Control of Gene Expression

1) What are introns and exons? (2)
2) What are the different types of mutations? (5)
3) What is a chromosomal translocation? (2)
4) Give 3 reasons why a mutation may not alter the protein? (3)
5) What are the consequences of a mutation? (3)
6) Give 4 examples of mutagenic agents? (4)
7) What are the differences between somatic and germ line mutations? (2)
8) Explain why a mutation in DNA is more likely to have serious consequences than a mutation in mRNA? (2)
9) What is DNA proofreading and what proportion of errors does it fix? (2)
10) What is the error rate of DNA polymerase? (1)
11) What is the overall mutation rate? (1)
12) There is one mutation for every 2048 bacteria. How does this explain the ability of bacterial populations to respond rapidly to changing environmental pressures? (2)
13) What is a single nucleotide polymorphism? (2)
14) What are the 2 key characteristics of stem cells? (2)
15) Describe the different types of stem cells from most potent to least potent? (4)
16) What is the potency of adult stem cells and embryonic stem cells? (2)
17) What is the name of an embryo at about 5 days post-fertilisation? Draw a labelled diagram of this? (4)
18) What is the potency of haematopoietic stem cells? (1)
19) What are induced pluripotent stem cells (iPSCs)? (2)
20) What are the advantages of using iPSCs? (2)
21) Which 4 specific transcription factors can help with creating iPSCs? (4)

22) What are transcription factors and why are they important? (3)

23) Explain somatic cell nuclear transfer? (2)

24) Discuss the advantages and disadvantages of using stem cells to treat human disorders? (4)

25) What are the different steps involved in gene expression? (4)

26) At what stages can gene expression be altered? (4)

27) What role do Transcription Factors play in gene expression? (3)

28) Explain how hormones such as oestrogen can act as transcription factors? (3)

29) What happens when the Transcription Inducing Complex (TIC) is complete? (2)

30) What is RNA interference (RNAi)? (2)

31) What are the roles of the following in RNAi? (4)

    a. Dicer

    b. RNA-Induced Silencing Complex (RISC)

32) Which protein in RISC is involved in RNA cleavage? (1)

33) What are siRNA and miRNA? (2)

34) What is the average length of siRNA? (1)

35) What are the similarities between siRNA and miRNA? (3)

36) What are the differences between siRNA and miRNA? (2)

37) What happens to the short dsRNA (i.e. siRNA) in order to form the guide strand? (1)

38) What is the importance of the guide strand? (2)

39) How can RNAi be useful in cancer prevention? (2)

40) What is meant by antisense RNA and sense RNA? (2)

41) The combination of sense and antisense RNA in RNAi shows that the dsRNA mixture is more effective in RNAi than either strand alone (10 times more effective). How has this helped to revolutionise RNAi? (2)

42) Draw a labelled diagram to show how RNAi works? (4)

43) Given that siRNAs are large, polar molecules;

   a. Why is it that they cannot pass across cell membranes? (2)

   b. What are liposomes and how can they be used as a vector to get siRNAs into cells? (2)

   c. Why might viruses cause problems as vectors of siRNA? (2)

   d. Nanoparticles can also be used to get siRNAs into target cells. What are their components and how are they useful? (4)

44) What is cancer? (1)

45) What are the two basic types of tumour and what are the differences between them? (4)

46) What are the three defining or hallmark features of cancer? (3)

47) What are the roles of proto-oncogenes? (3)

48) What are oncogenes and how are they formed? (2)

49) What are the roles of tumour suppressor genes? (3)

50) What happens if there is a mutation in a tumour suppressor gene? (2)

51) What is p53, where is it located and why is it important? (2)

52) What is apoptosis and how is it different to necrosis? (2)

53) What is epigenetics? (2)

54) What is the epigenome? (2)

55) How and why does methylation affect gene transcription? (2)

56) What is the role of DNA methyltransferase? (1)

57) How can a mutation of DNA methyltransferase lead to cancer? (2)

58) What are histones and why are they important in gene regulation? (2)

59) Explain how decreased acetylation inhibits gene transcription? (3)

60) How have twin studies demonstrated the epigenetic effects? (2)

61) State whether the following statements are true/false? (3)

a. Epigenetic changes are heritable?

b. Epigenetic changes affect gametes?

c. Epigenetics do NOT change the DNA base sequence?

62) How can the following affect gene expression (12);

a. Mutations

b. RNAi (e.g. siRNA, miRNA, non-coding RNA)

c. Increased methylation

d. Decreased acetylation

63) How is it possible to develop cancer without any changes to the DNA base sequence? (2)

64) Explain why;

a. Some types of breast and endometrial cancers have oestrogen receptors? (3)

b. Why hormonal treatments (e.g. Tamoxifen) can be used to treat these types of cancers and to slow down their progress? (2)

Total: /175