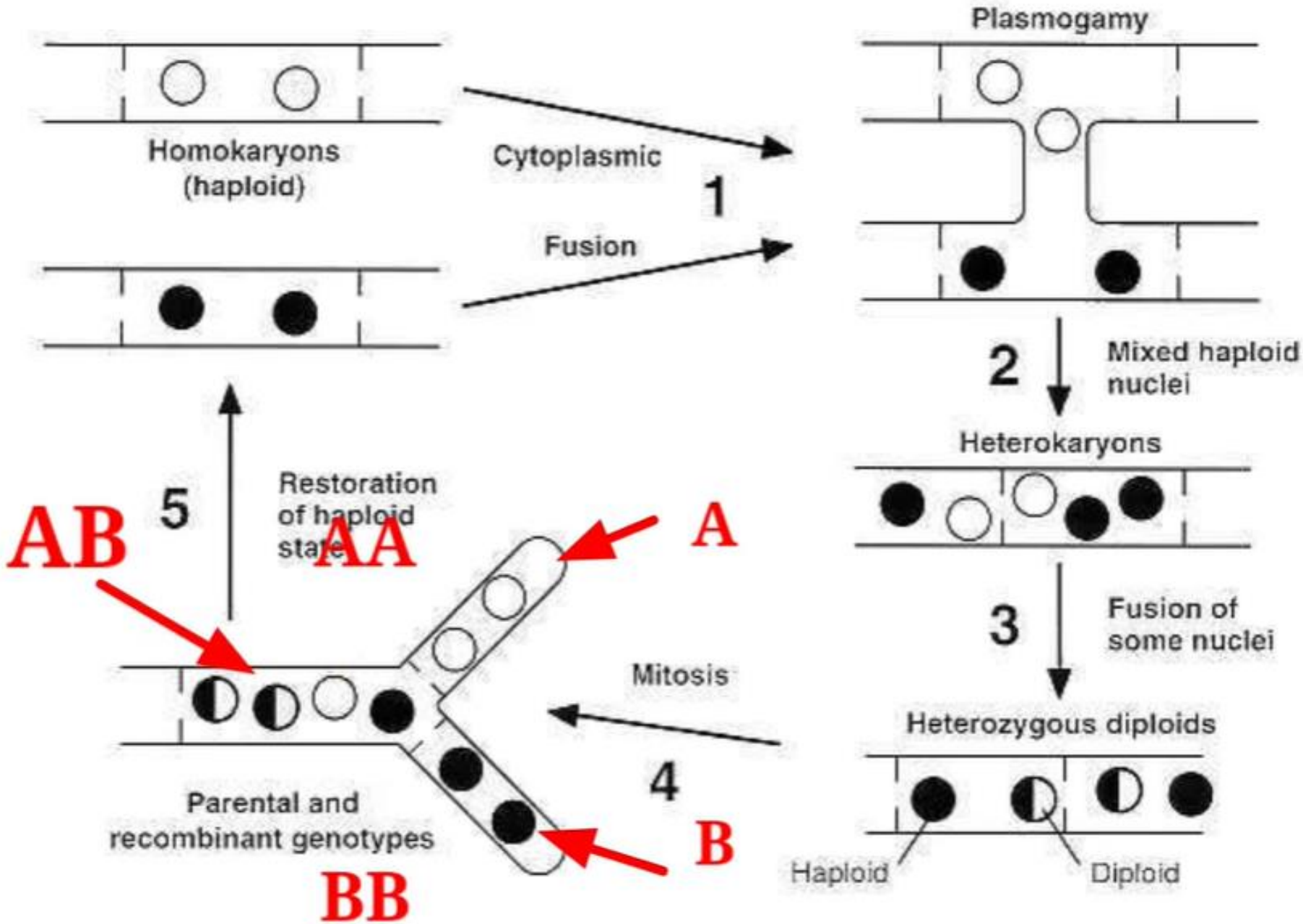
- The Heterokaryotic mycelium is mainly formed by the anastomosis of somatic hyphae of different genetic combinations.
- The mating of foreign nucleus or nuclei within the mycelium multiplies and its progeny grows through the mycelium giving it heterokaryotic.
- The mutation of one or more nuclei within homokaryotic mycelium also makes it heterokaryotic.
- This happens in those fungi which are belonging to Ascomycetes.

