



**CHANDIGARH  
UNIVERSITY**

Discover. Learn. Empower.

# INSTITUTE-UNIVERSITY INSTITUTE OF ENGINEERING

## ACADEMIC UNIT-II

Computer Science Engineering

Subject Name-Biology For Engineers

Subject Code- 20SZT148

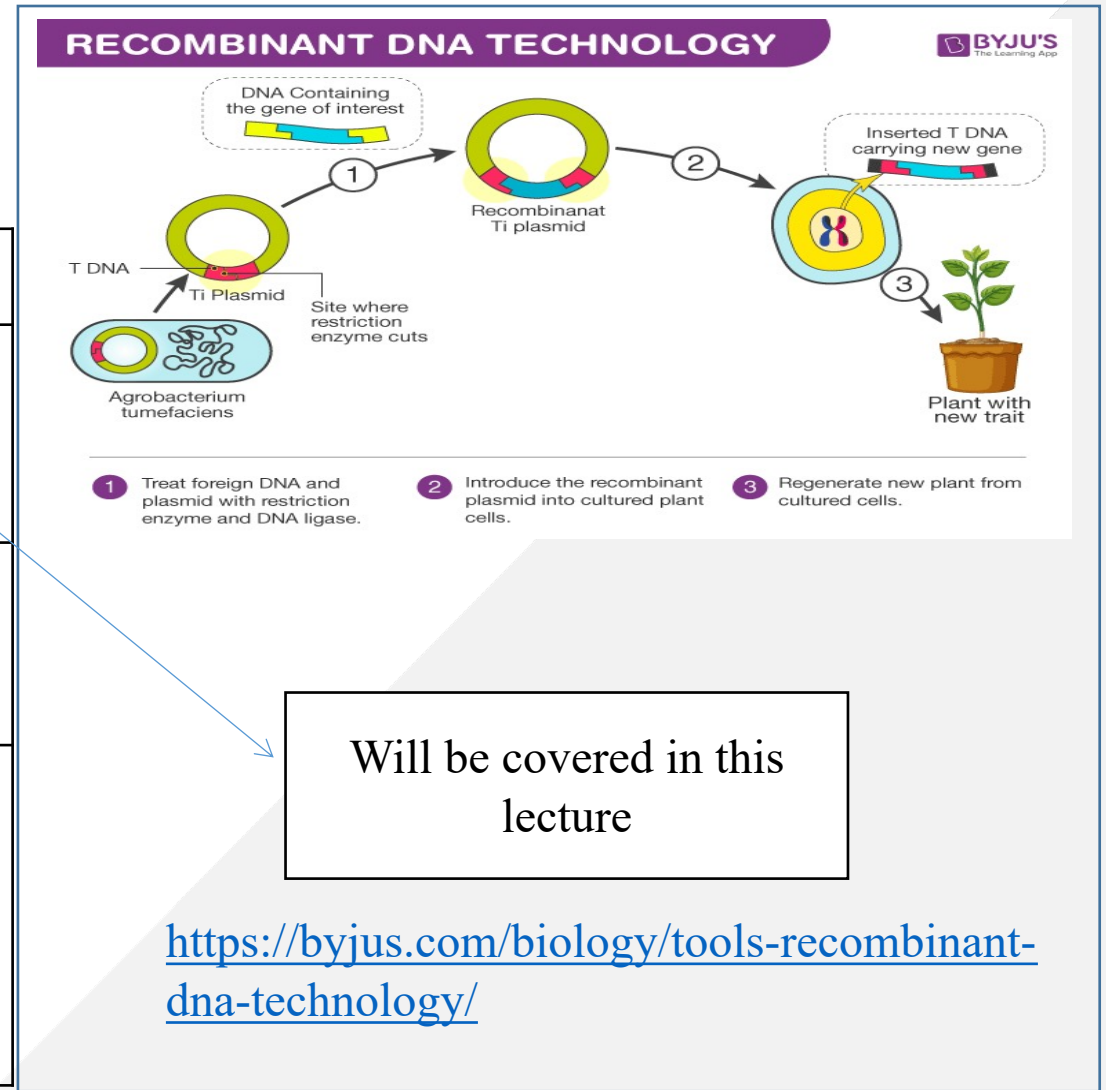


**BAC AND YAC**

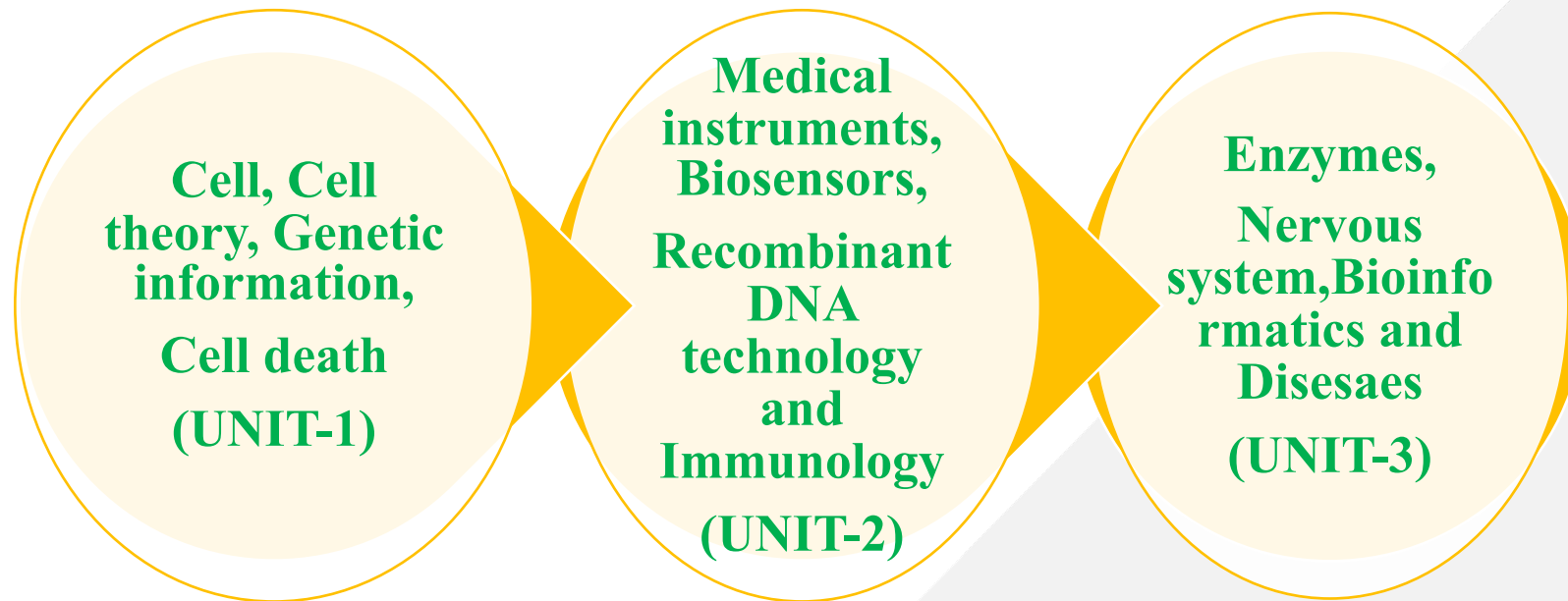
**DISCOVER . LEARN . EMPOWER**

## Course Outcome

CO Number	Title	Level
<b>CO1</b>	It gives an idea about the about the basic cell biology.	<b>Understanding</b>
<b>CO2</b>	It deals with the idea of uses of biology in engineering.	<b>Understanding</b>
<b>CO3</b>	It provide knowledge about the uses of softwares in biology field.	<b>Remembering</b>



