

GENES CHROMOSOMES AND DNA



These Quiz Sheets are designed to support science teachers who have already covered some aspects of inheritance with their Key Stage 4 students. They are not intended as an introduction to basic genetics. It is important to be aware that some students in the class may themselves have a genetic condition, or be a carrier, or have a relative who is affected. Sensitivity is required to avoid putting such students under stress.

SUGGESTED AGE RANGE

14—16 year olds who have completed the genetics component within National Curriculum Science or its equivalent.

USING THE QUIZ SHEETS WITH STUDENTS

Before the lesson, decide which Quiz Sheet(s) you wish to use with your students and photocopy the relevant materials.

You might like to try some or all of the following depending on the amount of time you have and the ability range of your students:

- Awarding the title 'Gene Genius' to all students in the top-scoring group.
- Encouraging different teams of students to mark each other's Quiz Sheets (using either the answer sheets or their own knowledge).
- Going over some of the Quiz Sheets with the whole class.
- Marking some completed Quiz Sheets yourself after the lesson.
- Suggesting that teams which request Information Sheets 1 and/or 2 to help them complete Quiz Sheet C should halve their score for this Quiz Sheet.
- Extending the activity by asking students to produce a simple information/quiz sheet themselves, using writing and drawings, with headings such as What is a gene? What everyone should know about DNA etc.

TEAMS

Ask students to get into groups of four. Each 'team' could choose a name for themselves (the name should have something to do with genetics i.e. the Gene Geniuses, Cool Clones etc.)

Hand out copies of the Quiz Sheet(s) you have selected and ask students to work through them in their groups. Set a time limit for the activity.

HUMAN GENETIC ACTIVITIES: TEACHERS' NOTES QUIZ SHEETS

QUIZ SHEET A : QUIZ OBJECTIVE

To clarify the relationship between genes, chromosomes and DNA.

CURRICULUM LINKS

Science

National Curriculum Science (Double) at KS4, Life Processes and Living Things, Section 4: Variation, inheritance and evolution. 'Pupils should be taught that "g. the gene is a section of DNA.'

Scottish Certificate of Education, Biology — Standard Grade, Topic 6: Inheritance. Learning outcomes, General Level — 'State that:... genes are parts of chromosomes.'

N.B. For more able students, you may wish to photocopy the Quiz Sheet and remove the prompt words/numbers.

ANSWERS TO QUIZ SHEET A

chromosomes proteins genes DNA 100,000 code human genome divide nucleus microscope

Almost all cells in the human body contain DNA. If you look at a cell through a powerful Microscope you can see tiny thread-like structures called Chromosomes in the Nucleus the cell. They show up most clearly when the cell is about to Divide.

If you take each chromosome and 'unravel' it, you will find that it is made up of a long strand of DNA which contains instructions in the form of a chemical code. Four chemical bases, represented by the letters A (for adenine), G (for guanine), C (for cytosine) and T (for thymine) make up the code. In groups of three (CAG, TCA, ACG etc.), these bases determine the order in which amino acids are joined together to form the many tens of thousands of Proteins your body needs to develop and work properly.

Sections of DNA which instruct the cells to make proteins, and so control all life processes, are called Genes

Human DNA is thought to contain about 30,000 pairs of genes. One of each pair of genes has come from the mother and one from the father. Scientists working on the Human Genome project will find, and eventually understand more about, all human genes. You can explore some of the moral and social dilemmas which this knowledge might bring elsewhere in Genes and you.

HUMAN GENETIC ACTIVITIES: TEACHERS' NOTES QUIZ SHEETS

QUIZ SHEET B

OBJECTIVE

To clarify the difference between genes, chromosomes and DNA.

