MOLECULAR BIOLOGY

HOMOLOGOUS RECOMBINATION

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HOMOLOGOUS RECOMBINATION

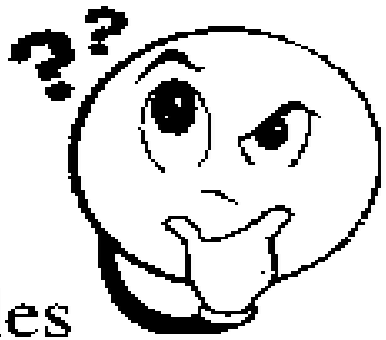
Why do chromosomes undergo recombination?

1. include roles in specialized DNA repair systems,
2. specialized activities in DNA replication,
3. regulation of expression of certain genes,
4. facilitation of proper chromosome segregation during eukaryotic cell division,
5. maintenance of genetic diversity,
6. and implementation of programmed genetic rearrangements during embryonic development.

Introduction

- **Homologous recombination** is a type of genetic recombination in which nucleotide sequences are exchanged between two similar or identical molecules of DNA.
- It is most widely used by cells to accurately repair harmful breaks that occur on both strands of DNA, known as double-strand breaks.
- It can also be involved in mutation.

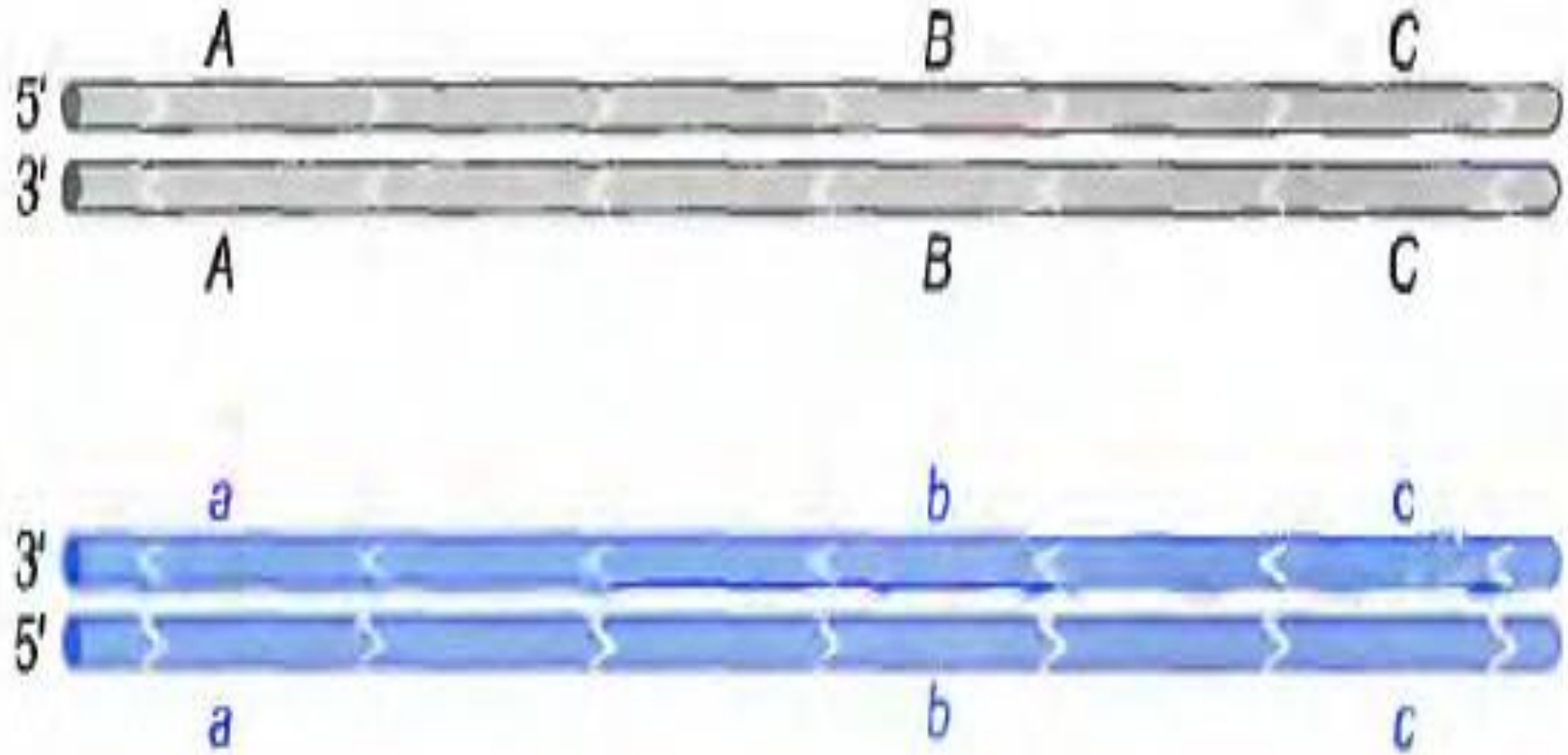
Key steps of HR

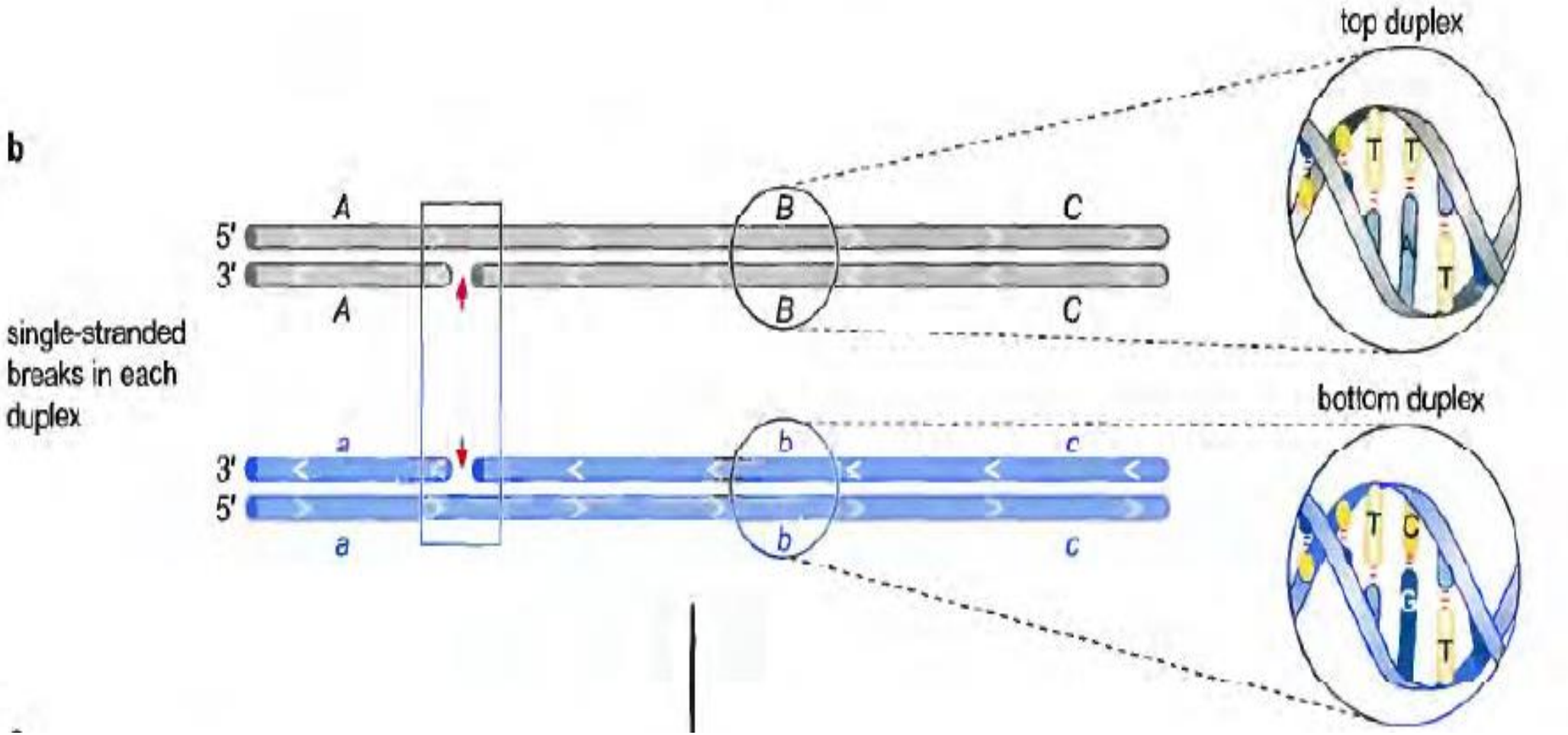


1. Alignment of **two homologous DNA** molecules
2. Introduction of **breaks** in the DNA
3. Formation of initial short regions of **base pairing** between the two recombining DNA molecules.
4. **Strand invasion**.
5. Formation of Holliday junction & Cleavage of the **Holliday junction**

