

27 September 2013

## Practice questions for the first midterm exam

You will find here a few practice questions (Q1-Q10) as well as a few multiple choice and short questions that were used in exams from previous years. You may find that some of the practice questions are difficult. However, remember that you have your notes to help you answer them and that the purpose of these questions is to help you review the topics covered in class. We will discuss these questions with you on Friday the 27<sup>th</sup>.

**Q1:** What are the consequences of having an eukaryotic chromosome (150 million base pairs) with :

- a) Only one replication origin?
- b) A telomere at only one end ?
- c) No centromere

One or two lines maximum per answer!!!

**Q2 :** True or False? In a cell, most of the chromatin exists in the form of beads on a string. Explain your answer.

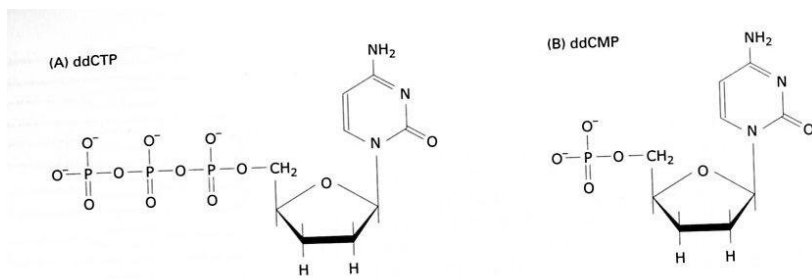
**Q3:** Associate the following measurements with the chromatin condensation forms.

- 1- Human chromosome 22 in its mitotic form.
- 2- Human chromosome 22 in the “beads on a string” form.
- 3- Human chromosome 22 in the 30 nm fiber form.
- 4- Human chromosome 22 totally unwrapped.

- a) 1.5 cm
- b) 0.4 mm
- c) 2  $\mu$ m
- d) 6.5 mm

**Q4:** True or False? Each time the genome is replicated, half of the newly made DNA is synthesized as Okazaki fragments. Please explain your answer briefly.

**Q5:** Look carefully at the following two compounds: dideoxycytidine tri-phosphate (ddCTP) and dideoxycytidine mono-phosphate (ddCMP).



What would be the effect of adding, to an in vitro DNA replication reaction:

- A) A large excess of ddCTP compared to dCTP ?
- B) A ddCTP concentration equal to 10% of the dCTP concentration? I would not ask this question at the exam but it is what gave Sanger a Nobel Prize.
- C) A large excess of ddCMP compared to dCTP ?
- D) A ddCMP concentration equal to 10% of the dCTP concentration??

**Q6:** True or False? In a replication bubble, the same parental DNA strand acts as template for leading strand synthesis in one fork and for lagging strand synthesis in the other fork. Explain your answer briefly.

**Q7:** If a replication origin is removed from an eukaryotic chromosome, the adjacent DNA on both sides will eventually be lost as it cannot be replicated. True or False? Explain your answer.

**Q8:** The replication mechanism creates a problem for linear chromosomes. The presence of the telomerase allows for a solution to this problem. However, telomerase is inactive in some human somatic cells. If you consider a DNA replication cycle in such a cell, which of the following statements is true if you compare daughter chromosomes to the initial chromosome?

- A) One daughter chromosome will be shorter at one end and the other will be of normal length at the both ends.
- B) One daughter chromosome will be shorter at both ends and the other will be of normal end at both ends.
- C) One daughter chromosome will be shorter at one end and the other will be shorter at the other end.
- D) Both daughter chromosomes will be shorter at the same end.
- E) Both daughter chromosomes will be shorter at both ends.

**Q9:** True or False ? The various DNA repair mechanisms all depend from two copies of genetic information: one on each homologous chromosome. Explain your answer.

**Q10:** True or False : Spontaneous depurination and the elimination of a C that has been turned into a U by deamination both proceed through an identical intermediate that is repaired by the AP endonuclease (+ polymerase and ligase) Explain your answer.

**Sample questions from a previous exam :**

**BCH/BIO3170**

**1. Which of the following statements regarding nucleic acids is INCORRECT?**

- A. The same two purines are found in DNA and RNA.
- B. The two pyrimidines on DNA are C and T
- C. In RNA, one finds U instead of T
- D. Bases are attached to position 1 of the sugar by a bond that links the N atom in position #9 of purines.
- E. The only difference between nucleotides U and T is the presence of a methyl group in position C-6

**2. Which position(s) in the purine rings has the potential to form H bonds but does not participate Watson-Crick pairings between bases?**

- A. N-3
- B. N-1
- C. N-7
- D. N-3 and N-1
- E. N-3 and N-7

**3. Which of the following statements regarding the replication bubble is FALSE ?**

- A. It contains more than two DNA molecules undergoing synthesis
- B. Okazaki fragments are found only on one strand.
- C. Topoisomerase facilitates opening of the double helix.
- D. SSB proteins prevent formation of hairpins on single strand DNA
- E. Replication of DNA is bi-directional in *E. coli*.

**4. Identify the correct statement:**

- A. Nucleosomes are repeats of a 30 nm fiber in which 247 DNA nucleotide pairs are wrapped around 8 molecules of histone.
- B. More than 20% of human DNA are in exons.
- C. Repeated sequences constitute a large proportion (about 50%) of the human genome.
- D. In an eukaryotic cells, DNA replication starts exclusively at the centromere.
- E. The nucleosome core is made of 8 dimers of the following 4 histones (H2A, H2B, H3 et H4).

**5. Which of these statements regarding DNA repair is FALSE.**

- A. DNA glycosylases recognize altered bases on DNA.
- B. There are several different DNA glycosylases.
- C. Flipping of altered bases to the outside of the double helix facilitates recognition by DNA glycosylases.
- D. Base excision repair is used to fix pyrimidine dimers.
- E. None of the above.

**6. Which of the following three statements regarding site-specific recombination is FALSE:**

- a Site specific recombination can lead to the loss of a gene's function. La recombinaison spécifique de site peut causer la perte de fonction d'un gène.
- b Transposons (true DNA transposons) move as a DNA intermediate.
- c Non-retroviral retrotransposons move using a mechanism that requires a reverse transcriptase and an endonuclease.
- d Statements a, b, and c are all TRUE
- e Statements a, b, and c are all FALSE.

**Short Questions:**

**1. Define complementary base pairing and explain briefly why it is important for the formation of DNA double helix.**

**2. Describe in ONE SENTENCE the role of the following proteins:**

**Primase:**

**Topoisomerase I:**

**RecA:**

**Clamp loader:**