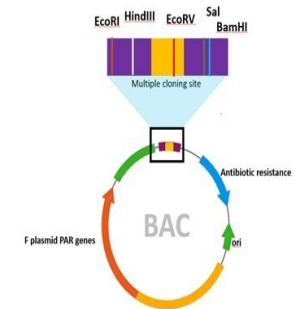
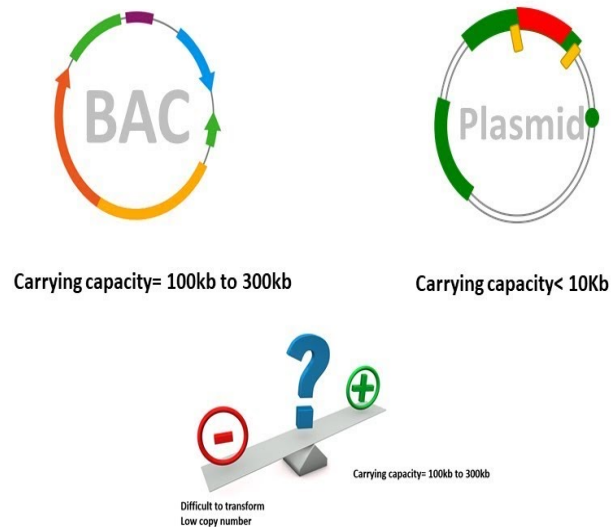
# BIOLOGY FOR ENGINEERS



# BAC

•Bacterial artificial chromosomes (BAC) were developed by Mel Simmons and coworkers in the early 1990s and are based on the fertility factor (F factor) of *Escherichia coli*. The F plasmid, a ~ 100 kb circular double stranded DNA, is present in an *E. coli* cell in only 1-2 copies.

Bacterial artificial chromosomes are specially designed for cloning very big DNA fragments



