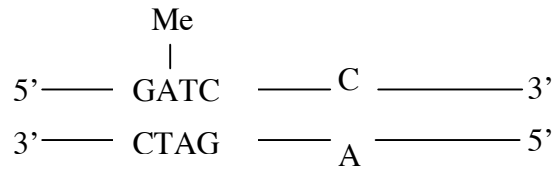


Biology 312 Exam II Practice Problems

1. Right after the replication fork has passed in a wild type strain of *E. Coli*, the following stretch of DNA is found [Me=Methyl group]:

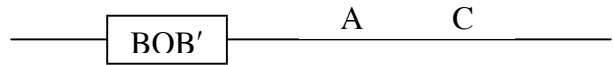
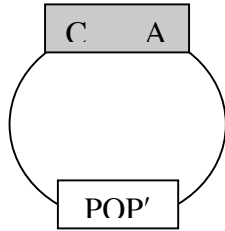


- What repair system will correctly fix this problem?

- Draw the above region as it should look after it has been repaired?

2. You have isolated a novel mutant of λ phage. After much painstaking work, you have constructed the following maps of (1) the mutant phage and (2) the region of the *E. coli* chromosome around the bacterial attachment site (BOB'). You notice two things about your mutant phage:

- It has a normal phage attachment site (POP')
- It has a stretch of DNA that is homologous to a stretch of DNA in the *E. coli* chromosome (shown below in the shaded region marked A C)



Bacterial Chromosome

You allow your mutant phage to integrate into the bacterial chromosome in a wild type *E. coli*. You find two distinct products that are due to two different types of recombination. Draw them both and indicate if you would expect to find each of the products if the host bacteria had been RecA⁻ (no functional RecA protein).

3. Bacterial Phage Frodo has a linear genome and it encodes a site-specific recombinase system to promote recombination between individual phage genomes. This recombination occurs at specific RING sites that contain the binding sites for the phage's INT recombinase and the sequence where strand exchange occurs. You infect a bacterial strain with two genetically distinct strains of phage (different gene alleles are given by upper and lowercase letters) and look for recombinant strains in the progeny released from the bacterial cell. What are the genotypes of the two recombinant phage produced by site-specific recombination between the two parent phage chromosomes shown below?

Parental Phage:

5' A B RING C 3'
 3' A B RING C 5'

Recombinants:

5' a b RING c 3'
 3' a b RING c 5'

- A popular model of site-specific recombination catalyzed by INT proposes that recombination occurs by the formation and subsequent resolution of a Holliday junction at the RING sites. Redraw the two parental phage chromosomes as they would appear when connected by a Holliday Junction within their RING regions. Make sure to label all of the 5' and 3' ends of the DNA and place the different parent alleles on the chromosomes in your drawing.
- Indicate with arrows in your drawing above how the INT must resolve the Holliday junction in order to produce recombinant products.