3. Genetics – 3.2 Chromosomes

Name:

Understandings, Applications and Skills (This is what you maybe assessed on)

	Statement	Guidance
3.2.U1	Prokaryotes have one chromosome consisting of a circular DNA molecule.	
3.2.U2	Some prokaryotes also have plasmids but eukaryotes do not.	
3.2.U3	Eukaryote chromosomes are linear DNA molecules associated with histone proteins.	
3.2.U4	In a eukaryote species there are different chromosomes that carry different genes.	
3.2.U5	Homologous chromosomes carry the same sequence of genes but not necessarily the same alleles of those genes.	
3.2.U6	Diploid nuclei have pairs of homologous chromosomes.	
3.2.U7	Haploid nuclei have one chromosome of each pair.	The two DNA molecules formed by DNA replication prior to cell division are considered to be sister chromatids until the splitting of the centromere at the start of anaphase. After this, they are individual chromosomes.
3.2.U8	The number of chromosomes is a characteristic feature of members of a species.	
3.2.U9	A karyogram shows the chromosomes of an organism in homologous pairs of decreasing length.	The terms karyotype and karyogram have different meanings. Karyotype is a property of a cell - the number and type of chromosomes present in the nucleus, not a photograph or diagram of them.
3.2.U10	Sex is determined by sex chromosomes and autosomes are chromosomes that do not determine sex.	
3.2.A1	Cairns' technique for measuring the length of DNA molecules by autoradiography.	
3.2.A2	Comparison of genome size in T2 phage,Escherichia coli, Drosophila melanogaster, Homo sapiens and Paris japonica.	Genome size is the total length of DNA in an organism. The examples of genome and chromosome number have been selected to allow points of interest to be raised.
3.2.A3	Comparison of diploid chromosome numbers of Homo sapiens, Pan troglodytes, Canis familiaris, Oryza sativa, Parascaris equorum.	
3.2.A4	Use of karyograms to deduce sex and diagnose Down syndrome in humans.	
3.2.S1	Use of databases to identify the locus of a human gene and its polypeptide product.	

Recommended resources:

http://bioknowledgy.weebly.com/32-chromosomes.html

Allott, Andrew. *Biology: Course Companion.* S.l.: Oxford UP, 2014. Print.

3.2.U1 Prokaryotes have one chromosome consisting of a circular DNA molecule. AND 3.2.U2 Some prokaryotes also have plasmids but eukaryotes do not.

1. Draw and label a diagram to show the two types of DNA present in a generalised prokaryote cell.

2. Distinguish between the two types of DNA.

3. Explain why prokaryotes only possess a single chromosome.

3.2.A1 Cairns' technique for measuring the length of DNA molecules by autoradiography. AND Nature of Science: Developments in research follow improvements in techniques - autoradiography was used to establish the length of DNA molecules in chromosomes. (1.8)

4. The development of autoradiography allowed Cairn to measure the length of DNA. List the technologies are essential for the use of technique.

5. Outline Cairns' technique for measuring the length of DNA molecules

3.2.U3 Eukaryote chromosomes are linear DNA molecules associated with histone proteins.

6. Distinguish between eukaryote and prokaryote chromosomes.

3.2.U4 In a eukaryote species there are different chromosomes that carry different genes.

7. Outline the three ways in which chromosomes can vary:

-
-
-

8. If chromosomes vary describe how individuals of a species are similar in terms of their DNA.

3.2.S1 Use of databases to identify the locus of a human gene and its polypeptide product.

9. Use the online database (http://www.genecards.org/) to search for the genes and the loci responsible for synthesising human polypeptides. Complete the table to summarise your findings.

Polypeptide	Gene Name	Genomic location	
		Chromosome	Locus
Rhodopsin	*RHO Gene*	*3*	*129,528,639 bp from pter*
Collagen …… *(chosen type of)*			
Insulin			
(polypeptide of choice)			

n.b. pter is the end (terminus) of the short arm of the chromosome and qter is the end of the long arm of the chromosome.

3.2.U8 The number of chromosomes is a characteristic feature of members of a species.

10. The number of chromosomes possessed by a species is known as the N number. State what the N number is for humans.

11. Give two reasons why the chromosome number can be used to characterise a species.

3.2.U6 Diploid nuclei have pairs of homologous chromosomes. AND 3.2.U7 Haploid nuclei have one chromosome of each pair.

12. Eukaryotic nuclei can be described as being haploid or diploid. Describe what is meant by these terms.
    a. Haploid

    b. Diploid

13. List the types of cell in humans that are haploid and state the number of chromosomes present in the nuclei.

14. List the types of cell in humans that are diploid and state the number of chromosomes present in the nuclei.

15. Extension: give a type of human cell that is neither haploid nor diploid.

3.2.A3 Comparison of diploid chromosome numbers of Homo sapiens, Pan troglodytes, Canis familiaris, Oryza sativa, Parascaris equorum.

