

Chapter 7: Lytic Bacteriophage

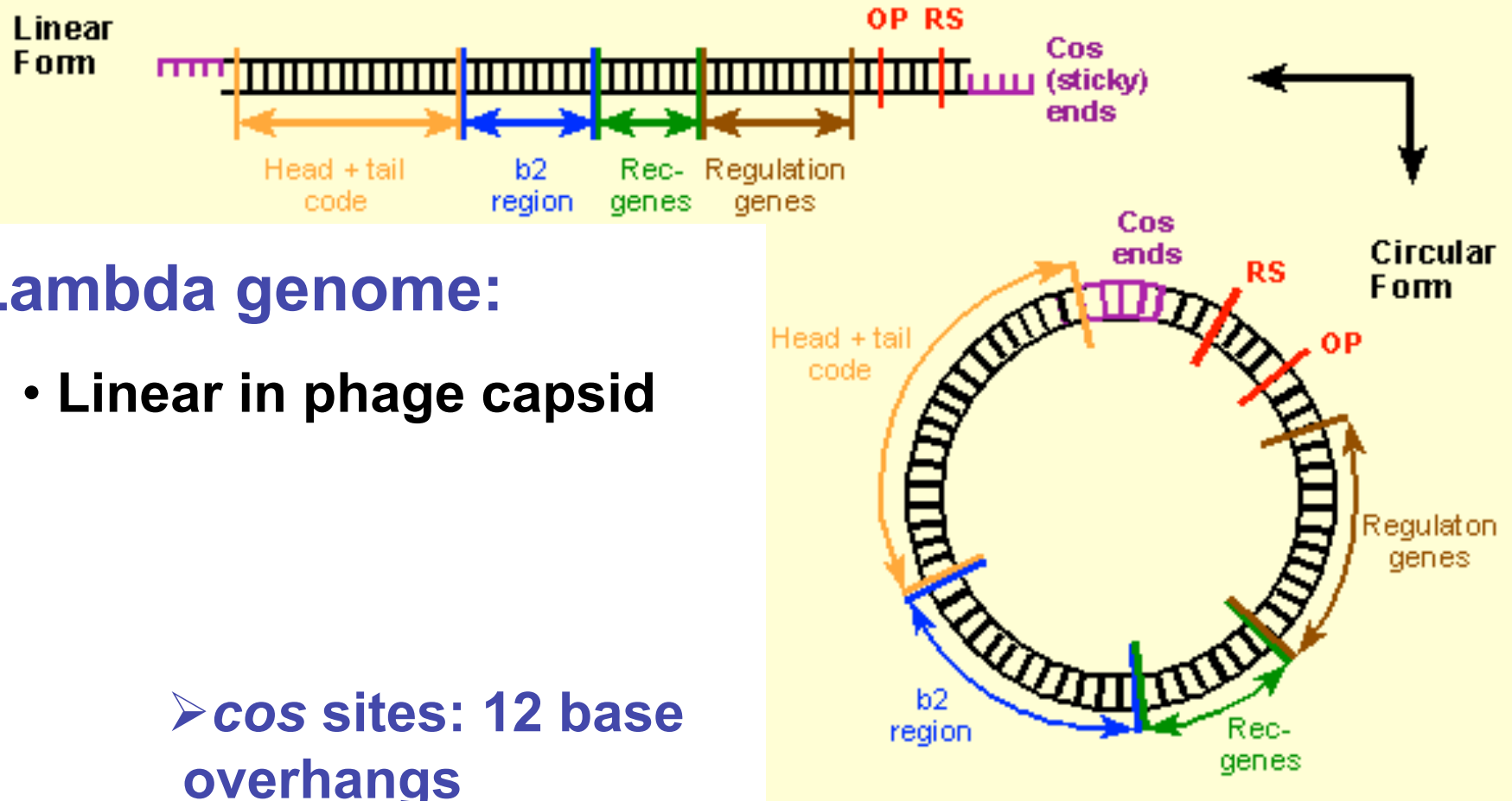
Lytic cycle: series of events following infection by a bacteriophage that leads to the production of more phage particles

General series of events:

- 1) Injection of DNA**
- 2)**
- 3) Replication of phage genome DNA**
- 4)**
- 5) Packaging of viral DNA into heads and tails**
- 6)**

Lambda Lytic Cycle

Basic Features of Bacteriophage λ



Lambda genome:

- Linear in phage capsid

➤ **cos sites: 12 base overhangs**

Important Proteins of Lambda

N: Antiterminator protein acting on t_L^1 , t_R^1 , and t_R^2

O and P: initiation of λ DNA replication by theta mechanism

Q: Antiterminator protein acting on t_R'