<https://www.youtube.com/watch?v=Qqsw6ytGsyE>

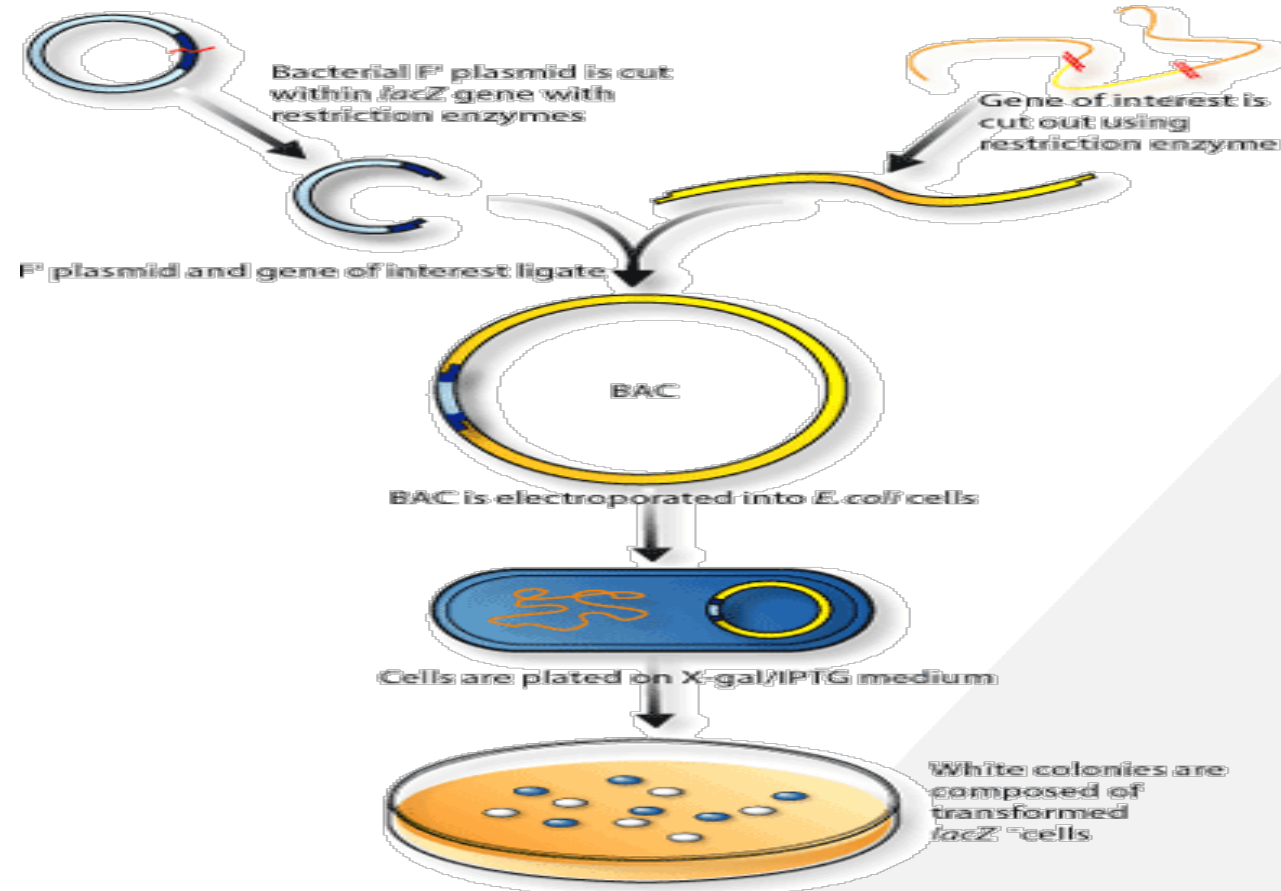
# BAC

- The synthetic BAC vectors, which are only ~7.5 kb double stranded DNA circles contain the replication origin *oriS* and the gene *repE* of the F plasmid that are responsible for initiation and proper orientation of replication of the BAC vector.
- The *parA* and *parB* genes of the F plasmid ensure efficient segregation of the F factor into the daughter *E. coli* cells after its replication are also incorporated in the BAC vector.
- The BAC vectors also contain multiple cloning sites (*mcs*), a selectable marker in the form of antibiotic resistance and colour based identification (*lac Z* complementation system) of recombinants carrying inserts.

# BAC

- The recombinant BACs have been found to exhibit a lower level of rearrangement and chimerism of the cloned DNA sequence than exhibited by YACs.
- The cloning of DNA in BACs is done as is done in a plasmid, by linearising the vector with a restriction endonuclease, treating with phosphatase and then ligating with the DNA fragments to be cloned.
- E. coli has to be transformed by electroporation because of the large size of the recombinant BAC.

# BAC



<https://www.ukessays.com/essays/sciences/bacterial-artificial-chromosomes-bacs-3810.php>

# YAC

Yeast artificial chromosome (YAC) is a human-engineered DNA molecule used to clone DNA sequences in yeast cells

YACs are plasmid shuttle vectors capable of replicating and being selected in common bacterial hosts such as *Escherichia coli*, as well as in the budding yeast *Saccharomyces cerevisiae*.

<https://www.slideshare.net/gurya87/yeast-artificial-chromosomes-yacs-44970900>



# YAC

## YEAST ARTIFICIAL CHROMOSOMES

- YAC is an artificially constructed chromosome that contains a
  - ❑ Centromere
  - ❑ Telomeres
  - ❑ Autonomous replicating sequence (ARS) element required for replication and preservation of YAC in yeast cells
- ARS elements are thought to act as replication origins
- ❖ First described in 1983 by Murray and Szostak