CURRICULUM LINKS

Science

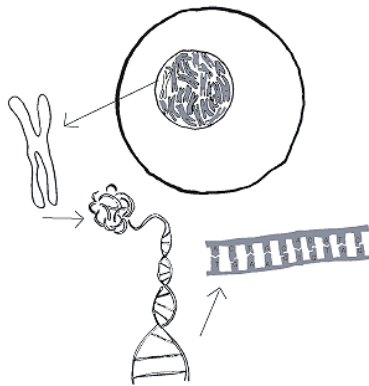
National Curriculum Science (Double) at KS4, Life Processes and Living Things, Section 4: Variation, inheritance and evolution. 'Pupils should be taught. "g: that the gene is a section of DNA.'

Scottish Certificate of Education, Biology - Standard Grade, Topic 6: Inheritance. Learning outcomes, General Level — 'State that... genes are parts of chromosomes.'

N.B. For more able students, you may wish to photocopy the Quiz Sheet and remove the prompt words/numbers.

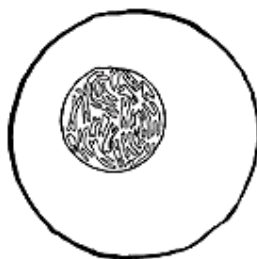
ANSWERS TO QUIZ SHEET B

QUIZ SHEET B



Label the diagram correctly using these words:

DNA gene chromosome nucleus a cell



Label the diagram correctly using these words:

DNA gene chromosome nucleus a cell

HUMAN GENETIC ACTIVITIES: TEACHERS' NOTES QUIZ SHEETS

QUIZ SHEET C

OBJECTIVE - To clarify how gender is determined in humans.

CURRICULUM LINKS

Science

National Curriculum Science (Double) at KS4, Life Processes and Living Things, Section 4: Variation, inheritance and evolution. 'Pupils should be taught: d. how gender is determined in humans.'

Scottish Certificate of Education, Biology — Standard Grade, Topic 6: Inheritance. Learning outcomes, General Level - 'State that:

- each sex cell carries one set of chromosomes;
- .how the sex of a child is determined with reference to X and Y chromosomes.'

Information Sheet 1 (Chromosomes and you) and Information Sheet 2 {Boy or Girl?} could be given to students to help them complete Quiz Sheet C. The use of these Information Sheets is optional.

N.B: For more able students, you may wish to photocopy the Quiz Sheet and remove the prompt words/numbers

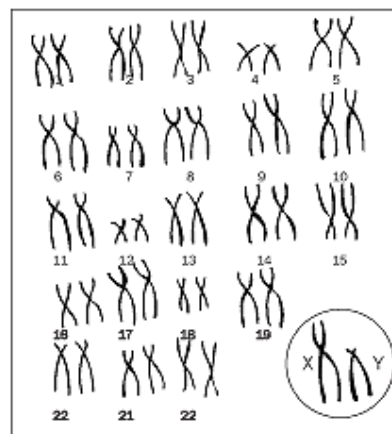
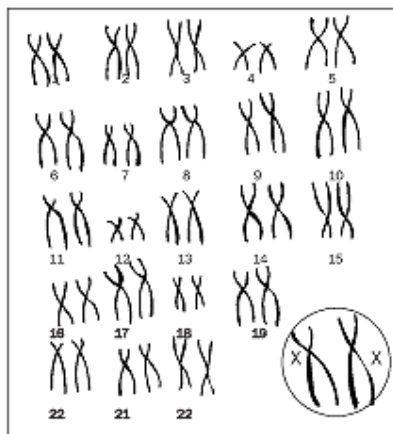
ANSWERS TO QUIZ SHEET C

Why do some fertilised eggs develop into girls and others into boys? Fill in the boxes below using only the numbers 22, 23, and 46 and the letters X and Y.