Cl: Repressor, inhibits txn from P_L and P_R

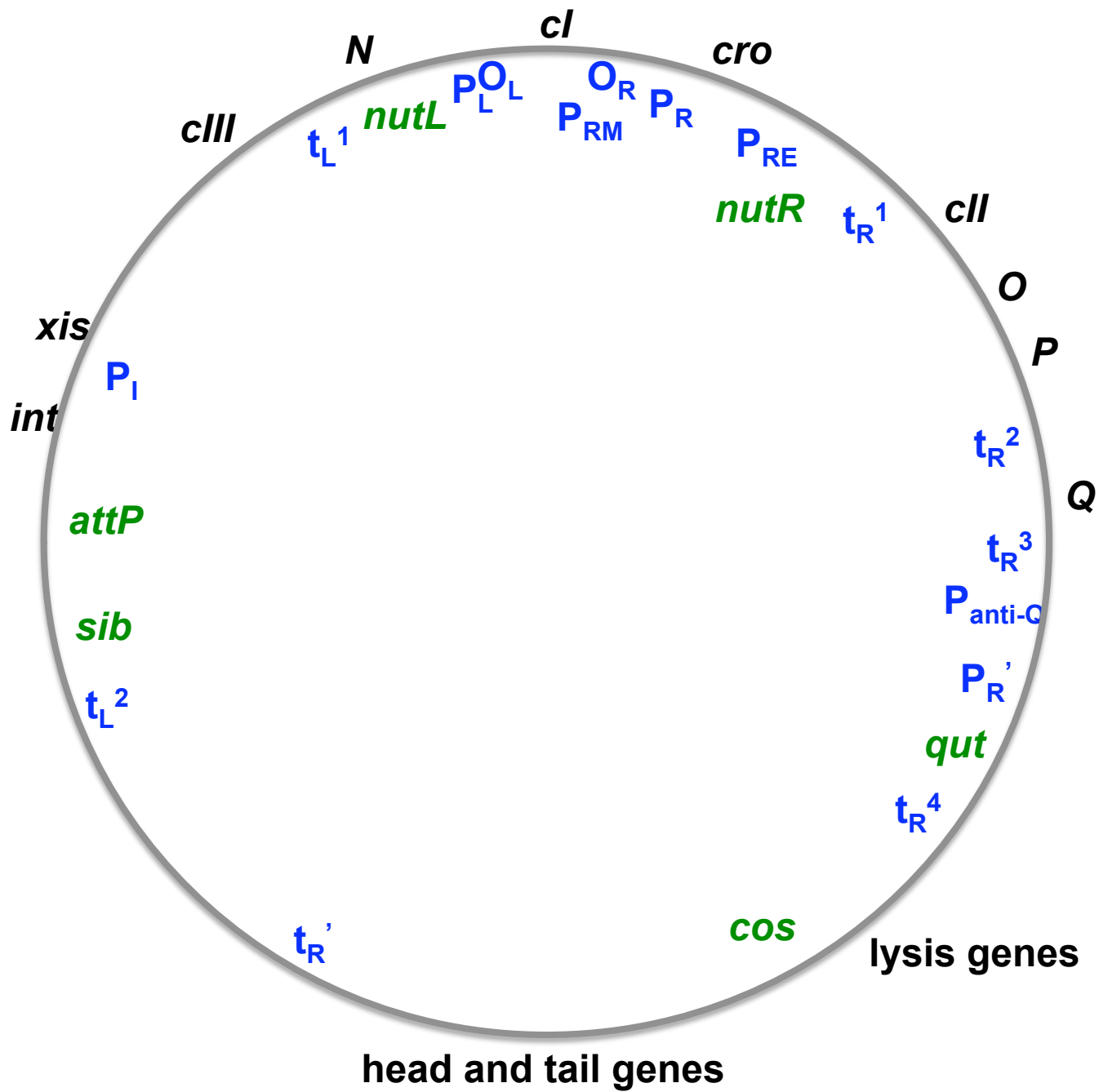
CII: Activates txn at P_I , P_{RE} , and P_{anti-Q}

CIII: Stabilizes CII

Cro: Repressor, binds to O_L and O_R (inhibits of Cl synthesis)

Int : Integrase, required for recombination into chromosome

Xis: Excisase, excises prophage from host genome



3 Phases of the Lytic Cycle

1) Immediate early

➤ The lambda genes *cro* and *N* are transcribed.

- Cro is a repressor that binds to DNA at the operator (O_L and O_R sites); it is negatively autoregulated

✧ N binds to transcripts from P_R and P_L at the *nutR* and *nutL* (N-utilization) sites preventing the stem-loop of t_R^1 and t_L^1 from forming



↳ P_I : yields more integrase

P_{RE} (repressor establishment): yields CI

P_{anti-Q} : yields antisense RNA to Q mRNA

↳ O: acts similar to DnaA; opens DNA for rep

P: recruits host machinery for replication

↳ transcription continues from P_R' to t_R^5 due to antitermination through t_R^4

3) Late lysis: assembly of progeny phage

↳ Production of head, tail, and lysis proteins

↳ Decreased txn of *N*, *cIII*, and *xis*

Decreased txn of *cl*

Decreased txn of *cro*, *cII*, *O*, *P*, and *Q*

- TXN from P_I , $P_{\text{anti-Q}}$, and P_{RE} due to activation by CII:
important in control and the lysogeny to lytic switch