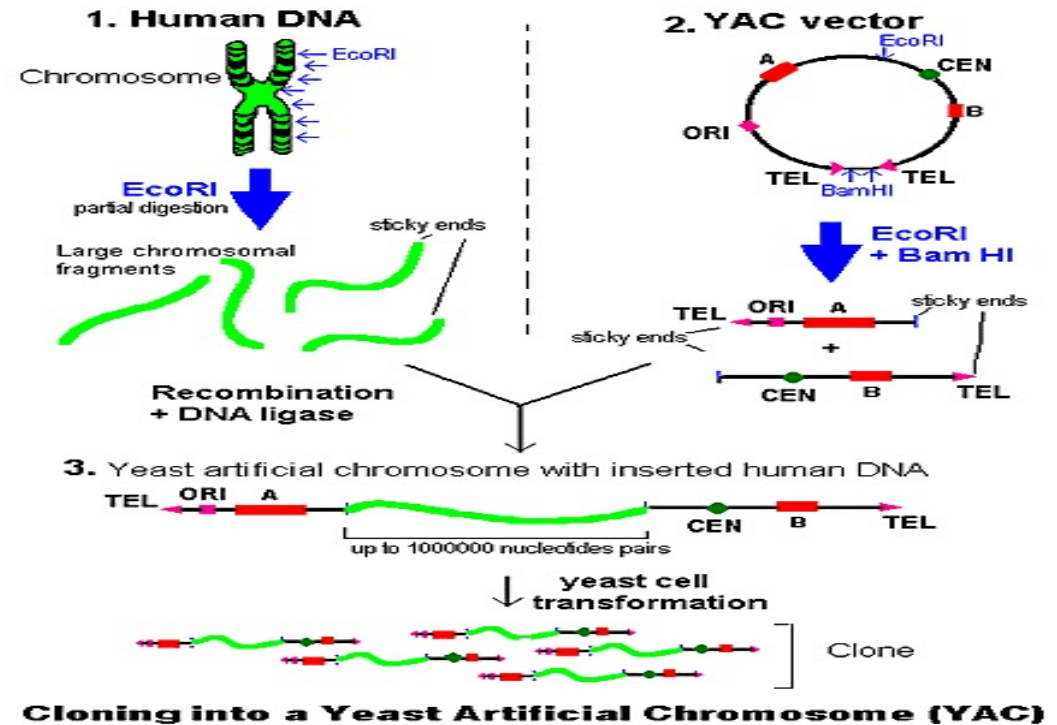
<https://www.slideshare.net/gurya87/yeast-artificial-chromosomes-yacs-44970900>

# YAC

- Cloning of DNA fragments much larger than 45 kb became possible in 1987, when D.T. Burke and G.F. Carle developed in the laboratory of M.V. Olson an altogether new type of yeast vector, which they called yeast artificial chromosome (YAC).
- The development of YAC's were based on the logic that an eukaryotic linear chromosomes needs for its replication and stability, not only replication origins, but also the centromere and the telomere.

# YAC

- The centromere sequence would attach to the mitotic spindle during cell division and help in efficient segregation of the chromosomes into the daughter cells.
- The telomere would preserve the integrity of the ends of the linear chromosomes.



<http://www.ebioworld.com/2011/08/yeast-artificial-chromosome-yac-vectors.html>

# YAC

- Once these elements were provided, the vector could be replicate stably like a chromosome and could accommodate chromosomes sized inserts. Though an YAC vector is meant to be propagated like a chromosome in yeast, it is a circular double stranded DNA that contains a replication origin (colE 1) compatible with E. coli in addition to yeast replication origin or an yeast ARS element.
- The col E1 replication origin is useful to a yeast replication origin or an yeast ARS elements. The colE1 replication origin is useful for amplification of the vector in E. coli.

# CONCLUSION

- Recombinant DNA technology is the joining together of DNA molecules from two different species.
- The recombined DNA molecule is inserted into a host organism to produce new genetic combinations that are of value to science, medicine, agriculture, and industry.
- Recombinant DNA technology is used to make microbes, plants, and animals that carry genes from other species.
- Recombinant DNA technology can be used in the prenatal diagnosis of human genetic disease.

# ASSESSMENT PATTERN

Assessment Pattern	Total Marks
1 <sup>st</sup> Hourly Test	36
2 <sup>nd</sup> Hourly Test	36
Surprise Test	12
Assignment (3)	10
Quiz	4
End Semester Examination	60

# REFERENCES

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- Robert Weaver. 2012 “Molecular Biology,” 5th Edition, MCGraw-Hill.
- Jon Cooper, , 2004. “Biosensors A Practical Approach” Bellwether Books.
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# THANK YOU

For queries  
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