

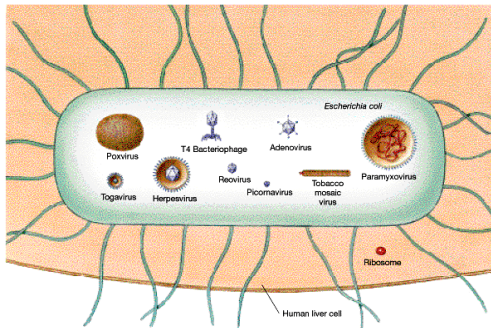
## Chapter 13

Genetics of viruses and Prokaryotes

### 13.1 Common Sizes of Microorganisms

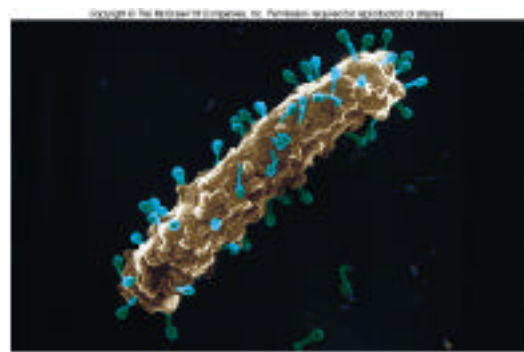
MICROORGANISM	TYPE	TYPICAL SIZE RANGE ( $\mu\text{m}^3$ )
Protists	Eukaryote	5,000–50,000
Photosynthetic bacteria	Prokaryote	5–50
Spirochetes	Prokaryote	0.1–2.0
Mycoplasmas	Prokaryote	0.01–0.1
Poxviruses	Virus	0.01
Influenza virus	Virus	0.0005
Poliovirus	Virus	0.00001

### Relative sizes and shapes of viruses



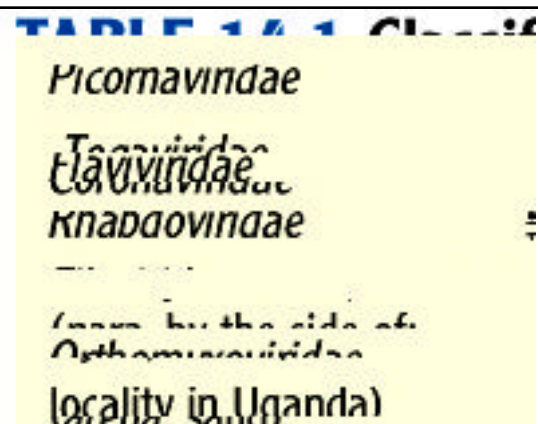
Many shapes - Spherical to icosahedral

### Bacteriophages (ready to eat)



### Viruses

- Nucleic acid
  - DNA or RNA
- Proteins
  - Capsid
- Sometimes lipids
  - Envelope
- Shapes
  - Long helix
    - Tobacco mosaic virus
  - Near spherical shape
    - Isosahedron (20 sided)
      - Poliovirus
    - HIV



**TABLE 14.1 Classification of RNA Viruses Infecting Vertebrates**

<i>Roviviridae</i> (respiratory enteric gripes virus)		Naked virion	Linear ds RNA divided into 10, 11, or 12 segments	Diarrhea in animals
<i>Birnaviridae</i> (B1, two)		Naked virion; icosahedral	2 segments of linear ds RNA	No human pathogens; diseases in chickens and fish
<i>Retroviridae</i> (retro, backwards)		Icosahedral; lipid-containing envelope	2 identical molecules ss RNA	HIV

