

**Multiple choice questions**

- 1) One or more part of the nucleosomes can be epigenetically modified. Which ones cannot be epigenetically modified? More than one answer is correct.
- a) Histone's core
  - b) DNA sequence
  - c) Histone's tails
  - d) Scaffold proteins that regulate histone modification
  - e) Histone-1

**The correct answers are D and E. The scaffold proteins are part of the reader complex and detect the histone modifications to spread the signal. The histone-1 is the linker histone between two nucleosomes.**

- 2) Mutations of HDAC proteins induce loss of their activity and it results in changes of the chromatin epigenetic marks. What is the effect on gene expression?
- a) Gene silencing
  - b) No changes
  - c) Activation of gene expression
  - d) Increase in histone 3 (H3) methylation
  - e) Depends on other proteins

**The correct answer is C. Loss of function of Histone Deacetylation increases Lysine-Acetylation and this is usually associated with activation of gene expression.**

- 3) How many fluorescent probes (60 nucleotides long) you need to label a genomic region spanning from Chr 6: 13.5 Mb to 13.7 Mb.
- a) roughly 3000 probes
  - b) 400 probes
  - c) 333000 probes
  - d) 1200 probes
  - e) roughly 300 probes

**The correct answer is A. To label 0.2 Mb (200,000 bp) using 60 oligonucleotides fluorescent probes you need roughly 3000 probes.**

- 4) At mitosis, human chromosome 1 is condensed to a form that measures only 10  $\mu\text{m}$  in length. A single nucleosome core particle is 11 nm long and contains 147 bp of DNA (0.34 nm/bp). What packing ratio (DNA length to nucleosome length) has been achieved by wrapping DNA around the histone octamer?
- a) 0.025
  - b) 4.5
  - c) 3.5

- d) 0.45
- e) 0.25

**The correct answer is B, The packing ratio within a nucleosome core particle is 4.5 [(147 bp \* 0.34 nm/bp)/(11 nm) = 4.5].**

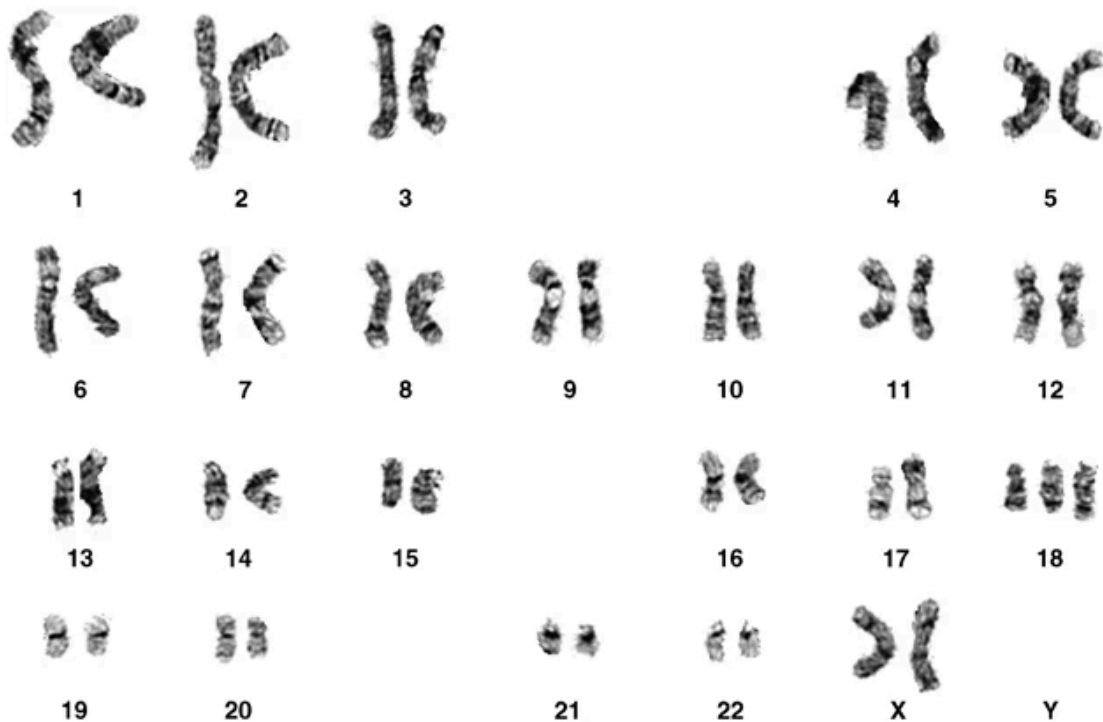
- 5) Which are the less condensed regions of an interphase chromosome that stain diffusely?
- a) Introns
  - b) Exons
  - c) Coding genes
  - d) Euchromatin
  - e) Heterochromatin

**The correct answer is D. The euchromatin includes coding and non-coding regions and its condensation depends on the histone marks post-translational modifications**

- 6) Which of the following information is correct (can be multiple answers)?
- a) The reader complex is a protein complex
  - b) The reader complex is made of proteins and DNA
  - c) The reader complex recognises histone modifications
  - d) The reader complex modifies histone tails
  - e) The reader complex recruits other components with a catalytic activity

**The correct answers are A, C and E.**

- 7) Observe the karyotype below and select all the correct answers.



- a) The patient is male
- b) The patient is healthy
- c) The patient is trisomic
- d) The patient has chromosomal translocations
- e) The chromosomes were extracted at mitosis

**The correct answers are C and E.**

**TRUE or FALSE**

- 1) The DNA is organized in chromosomes only during mitosis.

TRUE or **FALSE**

- 2) In the living cell, chromatin usually adopts the extended “beads-on-a string” form.

TRUE or **FALSE**

- 3) The four core histones are relatively small proteins with a very high proportion of positively charged amino acids; the positive charge helps the histones bind tightly to DNA, regardless of its nucleotide sequence.

**TRUE** or FALSE

- 4) Genes are highly expressed during mitosis.

TRUE or **FALSE**

5) Core histones are highly conserved across evolution

**TRUE** or FALSE

6) Telomeric and centromeric regions of chromosomes contain many genes

TRUE or **FALSE**