

OVERVIEW

Aimed at **key stage 3 and 4** pupils.

In the first part of this activity, the class will answer multiple choice questions on genetics. They will then investigate recessive inheritance - using pairs of socks to represent chromosomes.

LEARNING OBJECTIVES

CURRICULUM LINKS

To learn about the inheritance of Sickle Cell Anaemia

KS3: Life processes are supported by the organisation of cells into tissues, organs and body systems

KS4 The ways in which organisms function are related to the genes in their cells

KS4: Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments

you will NEED

Student worksheets

4 identical socks (2 with white stickers and 2 with red stickers on them) per group

Activity

Watch the film **Pamela's Story** about Sickle Cell Anaemia

Pupils complete the first quiz activity on the worksheet as an individual

Pupils work in groups of three as instructed on their worksheets

ANSWERS

- Your genetic information is stored in structures called:
c) chromosomes
- This genetic information is present in every cell. Where in the cell is it stored?
b) nucleus
- Approximately how many genes do humans have?
a) 20,000
- How many chromosomes are there in a human body cell?
b) 46
- How are these chromosomes arranged?
a) In pairs
- Where do these chromosomes come from?
c) Both your Mum and Dad

Understanding inheritance activity:

Pupils should start to see a pattern emerge, as they randomly select pairs of chromosomes. There will be roughly **1:2:1 ratio** between the three possible results.

Summary of results:

| | White + White sticker | White + Red sticker | Red + Red sticker |
|--|--------------------------------------|--------------------------------------|--------------------------------------|
| Frequency of result | Expect on average 2 of these results | Expect on average 4 of these results | Expect on average 2 of these results |
| Child affected by sickle cell anaemia? | NO | NO (Healthy Carrier) | YES |

On average, what is the chance of two carriers of Sickle Cell Anaemia having a child affected by Sickle Cell Anaemia? **1 in 4 chance or 25%**

What pattern of inheritance describes the way Sickle Cell Anaemia is inherited?
c) Recessive inheritance

FURTHER information

See Pamela's Story Teacher Factsheet on Sickle Cell Anaemia for basic information. For more detailed information, link to the patient support group: www.sicklecellsociety.org
For more detailed scientific information about Sickle Cell Anaemia, the American website, Your Genes, Your Health provides an excellent summary: www.ygyh.org/sickle/cause.htm

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DAY, VISIT US AT WWW.JEANSFORGENES.ORG

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GENES

You have watched the film about Pamela who is affected by **Sickle Cell Anaemia**. Pamela experiences serious medical problems when her red blood cells become sickle-shaped. The sickle-shaped cells have a tendency to get stuck in small blood vessels – stopping blood flow around some areas of the body. This can cause organ damage and intense pain.

Sickle Cell Anaemia is a genetic condition that Pamela has inherited from her parents. Pamela's parents are not affected by Sickle Cell Anaemia, but they both passed on a gene to Pamela that has caused Sickle Cell Anaemia.

This activity will help you understand more about chromosomes and how Pamela inherited Sickle Cell Anaemia from her parents.

INTRODUCTION

Answer the multiple choice questions below:

- 1 **Your genetic information is stored in structures called:**
 - a. lysosomes
 - b. ribosomes
 - c. chromosomes
- 2 **This genetic information is present in every cell. Where in the cell is it stored?**
 - a. cytoplasm
 - b. nucleus
 - c. cell membrane
- 3 **Approximately how many genes do humans have?**
 - a. 20,000
 - b. 200,000
 - c. 2,000,000
- 4 **How many chromosomes are there in a human body cell?**
 - a. 12
 - b. 46
 - c. 56
- 5 **How are these chromosomes arranged?**
 - a. In pairs
 - b. In threes
 - c. In fours
- 6 **Where do these chromosomes come from?**
 - a. Just your Mum
 - b. Just your Dad
 - c. Both your Mum and Dad