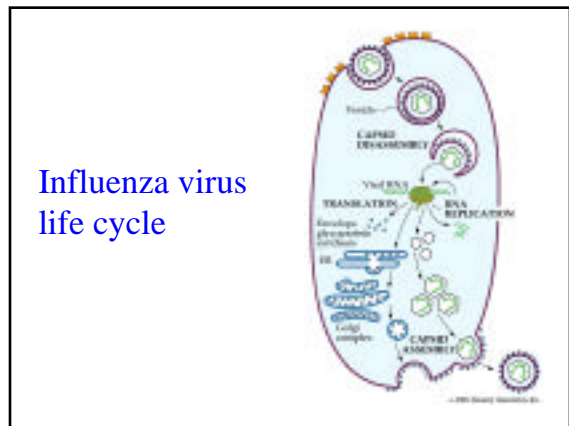
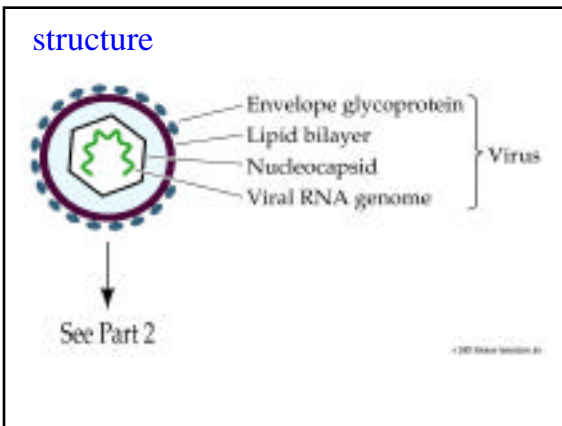
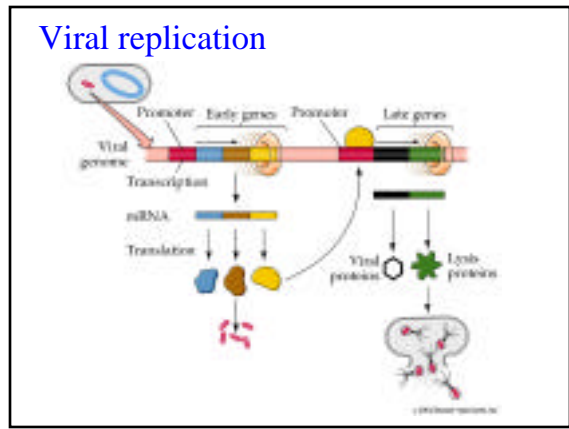
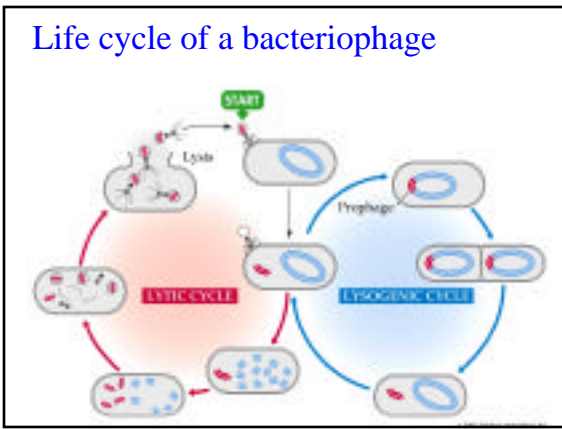
**TABLE 14.2 Classification of DNA Viruses Infecting Vertebrates**