a

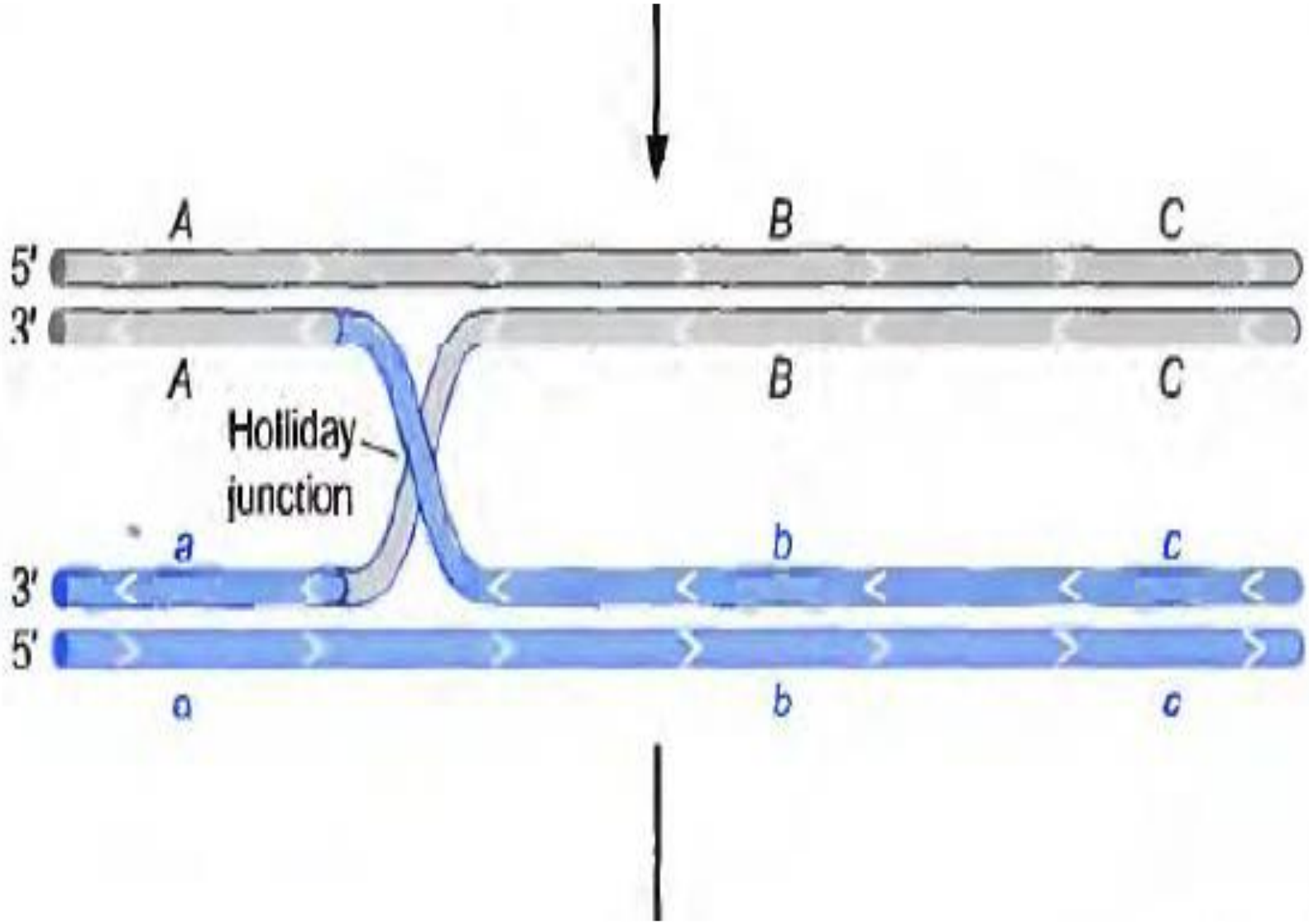
aligned homologous duplexes

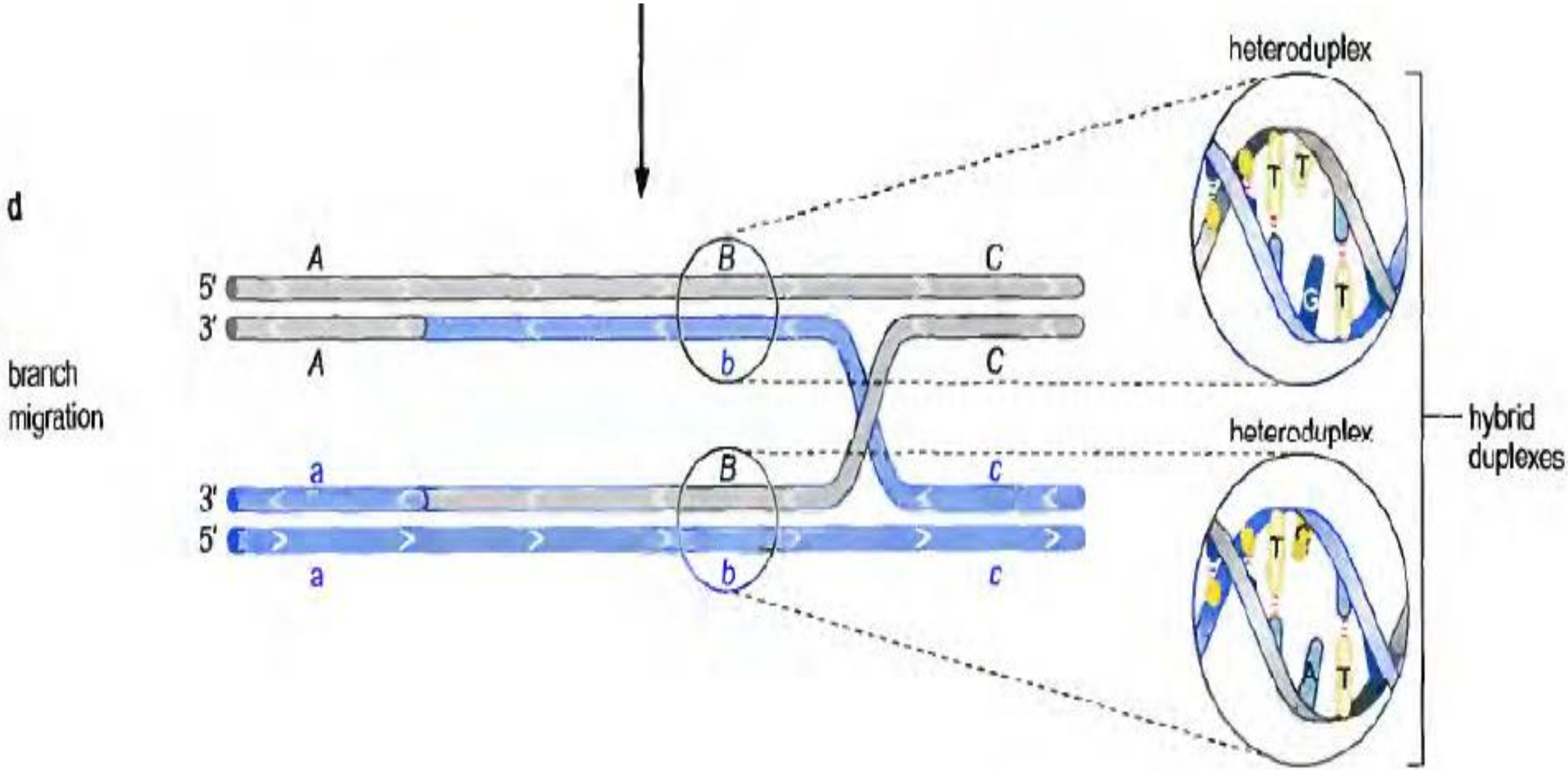



b
single-stranded
breaks in each
duplex
5'
3'
A
A
B
B
C
C
top duplex
T
T
A
T
3'
5'
a
a
b
b
c
c
bottom duplex
T
C
G
T