UNDERSTANDING INHERITANCE ACTIVITY

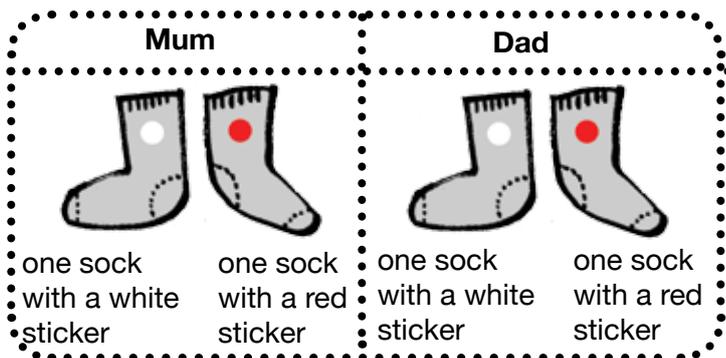
For this activity you will need to work in groups of three. Decide who is going to be:

Mum Dad Child

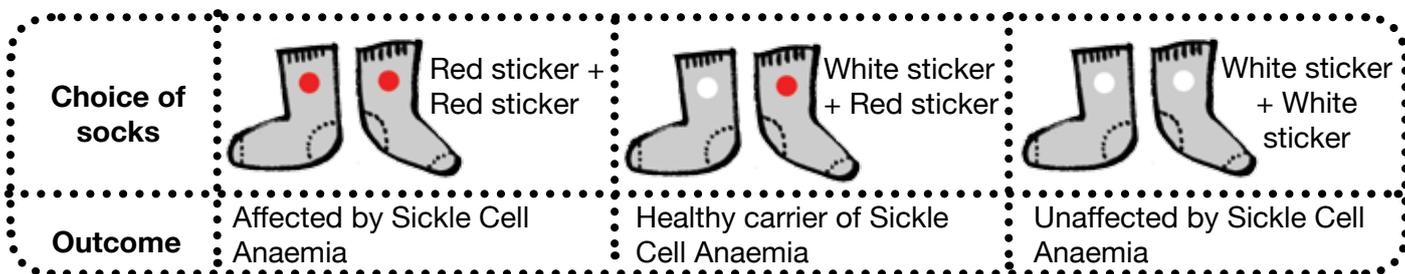
Your teacher will give you 4 socks and some stickers.

The socks represent **chromosomes** in this activity. Chromosomes are very small structures that can only be seen with powerful microscopes. They are long structures that can be stained to look like stripy socks.

Mum and Dad will each need a pair of socks:



The stickers on the socks represent a specific **gene**. The white sticker represents a normal copy of the gene making haemoglobin. The red sticker represents an altered copy of the gene making haemoglobin. This altered copy of the gene causes Sickle Cell Anaemia when one person inherits two copies of it. Mum and Dad are described as healthy carriers, as they only have one copy of this altered gene and another working copy of the gene.



GENES

INSTRUCTIONS

- 1 Mum and Dad hold their pair of socks behind their backs.
- 2 They shuffle the socks up behind their back for 10 seconds.
- 3 Once they have stopped shuffling, they should have one sock in each hand behind their back
- 4 The person nominated as the child picks whether they want the sock from the left or right hand
- 5 The child is given a random pair of socks
- 6 Note down the results in the table below

| Trial Number | What colour stickers were chosen? | Would the child be affected by Sickle Cell Anaemia? |
|--------------|-----------------------------------|---|
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SUMMARY OF RESULTS

| | White + White sticker | White + Red sticker | Red + Red sticker |
|--|-----------------------|---------------------|-------------------|
| Frequency of result | | | |
| Child affected by Sickle Cell Anaemia? | | | |

On average, what is the chance of two carriers of Sickle Cell Anaemia having a child affected by Sickle Cell Anaemia?

What pattern of inheritance describes the way Sickle Cell Anaemia is inherited?

- a) *X-linked inheritance*
- b) *Dominant inheritance*
- c) *Recessive inheritance*