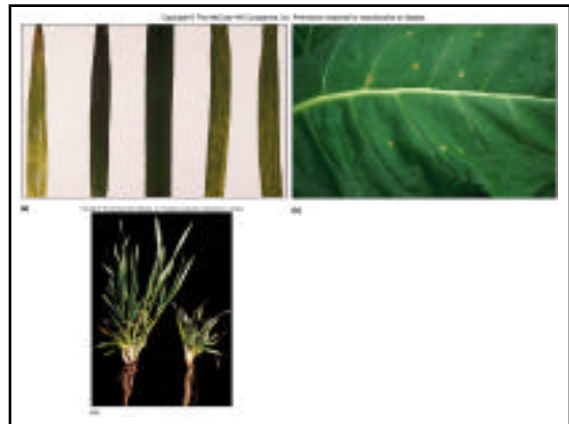
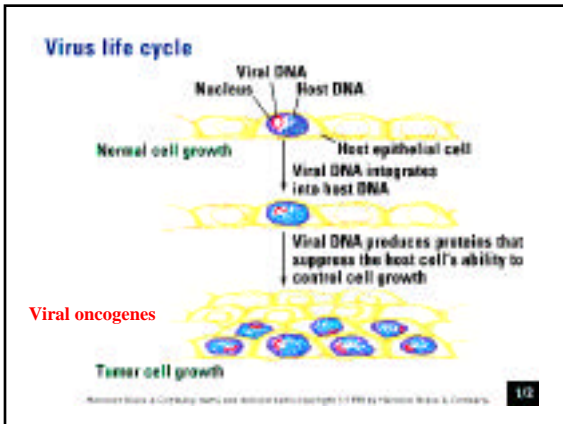
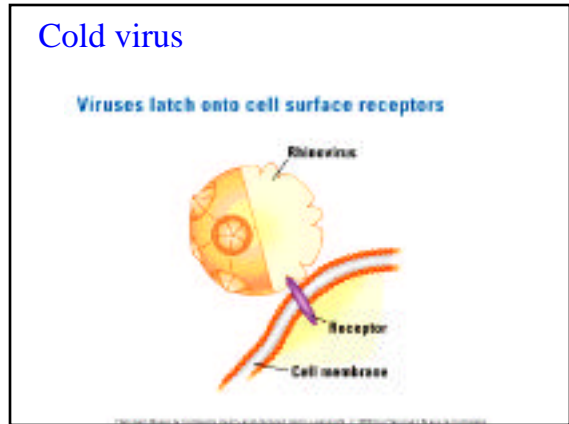
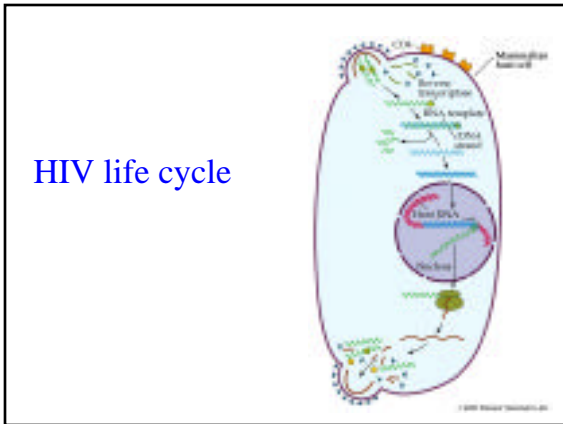
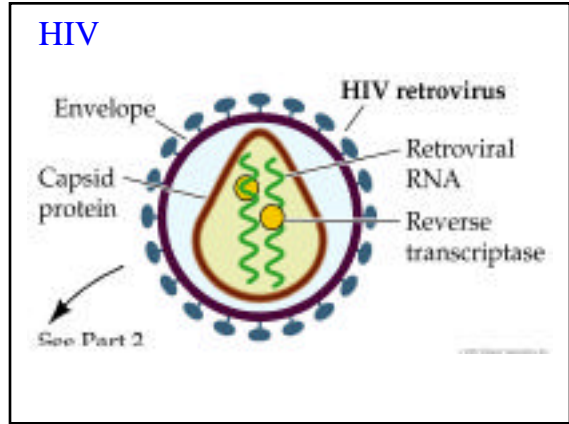
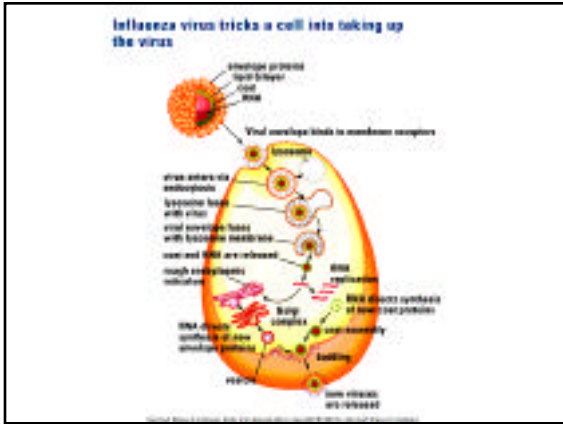
Family	Drawing of Virion	Virion Structure	Genome Structure*	Characteristics and Representative Pathogenic Members
<i>Hepadnaviridae</i> (hepa, liver; dna, deoxyribonucleic acid)		Lipid-containing envelope	1 molecule, mainly ds DNA but with a single-stranded gap	Hepatitis B virus
<i>Parvoviridae</i> (parvus, small)		Naked	1 molecule, ss DNA	Outbreaks of gastroenteritis following eating of shellfish
<i>Papovaviridae</i> (papilloma, polyoma, vaccinating agent)		Naked	1 molecule, circular ds DNA	Human papillomaviruses associated with genital and oral carcinomas
<i>Adenoviridae</i> (adeno, gland)		Naked	1 molecule, ds DNA	Some cause tumors in animals
<i>Herpesviridae</i> (herpes, creeping)		Enveloped with surface projections	1 molecule, ds DNA	Herpes simplex virus; cytomegalovirus
<i>Poxviridae</i> (pox, pustule)		Enveloped; large brick-shaped	ds DNA; covalently closed ends	Smallpox virus; vaccinia virus
<i>Iridoviridae</i> (irid, rainbow)		Enveloped	1 molecule, ds DNA	No known human pathogens; only animal pathogens

