

Title	The Specific Locus of Prophage $\phi 80$ on the K12 Chromosome
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The Specific Locus of Prophage $\phi 80$ on the K12 Chromosome

Among the numerous temperate phages isolated by Jacob (1955)¹), all the UV-inducible prophages (82, λ , 434, 381, 21, 424, 466) were linearly arranged on the Gal-R segment of the Hayes *Hfr* strain²). On the other hand, none of the non-inducible prophages was located on the Gal-R segment but rather on other regions.

A study was made of whether the UV-inducible prophage $\phi 80$ is located on the Gal-R segment of the K-12 chromosome. The genetic behaviour of the lysogenic character in cross experiments with $F^+(\phi 80)^-$ and $F^-(\phi 80)^+$ was first studied. In the cross experiment illustrated in Table 1, it was found that the $\phi 80$ -lysogenic character segregates among recombinants. $\phi 80$ prophage is weakly linked to Lac being located on the M (Methionine) marker side. This result suggests that the prophage $\phi 80$ is also usually found on the Gal-R segment where are the loci of Jacob's UV-inducible prophages.

Table 1. The Segregation of Characters (Lac and *ly* for $\phi 80$) in the Recombinant between W3637 ($F^-T^-L^-M^-Lac^+, \phi 80^-, \lambda^-, S^s \phi 80^r$) \times Y70 ($F^-T^-L^-B_1^-M^+, Lac^-, \phi 80^+, \lambda^-, S^r, \phi 80^r$) on Minimal Agar Plates Supplemented by Streptomycin.

	Lac ⁻ ($\phi 80$) ⁻	Lac ⁺ ($\phi 80$) ⁺	Lac ⁻ ($\phi 80$) ⁺	Lac ⁺ ($\phi 80$) ⁻
number	194	29	68	9
%	64.7	9.7	22.7	3.0

To test whether the prophage $\phi 80$ -locus is on the Gal-R segment of the K12 chromosome corresponding to the λ -locus, the following cross experiments (Table 2) were made on minimal agar plates containing galactose (1%) as the sole carbon source. In the Table, values represents the percentage of (*ly*)⁻ and (*ly*)⁺ in the total *gal*⁺ recombinants. It also shows the grade of linkage of the prophage $\phi 80$ -locus to the *gal* marker. Therefore, the $\phi 80$ prophage occupies a specific site which is distinct from the site of the prophage λ . It may be located near to the prophage 381 or 21 isolated by Jacob.

Table 2. The Grade of Linked Transfer of (*ly*)⁻ with Gal⁺ from the Hayes *Hfr* Strain to F⁻ Bacteria

	Hfr (<i>ly</i>) ⁻ \times 3102 (λ) ⁻ (Gal ₂ ⁻ B ₁ ⁻ λ^r) (Gal ₂ ⁻ λ^r)	Hfr (<i>ly</i>) ⁻ \times 3102 ($\phi 80$) ⁺ (Gal ₂ ⁻ B ₁ ⁻ $\phi 80^r$) (Gal ₂ ⁻ $\phi 80^r$)
(<i>ly</i>) ⁻	24	91
(<i>ly</i>) ⁺	76	9

It has been reported that clusters of genes, including *tryp* (Pardee *et al.*, 1959)³), were located round this prophage locus. Therefore the linkage between the *tryp*- and $\phi 80$ -loci had to be checked.

As shown in Table 3, it seems that the *tryp*- and $\phi 80$ -loci are so closely linked that the segregation of two loci are not observed.

Table 3. The Grade of Linked Transfer of $(ly)^-$ and $Tryp^+$ with Gal^+ on the Cross of Hayes Hfr $(ly)^-(Gal^+, try^+, S^s, B_1^-) \times F^- 4627 (\phi 80)^- (Gal^-, try^-, S^s, B_1^+)$

gal ⁺ S ^r B ₁ ⁺ recombinants					crossing over value %
$(\phi 80)^+$		$(\phi 80)^-$		total	
try ⁺	try ⁻	try ⁺	try ⁻		
0 (0%)	284 (91%)	28 (9%)	0 (0%)	312 (100%)	0

In strains of *E. coli* K12 the relationship between closely linked loci is traceable by joint transduction (or co-transduction) of P1 kc (Lennox, 1955,⁴ Jacob, 1956). The possibility that the transfer of lysogeny and nonlysogeny is accompanied by *tryp*-transduction by P1 kc was tested as follows:

- 1) $(ly)^- try^+ \text{ --- } \times (\phi 80)^+ try^- / \lambda / \phi 80$
- 2) $(\phi 80)^+ try^+ \text{ --- } \times (ly)^- try^- / \lambda / \phi 80$

Joint transduction was not observed. This result is not yet understood.

Nevertheless, these cross experiments clearly show that the *tryp* gene cluster and the $\phi 80$ prophage locus are closely linked. Therefore if the specific transduction of *gal*-genes is mainly due to the close linkage between λ and the *gal*-locus, the transduction of the *tryp* marker mediated by the $\phi 80$ phage should be also expected.

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