Most cells in the human body contain 46 chromosomes. But sex cells (or gametes) are different. Eggs (made in the woman's ovaries) and sperm (made in the man's testes) only contain 23 chromosomes. At fertilisation, the 23 chromosomes from the mother's egg join with the 23 chromosomes from the father's sperm so the fertilised egg (or zygote) receives the 46 chromosomes (23 pairs) it needs. 22 out of these 23 pairs are known as autosomes. The remaining pair, known as the sex chromosomes, are different in males and females. The two sex chromosomes are called the X and Y chromosomes because of their shape (see below):

Female

Male

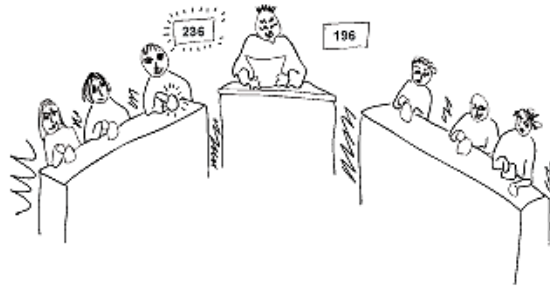


As you can see from the drawing, females have 22 pairs of chromosomes plus two X chromosomes, while males have 22 pairs of chromosomes plus an X and a Y chromosome. How is the sex of a baby determined? Well it all depends on whether the egg is fertilised by a sperm carrying an X or a Y chromosome. You see all female eggs contain an X chromosome. But sperm can contain either an X chromosome or a Y chromosome. Now if an egg is fertilised by a sperm containing an X chromosome, the zygote will have two X chromosomes and will develop into a girl. But if the egg is fertilised by a sperm containing a Y chromosome, the zygote will contain an X and a y chromosome and will develop into a boy.

HUMAN GENETIC ACTIVITIES: TEACHERS' NOTES QUIZ SHEETS

What are the chances of having a boy or a girl? Well it appears that of all sperms formed, roughly half will contain an X chromosome and half a Y chromosome. Fertilisation appears to be random so there is an equal chance of the egg being fertilised by an X or a Y sperm. This means your chances of having a boy or a girl are also equal.

QUIZ SHEETS FOR STUDENTS : QUIZ SHEET A



QUIZ SHEET A

SCORE 5 FOR EACH CORRECT ANSWER (maximum score 25)

What do you know about genes, chromosomes and DNA? Fit the words/numbers below into the gaps. You only need to use each word/number once.

CHROMOSOMES : PROTEINS : GENES : DNA : 30,000 : CODE

HUMAN GENOME : DIVIDE NUCLEUS : MICROSCOPE

Almost all cells in the human body contain DNA. If you look at a cell through a powerful _____ you can see tiny thread-like structures called in the _____ of the cell. They show up most clearly when the cell is about to _____ .

If you take each chromosome and 'unravel' it, you will find that it is made up of a long strand of _____ which contains instructions in the form of a chemical _____. Four chemical bases, represented by the letters A (for adenine), G (for guanine), C (for cytosine) and T (for thymine) make up the code. In groups of three (GAG, TCA, ACG etc.), these bases determine the order in which amino acids are joined together to form the many tens of thousands of _____ your body needs to develop and work properly.

Sections of DNA which instruct the cells to make proteins, and so control all life processes, are called _____. Human DNA is thought to contain about _____ pairs of genes. One of each pair of genes has come from the mother and one from the father. Scientists working on the _____ project hope to find, and eventually understand more about, all human genes.

You can explore some of the moral and social dilemmas which this knowledge might bring elsewhere in Genes and you.

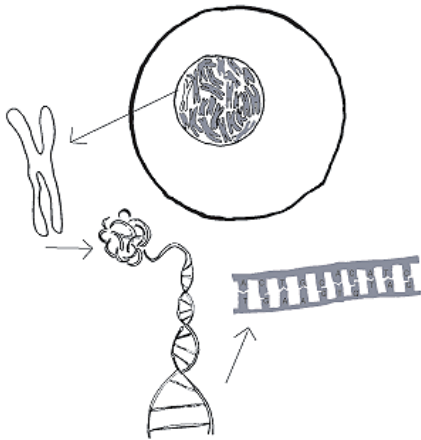
SCORE 5 FOR EACH CORRECT ANSWER (maximum score 50)

