



# THE SIGNAL AND THE NOISE

## ACTIVITY SHEET



### INTRODUCTION

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DR DARREN LOGAN'S RESEARCH IS TRYING TO FIND OUT IF THERE IS A GENETIC EXPLANATION FOR BEHAVIOUR. IF THESE BEHAVIOURAL GENES CAN BE IDENTIFIED THEN A DNA READ-OUT FOR AN INDIVIDUAL COULD PREDICT BEHAVIOUR AND POSSIBLE TREATMENT. DNA MANIPULATION IS MOSTLY ABOUT PHYSICAL OR MEDICAL ISSUES BUT WHAT IF IT COULD BE MANIPULATED TO ALTER BEHAVIOUR?



### AIMS

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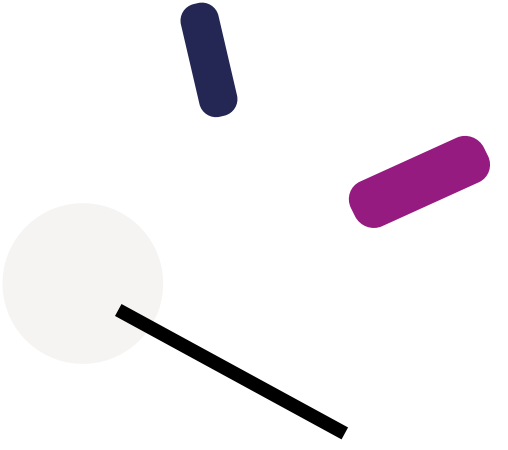
- To stimulate debate about the social, ethical and moral implications of altering behaviour
- To understand DNA sequencing technology and its possibilities for genetic manipulation



### MATERIALS

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THERE ARE 8 CARDS:

- Fear
  - Aggression
  - Lust
  - Parenting skill
  - Stubbornness
  - Curiosity
  - Embarrassment
  - Jealousy
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Either print as large cards for students to hold up at the front or as complete A4 sheets for handing out to students working in small groups. See page 6 for the template.

## STARTER

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ASK THE FOLLOWING QUESTION AT THE START AND END OF THE SESSION.

“Is it right to control behaviour by medicines or genetic manipulation?”

A GREAT VISUAL RESOURCE CAN BE FOUND HERE:

<https://www.gatesnotes.com/Health/Most-Lethal-Animal-Mosquito-Week>

## METHOD

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THE GAME TAKES THE FORM OF A BALLOON DEBATE TO EXAMINE THE IMPLICATIONS OF BEING ABLE TO GENETICALLY MANIPULATE DIFFERENT BEHAVIOUR TRAITS. ITS SUCCESS DEPENDS UPON THE SKILL OF THE FACILITATOR IN DRAWING OUT DISCUSSION STIMULATED BY THE STUDENTS' CHOICES AND THE WAY IN WHICH THEIR OPINIONS MAY CHANGE THROUGH THE PROCESS.

Split students into pairs and give a sheet with all 8 cards and ask them to discuss with each other and then rank the traits in order of which they would most like to live without.

For the whole group, by calling out each trait, record the how many it was ranked as most like to live without.

THE FACILITATOR CAN THEN RUN A GROUP DISCUSSION USING SIMILAR QUESTIONING TO DRAW OUT THE KEY ISSUES

- Why have you chosen a particular trait?
- What makes your personality?
- Is some level of fear/jealousy/curiosity a good thing?
- Is it right to control behaviour? ADHD Ritalin? DNA manipulation?
- Which would you least like to live without?
- What if stubbornness were called tenacity?
- What if embarrassment was called shame or conscience?

The facilitator should then run the vote again. The most popular trait is then eliminated and the voting starts again.

Continue the game eliminating a trait each time by popular vote. The facilitator should explore how votes change as discussion and elimination progresses. At the end review the collective ranking of the traits from 1 (most like to live without) to 8 (least like to live without) and submit them via the feedback questionnaire.

## DISCUSSION

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### FURTHER QUESTIONS ABOUT THE SOCIAL, ETHICAL AND MORAL IMPLICATIONS OF ALTERING BEHAVIOUR:

- What if we could modify along a graded scale?
- If the gene is switched off can nurture still have an impact?
- Should it be a reversible process?
- Should your settings be a medical passport?
- Who else should have access?
- What if this affected your suitability for a job or insurance premiums?
- Does a genetic disorder necessarily mean it has changed you for the worse?
- Is it inherited?

## EXTENSION QUESTIONS

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### THESE CAN BE USED WITHIN THE SESSION TO STIMULATE DEBATE OR FOR HOMEWORK/INDEPENDENT STUDY TASKS.

- Do we need to be able to control behaviour?
- Can nurture change nature?
- Do all behaviours have a genetic origin?
- Should everyone have their genomes sequenced?
- Should all genetic information be publicly available?

## OTHER RESOURCES

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### THE ANIMATION FEATURES DNA SEQUENCING TECHNOLOGY. SOME CLASSROOM RESOURCES CAN BE FOUND AT:

<http://www.glasgowsciencecentre.org/teacher-resources/dna-origami.html>

<http://www.insidedna.org.uk/content/?tag=downloads>

<http://www.yourgenome.org/resources>

# DNA FINGERPRINT SIMULATION

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THERE IS ALSO A DNA FINGERPRINT SIMULATION THAT STUDENTS CAN DO USING SPAGHETTI!