Plasmogamy

Karyogamy

Mitosis




Homokaryons
(haploid)
Cytoplasmic
1
Fusion
Plasmogamy
2
Mixed haploid
nuclei
Heterokaryons
3
Fusion of
some nuclei
Heterozygous diploids
Haploid
Diploid
4
Mitosis
5
Restoration
of haploid
state
AB
AA
A
B
BB
Parental and
recombinant genotypes

3. Multiplication of diploid nuclei

- Mentioned 5 types of nuclei can multiply at about the same rate but the diploid nuclei are present in much smaller numbers than the haploid nuclei.
- Portecarvo (1958) estimates a proportion of one diploid heterozygous nucleus to 1000 haploid nuclei.

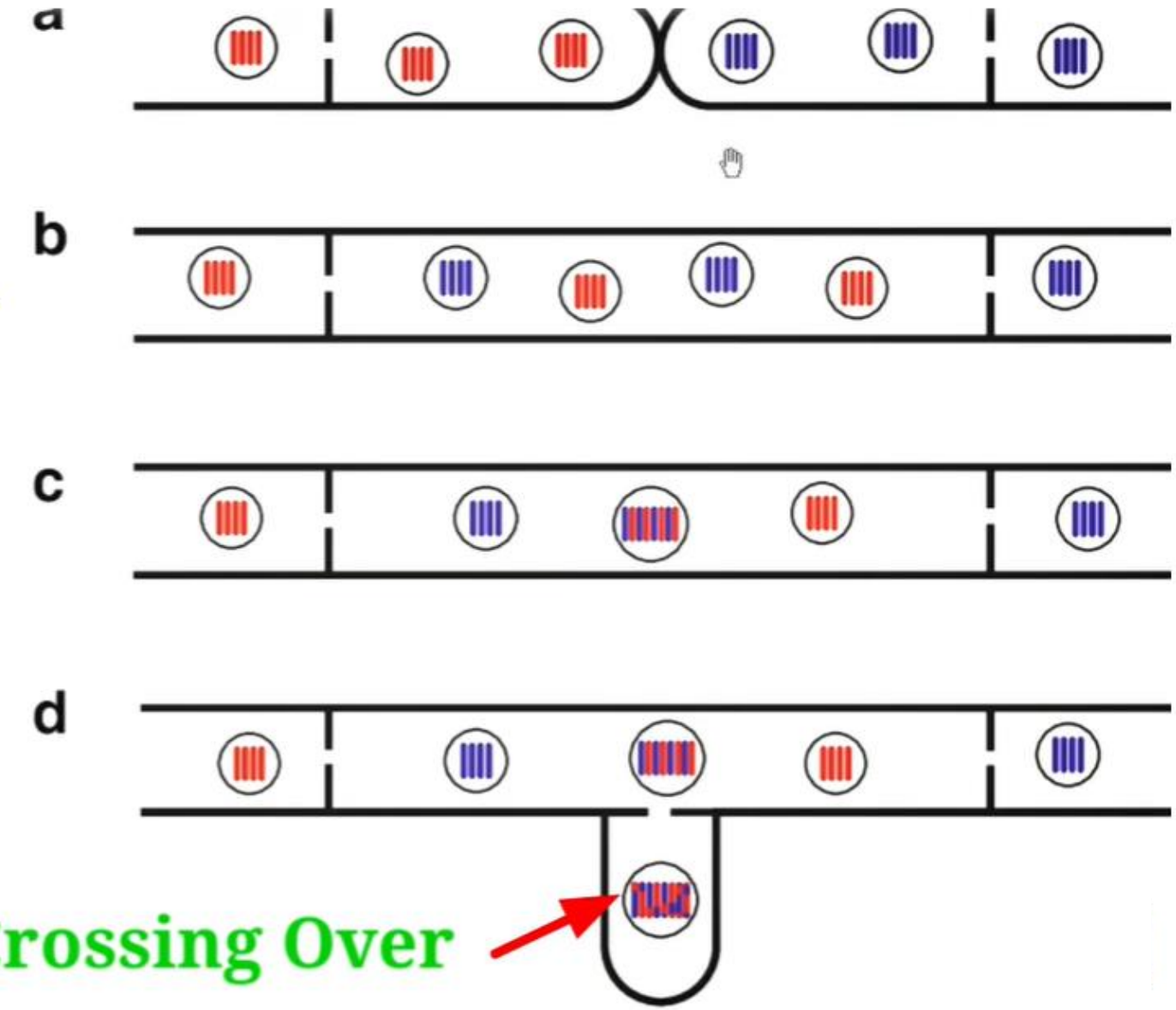
4. Occasional Mitotic crossing over.

- When diploid nuclei are multiplied, during this time mitotic crossing over may take place. Which may results in the formation of new gene combinations. These recombinations dependent on the existence of heterokaryosis, give the fungus some of the advantages of sexuality within the parasexual cycle.

