Bio. 251 – Quiz 1

Sept. 5, 2005

1. Miescher isolated from the nucleus of white blood cells a substance he called nuclein that Atman later named nucleic acid. What are the components of nucleic acids? Diagram in very simple fashion how these components fit together to form a subunit from which nucleic acids are made. What is this sub-unit called?

The components are phosphate, sugar and nitrogenous bases

See textbook for a diagram

These subunits are called nucleotides

2. List the various bonds that stabilize the levels of protein structure, in the order (first to last) in which they will come apart upon moderate heating. Indicate which levels of structure are stabilized by each type of bond.

Hydrophobic interactions and van der Waals forces - stabilize tertiary and quaternary levels of structure

Hydrogen bonding - stabilizes secondary, tertiary and quaternary

Ionic bonds - stabilize tertiary and quaternary structure

Covalent bonds should not be disrupted by moderate heating - they stabilize tertiary and quaternary structure
3. You are asked to dilute a sample of bacteria so that you can get about 100 colonies on a plate for counting. The starting concentration of these cells is estimated to be about $5 \times 10^7$ cells/ml. Show the dilution scheme you would use including the dilution factors and amounts of sample and diluent you will use for each step. I suggest that you bracket your dilutions, as usual.

If cell concentration is about $5 \times 10^7$ cell/ml and you want $1000 (10^3)$ cells/ml in the tube and $100 (10^2)$ cells on a plate, your total dilution factor would be $5 \times 10^5$.

A dilution scheme that would provide it would be:

5X dilution followed by a 100X dilution would give you a dilution factor of $5 \times 10^2$.

Then follow with 3 10X dilutions which would give you $5 \times 10^3$, $5 \times 10^4$ and $5 \times 10^5$ and 0.1 ml plated from each of these would give you $5 \times 10^4$, $5 \times 10^5$ and $5 \times 10^6$ total dilution factor on each plate. The middle one, $5 \times 10^5$ should provide about 100 cells on the plate if the original estimate is correct.

4. A new unicellular organism has been discovered in a thermal vent (water temp. 125° C) at the bottom of the Pacific Ocean. To what kingdom and domain is this organism most likely to belong?

   Kingdom – Monera

   Domain – Archaea

This organism has a number of unusual features and scientists would like to know what constitutes its genetic material. They discovered that it is possible to genetically transform this new organism with crude extracts, much like what can be done with bacteria. Therefore they did some preliminary experiments similar to those of Avery, MacLeod and McCarty to determine the identity of the transforming principle. They used various combinations of enzymes that could digest biological molecules (DNA, RNA, proteins and lipids) and noted
their effect on transformation. Their results are summarized in the table below:

<table>
<thead>
<tr>
<th>Enzyme Mix</th>
<th>DNAse</th>
<th>RNAse</th>
<th>Protease</th>
<th>Lipase</th>
<th>Inactivation of Transforming Principle</th>
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<tbody>
<tr>
<td>A</td>
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</table>

Which type of molecule is most likely the transforming principle and hence the genetic material? Explain your reasoning.

The only enzyme whose presence correlates with the disappearance of the transforming principle is protease, which suggests that protein is the genetic material. The protease is digesting the protein (inactivating the transforming principle) so that it is not available to transform the cells.