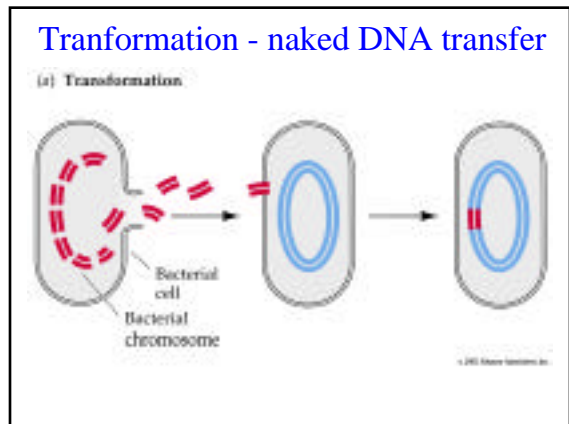
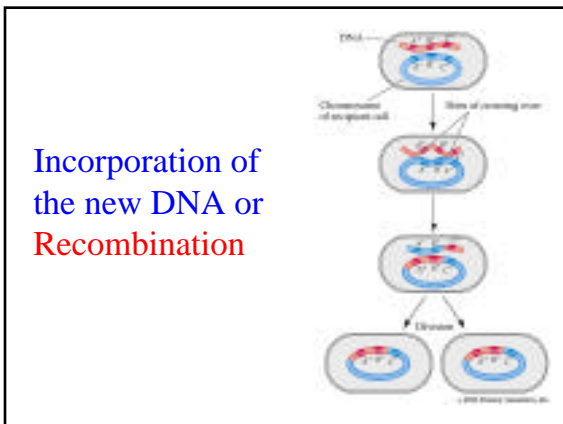
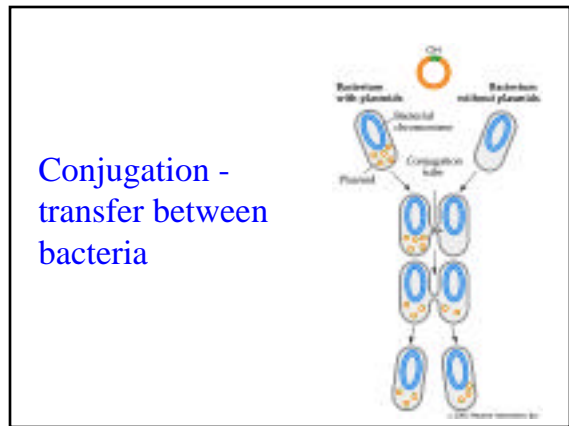
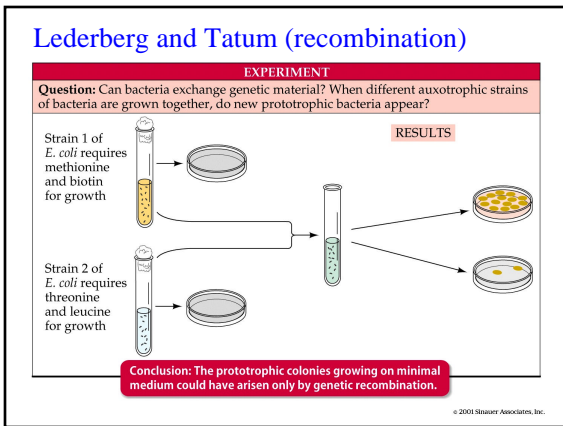
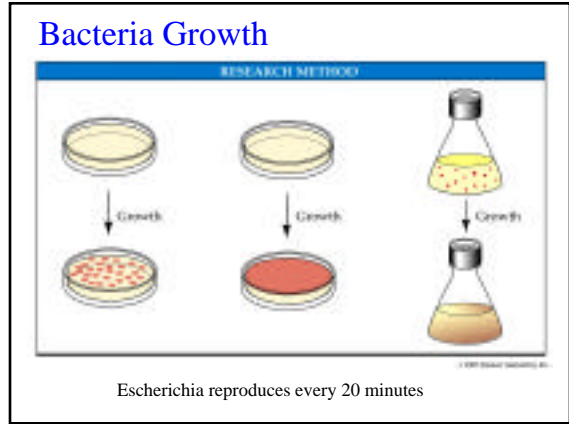
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**TABLE 14.3 Classification of Human Picornaviruses**

