

Solutions to Practice Problems for Molecular Biology, Session 1: DNA Structure, Classic Experiments

Question 1

In 1928, Griffith performed a series of experiments where he infected mice with two different strains of pneumonia-causing bacteria (*S. pneumonia*): the *smooth/virulent*, disease causing S strain and the harmless *rough/ non-virulent* R strain. You have three unknown samples (A/ B/ C) of *S. pneumonia* and want to characterize them. You inject these samples into mice both individually and in combination. You then obtain blood samples from the injected mice and culture the bacteria present. You also record whether the mice live or die. Your observations are summarized in the following table.

Set 1	Sample injected	Response of the mice	Type of strain recovered from mice
1	A	Dead	Live S strain
2	B	Live	None
3	C	Live	Live R strain
4	A + B	Dead	Live S strain
5	A + C	Dead	Live R and live S strains
6	B + C	Dead	Live R and live S strains

a) Assuming that each sample (A, B, and C) contained only one type of bacterial strain, what type of *S. pneumonia* is found in each sample? Choose from *live smooth/virulent*, *heat-killed smooth/virulent*, *live rough/non-virulent*, or *heat-killed rough/non-virulent*. Provide an **explanation** for your classification.

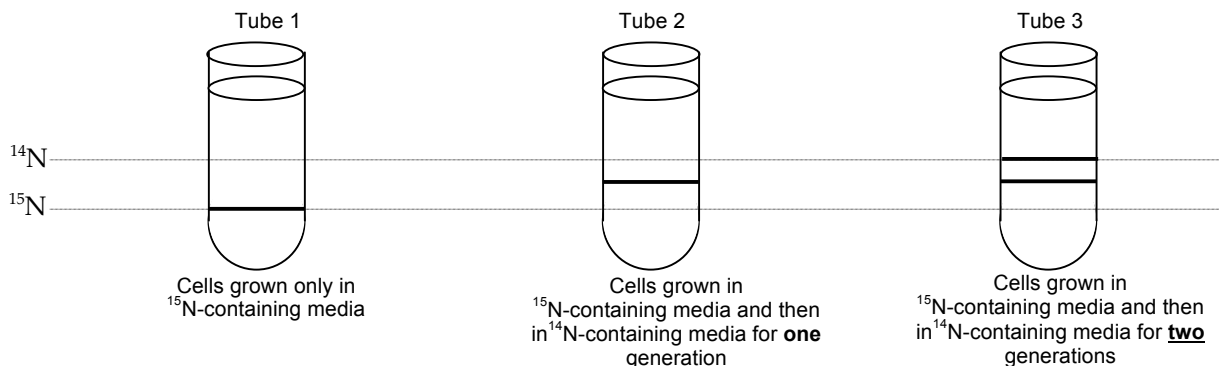
Sample A: *Live smooth/virulent*; In set 1 when A is injected alone, only live S viral strain is recovered and the mice die

Sample B: *Heat-killed smooth/virulent*; In set 2, when B is injected alone, no live viral strain is recovered indicating that they have been heat-killed. However, in set 6 when B and C are coinjected, the mice die and you recover both S and R strains indicating that the heat killed S strain transforms some live R strain to live S strain.

Sample C: *Live rough/non-virulent*; In set 3, when C is injected alone, only live R strain is recovered and the mice live.

Question 2

The Meselson-Stahl experiment suggested that DNA replicates in a semi-conservative manner. *E. coli* cells were grown for several generations in a media with ^{15}N . These *E. coli* cells were then transferred into a ^{14}N media and allowed to replicate their DNA. DNA was extracted from the cells grown in ^{14}N -containing media and separated by cesium chloride density centrifugation. In tube 1 below, you see the band formed by the DNA isolated from cells grown exclusively in ^{15}N media. On the schematic below, draw the band(s) that you would expect in tubes 2 & 3 if the DNA duplex is copied by a semi-conservative mode of replication.



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