QUIZ SHEETS FOR STUDENTS : QUIZ SHEET B

QUIZ SHEET B

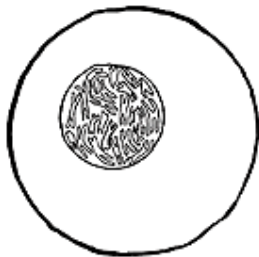
Responses from nearly 700 Year 10 and Year 11 students to a recent Genetic Interest Group questionnaire suggested that many of you are unclear about the difference between chromosomes, DNA and genes.

What about you? Do you know your genes from your DNA?



Label the diagram correctly using these words:

DNA GENE CHROMOSOME NUCLEUS A CELL



Label the diagram correctly using these words:

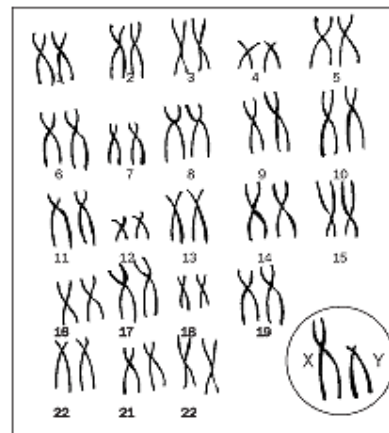
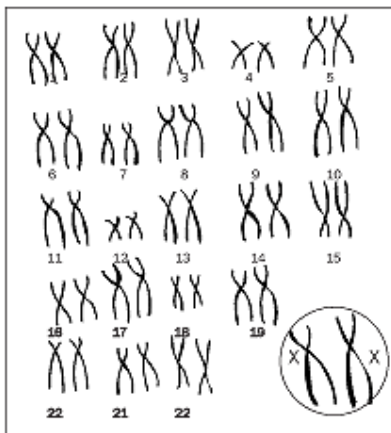
DNA GENE CHROMOSOME NUCLEUS A CELL

QUIZ SHEETS FOR STUDENTS : QUIZ SHEET C

QUIZ SHEET C

Why do some fertilised eggs develop into girls and others into boys? Fill in the gaps below using only the numbers **22**, **23** and **46** and the letters **X** and **Y**. (You will need to use some numbers/ letters more than once).

Most cells in the human body contain _____ chromosomes. But sex cells (or gametes) are different. Eggs (made in the woman's ovaries) and sperm (made in the man's testes) only contain _____ chromosomes. At fertilisation, the _____ chromosomes from the mother's egg join with the _____ chromosomes from the father's sperm so the fertilised egg (or zygote) receives the _____ chromosomes (_____ pairs) it needs. _____ out of these _____ pairs are known as autosomes. The remaining pair, known as the sex chromosomes, are different in males and females. The two sex chromosomes are called the _____ and _____ chromosomes because of their shape (see below)



As you can see from the drawing, females have _____ pairs of chromosomes plus two _____ chromosomes, while males have _____ pairs of chromosomes plus an _____ and a _____ chromosome. How is the sex of a baby determined? Well it all depends on whether the egg is fertilised by a sperm carrying an _____ or a _____ chromosome. You see all female eggs contain an _____ chromosome. But sperm can contain either an _____ chromosome or a _____ chromosome. Now if an egg is fertilised by a sperm containing an _____ chromosome, the zygote will have two _____ chromosomes and will develop into a girl. But if the egg is fertilised by a sperm containing a _____ chromosome, the zygote will contain an _____ and a _____ chromosome and will develop into a boy. What are the chances of having a boy or a girl? Well it appears that of all sperms formed, roughly half will contain an _____ chromosome and half a _____ chromosome. Fertilisation appears to be random so there is an equal chance of the egg being fertilised by an _____ or a _____ sperm. This means your chances of having a boy or a girl are also equal.