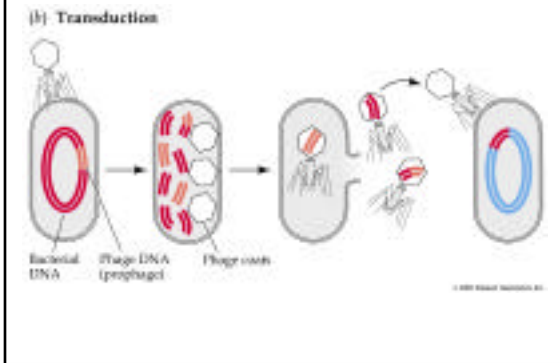
Family	Genus	Species
<i>Picornaviridae</i>	<i>Enterovirus</i>	Polioviruses 1–3 Coxsackieviruses A1–A24 (no A23), B1–B6 Echoviruses 1–34 (no 10 or 28) Enteroviruses 68–71
	<i>Rhinovirus</i>	Rhinoviruses 1–100
	<i>Hepatitis virus</i>	Hepatitis A virus



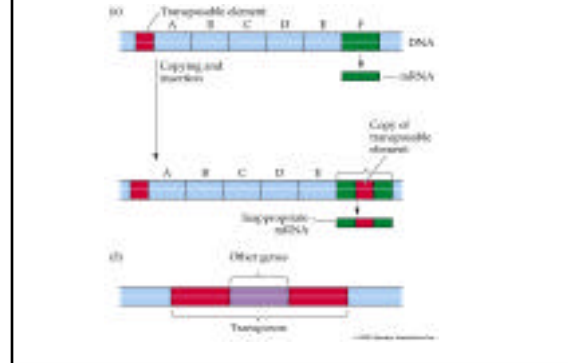




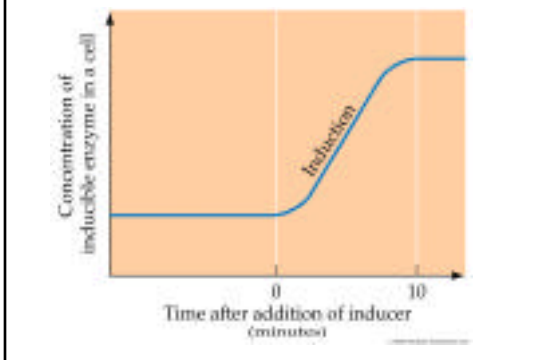
## Transduction - virus mediated transfer



