Revison: Meiosis Karyotypes and Non-disjunction

Aim: To measure where you are in your understanding of these three topics and to identify what your individual next steps should be, so you progress to the next level.

Assess yourself

4.2 Meiosis			
Reduction Division diploid / haploid homologous chromosomes	I can define these terms	I can outline the process of meiosis I know that meiosis makes 4 haploid chromosomes	I can explain where pairing of homologous chromosomes happens, crossing over, non-sister chromatids, and the two divisions

Test yourself with these definitions

Homologous chromosomes

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Diploid cell

……

Haploid cell

……

Sister chromatids

……

Non-sister chromatids

……

Pairing of homologous chromosomes

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Crossing over of non-sister chromatids,

……

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Outline of the process of Meiosis

Arrange the descriptions in the correct order of meiosis – then name each phase if you can.

Number of Phase	Description
1	Homologous chromosomes (each with 2 chromatids) pair up and form tetrad
	Spindle fibers move homologous chromosomes to opposite sides of the cell.
	Nuclear membrane reforms, cytoplasm divides, 4 haploid daughter cells are formed
	Chromosomes (with 2 chromatids) line up along the equator, not in homologous pairs
	Crossing-over occurs
	Chromatids of each chromosome separate
	Homologous chromosomes line up alone equator
	Cytoplasm divides, 2 daughter cells are formed

Assess yourself

4.2.4 non-disjunction			
chromosome number, Down syndrome (trisomy 21).	I know what non-disjunction is, I can say how it causes Downs syndrome.	I can say at exactly how non-disjunction happens during meiosis. I can describe how an extra chromosome gets into a gamete.	I can link non-disjunction, meiosis, crossing over, karyotypes & homologous chromosomes, in an explanation of trisomy 21 (Down syndrome)

Test yourself with these definitions

Non-disjunction

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Trisomy 21 / Down syndrome

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Gamete

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Test yourself with these Questions

How does Non-disjunction cause Downs syndromes?

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In which stages of meiosis could non-disjunction happen?

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1. What is the usual cause of Down's syndrome?

A. 21 pairs of chromosomes
B. Trisomy 21
C. Non-disjunction of sex chromosomes
D. Fertilization of the egg by two sperm

(Total 1 mark)

2. Which event occurs first in meiosis?

A. Centromere appearance
B. Chiasmata formation
C. Crossing over

(Total 1 mark)

3. What are homologous chromosomes?

A. Two chromosomes with differing sets of genes, in the same sequence, with the same alleles
B. Two chromosomes with the same set of genes, in a different sequence, with the same alleles
C. Two chromosomes with a different set of genes, in the same sequence, with different alleles
D. Two chromosomes with the same set of genes, in the same sequence, sometimes with different alleles

(Total 1 mark)

Answers

1. B **2.** A **3.** D

Assess yourself

4.2.5 Karyotyping,			
Chorionic villus sampling, Amniocentesis Pre-natal diagnosis	I can state what karyotyping is, how chromosomes are arranged and how cells are collected for a karyotype.	I can analyse a human karyotype to determine gender (Xy or XX) and whether non-disjunction has occurred.	I can explain the ethical and social issues associated with karyotyping

Definitions

Chromosome disorder

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Chorionic villus sample

……

Karyotype

……

Amniocentesis

……

Prenatal Diagnosis

……

Questions

Which fluid is sampled to try to detect chromosomal abnormalities in a fetus?

A. Placental
B. Umbilical
C. Amniotic
D. Spinal

What does a karyotype show?

A. Gel electrophoresis bands from DNA
B. The number and appearance of chromosomes
C. A pair of alleles controlling a specific character
D. All the genes possessed by a living organism

(b) Discuss the advantages and disadvantages of genetic screening for chromosomal and genetic disorders.

(8)

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Model Answer

(b) genetic screening is testing for the presence or absence of gene / chromosome;
screening for chromosomes can involve karyotyping;

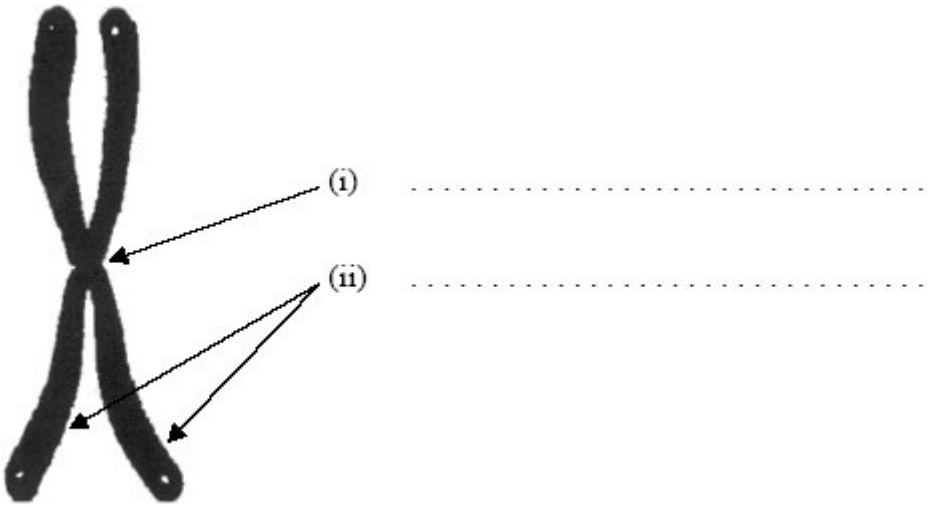
advantages: [4 max]
parents can choose to avoid having children with disorder (eg Down syndrome);
parents can prepare for a child with a disorder;
parents can use IVF to select embryos that are normal;
treatment can start to prevent symptoms;
fewer children with the disorder are born;

disadvantages: [4 max]
frequency of abortion can increase with testing;
parents can select embryos for sex of the child;
can have harmful side effects such as depression if you know you will develop a disorder later;
health insurance / treatment can be denied if there is genetic predisposition to a disorder;

8 max

Extension Questions

(a) State the names of the parts of the chromosome labelled (i) and (ii) on the diagram below.



(2)

[Source: adapted from Hartwell (editor) (2003), *Genetics: from Genes to Genomes,* 2nd edition, McGraw Hill, page 81]

(b) Explain how meiosis promotes variation in a species.

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(Total 7 marks)