EACH STUDENT REQUIRES:

- A strip of uncooked spaghetti (use the longest strips of spaghetti that you can find)
- A sheet of paper (template below on page 8)
- Ruler
- Pencil/Pen

Tell students to break their strip into 10 pieces of any length they choose (See page 7, figure 1).

Then place the first spaghetti fragment against the vertical axis of the template and draw a vertical line where it ends (figure 2).

Repeat this with each fragment, always measuring from the vertical axis (figure 3).

Now enclose the lines by drawing a line across the top and end (figure 4).

These now look like DNA fingerprints (figure 5) and can be compared across the class. Everyone will be different.

SIMPLE EXPLANATION THAT CAN BE USED WITH THE SIMULATION:

DNA is collected from cells, such as a blood sample, and cut into small pieces using a restriction enzyme. This generates thousands of DNA fragments of differing sizes as a consequence of variations between DNA sequences of different individuals. The fragments are then separated on the basis of size using gel electrophoresis. The separated fragments are then transferred to a nitrocellulose or nylon filter; this procedure is called a Southern blot. Next radioactive markers are added. These markers are fragments of DNA that have the complementary code which bind to the fragments trapped in the gel. A photographic film is placed over the gel. The film darkens when exposed to radiation, this marks the location of the DNA fragments and these bands make up the DNA fingerprint.

THERE IS A MORE DETAILED EXPLANATION AND GREAT DETECTIVE WORKSHOP AVAILABLE HERE:

<http://www.pbs.org/wgbh/nova/education/body/create-dna-fingerprint.html>

# SYLLABUS LINKS FOR DNA SEQUENCING IN A-LEVEL BIOLOGY

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## AQA

Topic 1 Biological molecules

Topic 4 Genetic information, variation and relationships between organisms

Topic 6 The control of gene expression

## EDEXCEL SALTERS-NUFFIELD

Topic 2 Genes and health

Topic 3 Voice of the Genome

Topic 8 Grey Matter

## EDEXCEL B

Topic 1 Biological molecules

Topic 3 Classification and biodiversity

Topic 7 Modern genetics

Topic 8 Origins of genetic variation

## OCR A

Module 2 Foundations in Biology

Module 6 Genetics, evolution and ecosystems

## OCR B

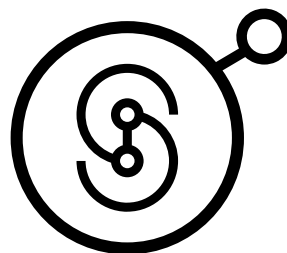
Module 2 Cells, chemicals for life

Module 5 Genetics, control and homeostasis

## WJEC

Component 2 Continuity of life

Component 3 option Neurobiology and behaviour



**S I L E N T**  
**S I G N A L**

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## BEHAVIOUR TRAIT CARDS

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FEAR

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AGGRESSION

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LUST

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PARENTING SKILL

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STUBBORNNESS

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CURIOSITY

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EMBARRASSMENT

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JEALOUSY

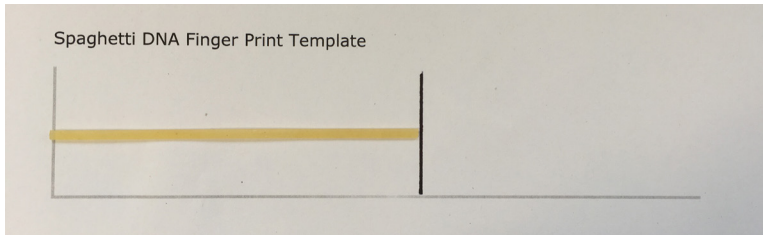
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# SPAGHETTI DNA FINGER PRINT TEMPLATES AND VISUAL GUIDE

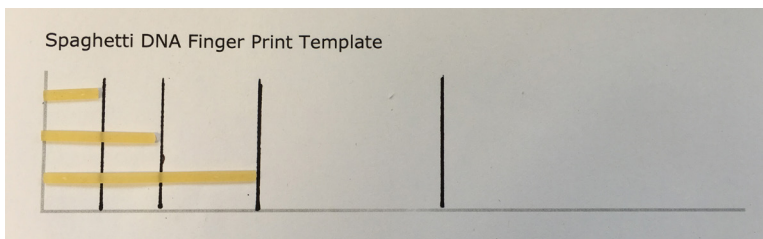
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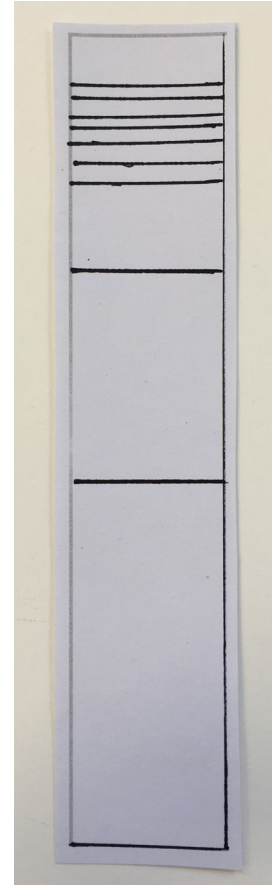
2



3



4



5



CBP CHEMIST READS A DNA PROFILE (JAMES TOURTELLOTTE)