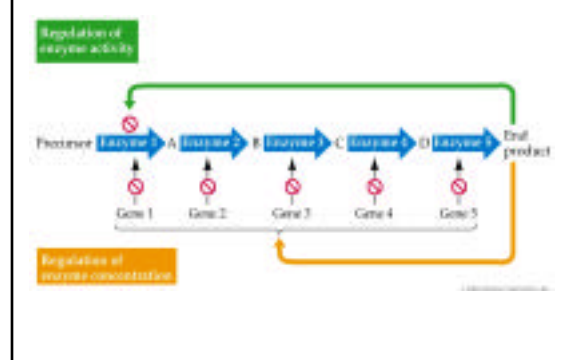
## Transposon or jumping genes



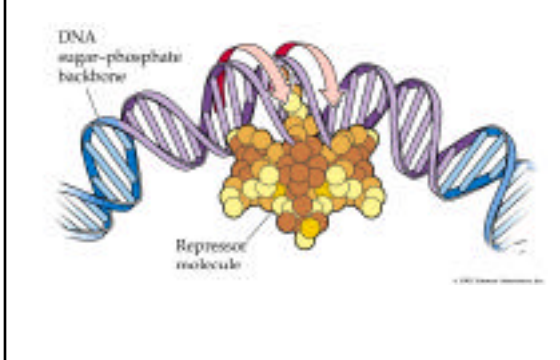
## Regulating genes by induction



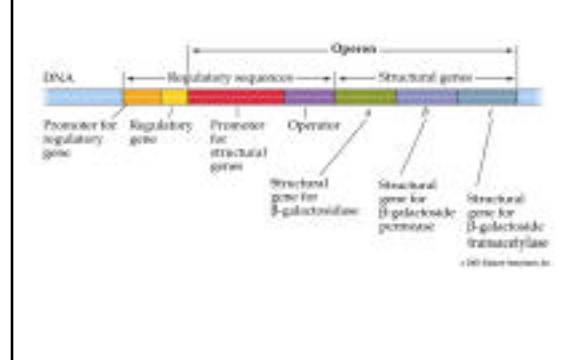
## Regulation of genes



## Repression of genes

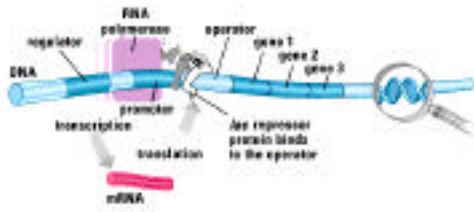


## The lac operon in *E. coli*



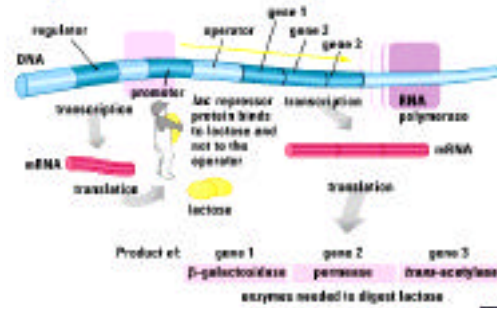
Repressor bind to the operator and prevents RNA polymerase from transcribing the genes

### Negative feedback in the *lac* operon



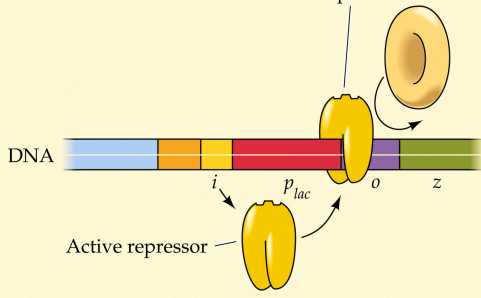
Lactose binds to the repressor and removes it from the operon

### Negative feedback in the *lac* operon

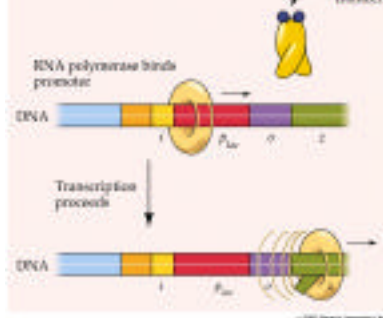


Lactose absent

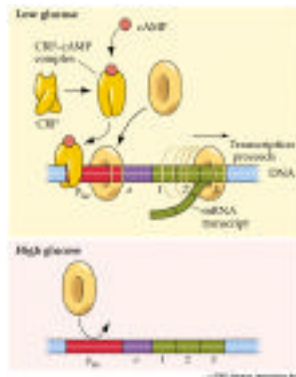
Repressor bound to operator



Lactose present



Positive control and Cap protein

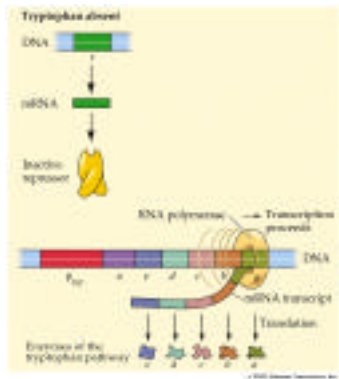


### Positive control

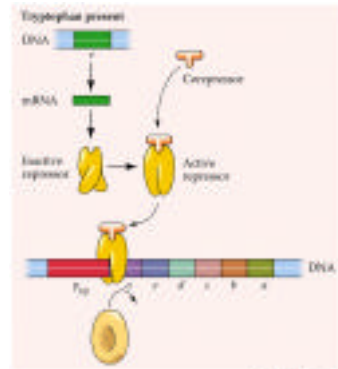
**13.2 The Relationships Between Positive and Negative Control in the *lac* Operon**

GLUCOSE	cAMP LEVELS	INDUCER PRESENT	LAC REPRESSION	TRANSCRIPTION OF <i>lac</i> GENES	LACTOSE USED BY CELL
Present	Low	Absent	Active and bound to operator	No	No
Present	Low	Absent	Inactive and not bound to operator	No	No
Absent	High	Present	Inactive and not bound to operator	Yes	Yes
Absent	High	Absent	Active and bound to operator	No	No

## Tryptophan



## Tryptophan



## Haemophilus influenzae genome



## Avery, MacLeod, and McCarty's experiments