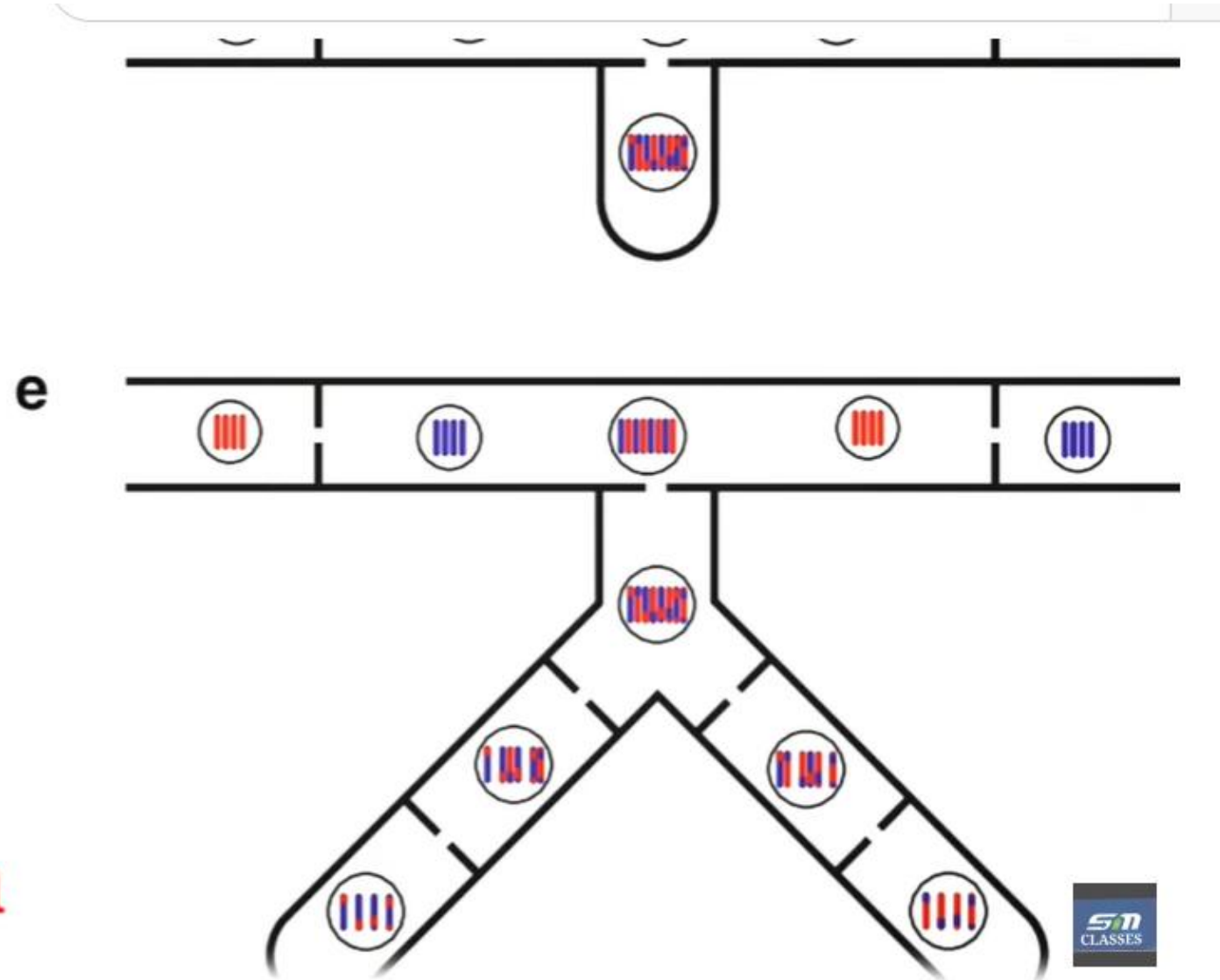
Plasmogamy

Karyogamy

Mitosis



Haplodization



5. Sorting out of diploid nuclei

- In those fungi which produce uninucleate conidia, sorting out of the diploid nucleus occurs by their incorporation into conidia which germinate to produce diploid mycelia. Diploid strains of several important imperfect fungi have been isolated.
- Roper (1952) first synthesized and isolated diploid strains of Aspergillus nidulans. The conidia of diploid strains are somewhat larger than those of haploid strains.

6. Occasional haploidisation of diploid nuclei, and

- Occasionally, some hyphae of diploid mycelium from haploid conidia which forms haploid mycelia on germination. The formation of haploid conidia by diploid mycelium indicates that haploidisation occurs in some diploid nuclei.