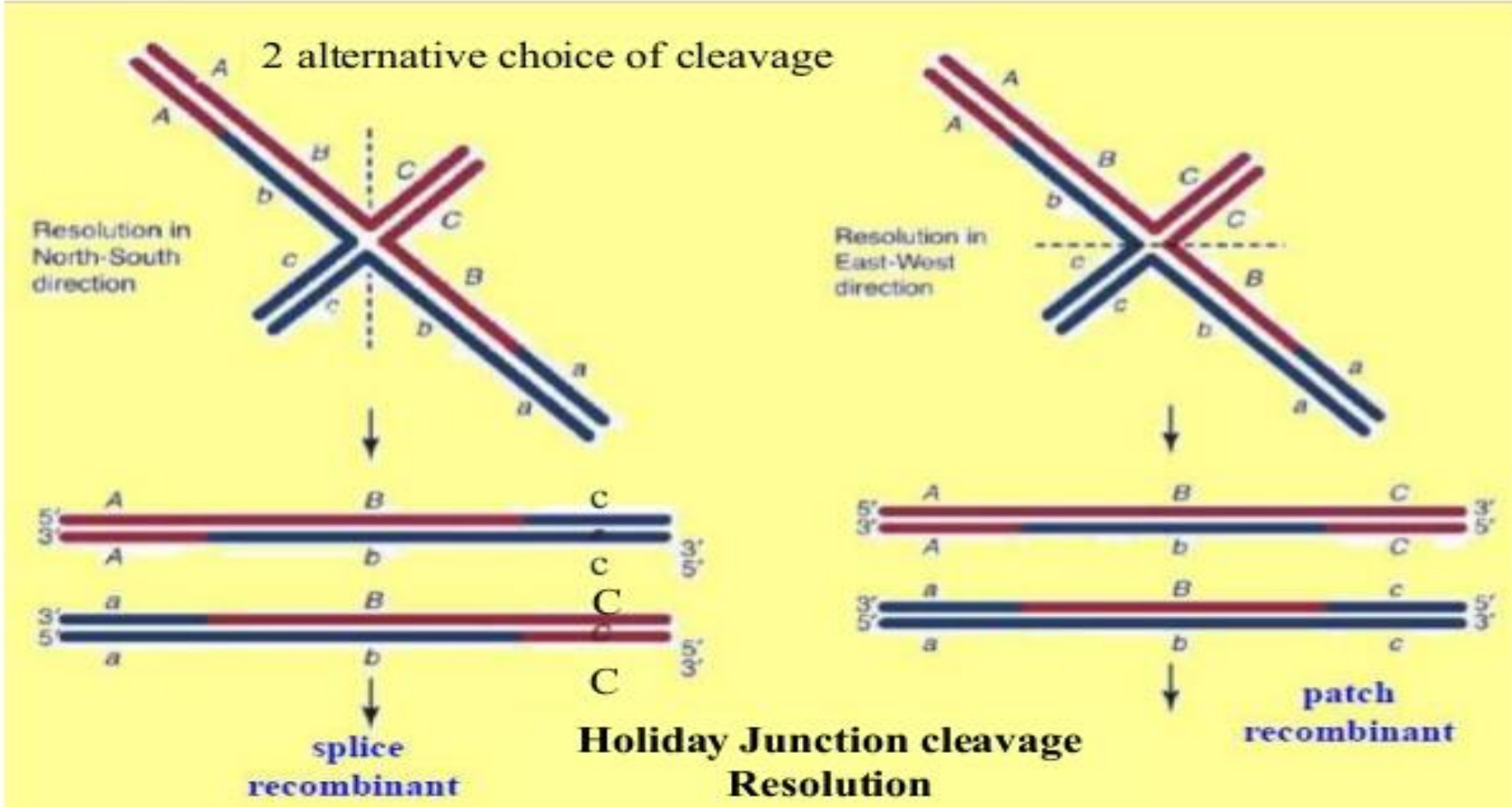
c

strand invasion




d
branch migration
5'
3'
A
A
B
b
C
C
a
a
B
b
c
c
3'
5'
heteroduplex
heteroduplex
hybrid duplexes

HOLLIDAY JUNCTION CLEAVAGE



Splice recombinant/ Crossover product:
Cut occur in 2 intact DNA strands of (b)

Patch recombinant/non crossover product
Cut occur in 2 cut DNA strands of (b)