16. Complete the table to compare diploid chromosome numbers in the selected organisms.

Organism	**Genome size (million base pairs)**
Humans *(Homo sapiens)*	
Asian rice (*Oryza sativa)*	
Chimpanzee *(Pan troglodytes)*	
Domestic Dog (*Canis familiaris)*	
Equine roundworm (*Parascaris equorum)*	

3.2.U5 Homologous chromosomes carry the same sequence of genes but not necessarily the same alleles of those genes.

17. State what is meant by the term homologous chromosome.

18. The chromosomes that make up a homologous pair have a different origin. State where they originate and explain why they this means that they can possess different alleles for a gene locus.

3.2.U10 Sex is determined by sex chromosomes and autosomes are chromosomes that do not determine sex.

19. One pair of chromosomes in human cells is not always homologous.
    a. State which pair

    b. Explain why the identified pair is not always homologous.

20. State the gene, if expressed, that causes the development of male characteristics and the chromosome it is located on.

21. Explain why there is a 50:50 chance of human offspring being male or female.

3.2.A2 Comparison of genome size in T2 phage, Escherichia coli, Drosophila melanogaster, Homo sapiens and Paris japonica.

22. State what is meant by the term genome size.

23. Complete the table to compare genome size in the selected organisms.

Organism	Genome size (million base pairs)
Virus - T2 phage	
Bacterium - *Escherichia coli*	
Fruit fly (*Drosophila melanogaster)*	
Humans *(Homo sapiens)*	
Canopy plant (*Paris japonica*)	

3.2.U9 A karyogram shows the chromosomes of an organism in homologous pairs of decreasing length. AND 3.2.A4 Use of karyograms to deduce sex and diagnose Down syndrome in humans.

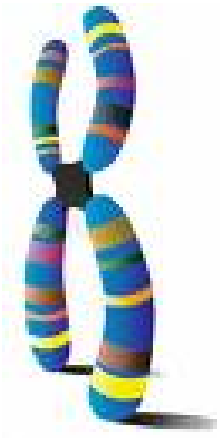
24. Distinguish between a karyogram and a karyotype.

25. State three visual aspects of homologous chromosomes which can be used to identify them for the purpose of a karyotype?

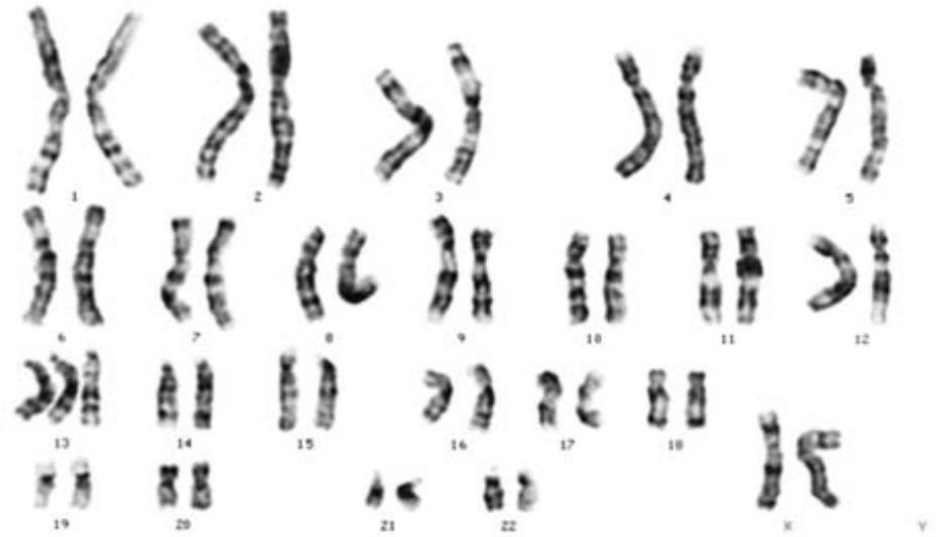
a. Banding patterns

b.

c.



26. Analyse the karyogram below:



http://www.tokyo-med.ac.jp/genet/kry/tri13k.jpg

Gender: Condition:

Citations:

Allott, Andrew. *Biology: Course Companion.* S.l.: Oxford UP, 2014. Print.

Taylor, Stephen. " Essential Biology 4.1 Chromosomes, Genes, Alleles, Mutations.docx." Web. 16 Jul. 2015. <http://www.slideshare.net/gurustip/essential-biology-041-chromosomes-genes-alleles-mutations>.

Taylor, Stephen. " Essential Biology 4.2 Meiosis core.docx." Web. 16 Jul. 2015. <http://www.slideshare.net/gurustip/essential-biology-42-meiosis-core>.