- Some diploid nuclei undergo haploidisation in the mycelium and are sorted out by incorporation of haploid nuclei in the uninucleate conidia. Some of these haploid strains are genotypically different from their parents because of their mitotic recombinations.

After the completion of the parasexual cycle, the mycelium should contain the following types of nuclei:

- Haploid nuclei like those of both the parents.
- Haploid nuclei with various new genetic recombinations.
- Several types of diploid homozygous nuclei.
- Several types of diploid heterozygous nuclei.

Consequences of Parasexuality

1. Haploid nuclei like both the parents
2. Haploid nuclei with various new genetic recombinations
3. Several types of diploid homozygous nuclei
4. Several types of diploid heterozygous nuclei

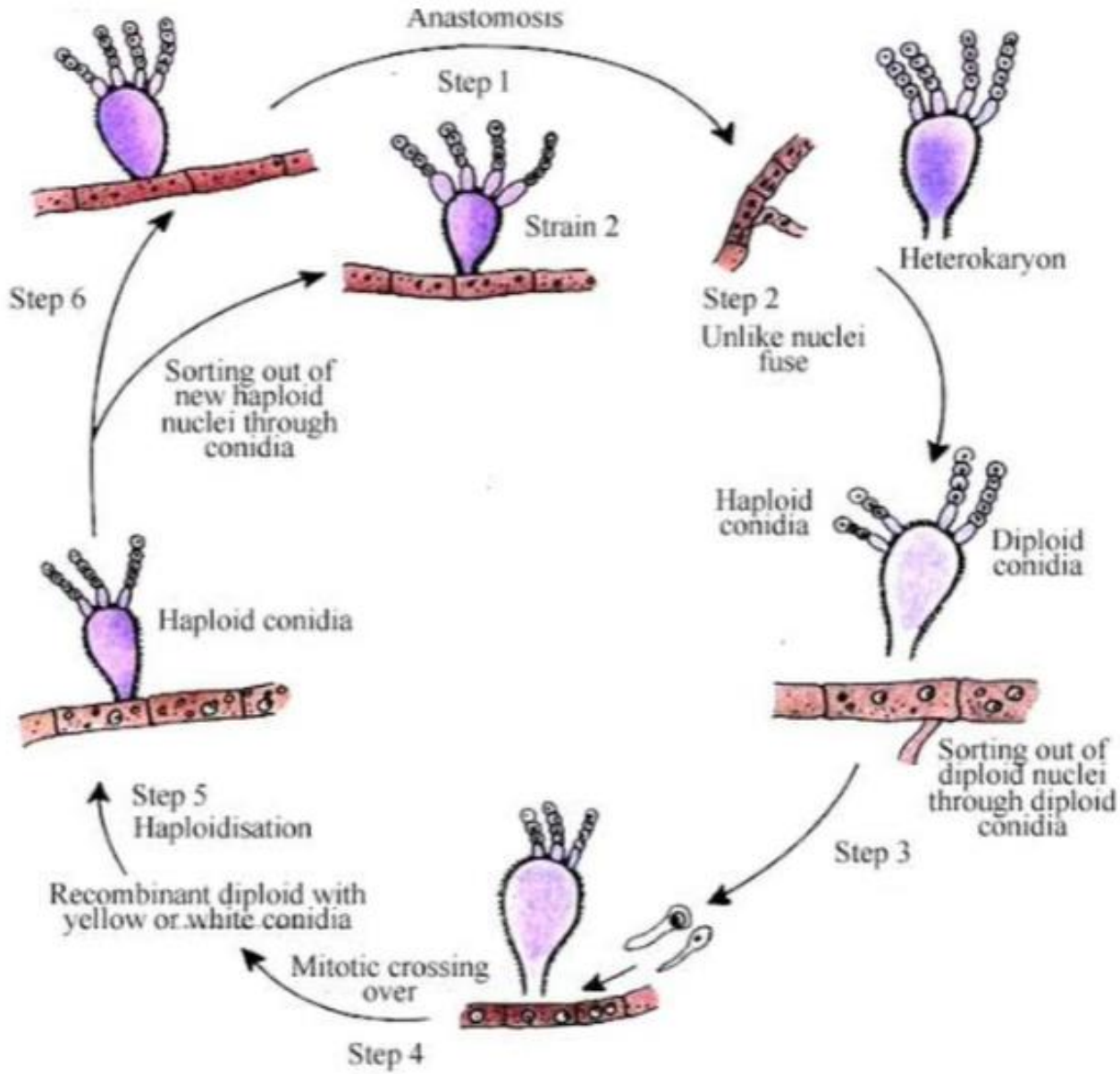


Fig: Pontecarvo's (1958) idea of Parasexual cycle.

THANK YOU