**ACTIVITY: DNA Q&A**

**Activity idea**

In this activity, students use information in the articles [New Zealand DNA databank](http://link.sciencelearn.org.nz/resources/1981-new-zealand-s-dna-databank) and [DNA profiling](http://link.sciencelearn.org.nz/resources/1980-dna-profiling) to answer questions about the national DNA Profile Databank and the structure of DNA.

By the end of this activity, students should be able to:

* identify information about the national DNA Profile Databank (DPD)
* interpret and make conclusions from this information
* describe the structure of DNA.

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**Introduction/background**

In 1995, New Zealand became the second country in the world to collect and store DNA profiles in a databank. Since then, forensic scientists and Police have used the national DNA Profile Databank (DPD) to solve thousands of crimes.

The databank operation involves two databases – the DPD (profiles of individuals) and the Crime Sample Database (profiles from unsolved crimes). By comparing the two, possible suspects can be identified and crimes linked.

The DNA databank is run by Environmental Science and Research (ESR) on behalf of the New Zealand Police, who collect the DNA samples.

**What you need**

* Copies of the student handout [Questions about DNA](#handout)
* Access to the articles [New Zealand DNA databank](http://link.sciencelearn.org.nz/resources/1981-new-zealand-s-dna-databank) and [DNA profiling](http://link.sciencelearn.org.nz/resources/1980-dna-profiling)

**What to do**

1. Hand out copies of the student handout [Questions about DNA](#handout) and have students answer the questions using information in the articles [New Zealand DNA databank](http://link.sciencelearn.org.nz/resources/1981-new-zealand-s-dna-databank) and [DNA profiling](http://link.sciencelearn.org.nz/resources/1980-dna-profiling)
2. Discuss the responses.

**Student handout: Questions about DNA**

***Finding***

1. Who runs the DNA databank?

1. Where is DNA found?

1. What percentage of DNA is identical between different people?

1. Who has access to the DNA databank?

1. What percentage of crimes has ESR been able to link to profiles on the DNA databank?

1. What category of sample did Jarrod Mangels supply the Police with when he was arrested in Nelson?

***Interpreting***

1. What percentage of an individual’s DNA would you expect to be unique to them?

1. Why don’t forensic scientists sequence a person’s whole genome?
2. Why do people who work for ESR or the New Zealand Police have their profiles on the DNA databank?
3. Who might think the databank is a good thing or a bad thing and why?

***Thinking***

1. Do you think the DNA databank has been successful? Why/why not?
2. Only ESR and the Police are allowed access to the DNA databank. Should anyone else (such as employers or insurance companies) be allowed to see it? Why/why not?
3. Half-way through his trial, Jarrod Mangels confessed to the murder of Maureen McKinnel and apologised to her family. Do you think he would have been convicted on the strength of the forensic evidence if he hadn’t confessed?
4. Would you give a voluntary sample to the DNA databank? Why/why not?

***Extra for experts***

1. Describe the structure of DNA.
2. What is the genetic code and how does it differ among different living things?
3. What is a short tandem repeat (STR), and how is it used to get a DNA profile?
4. What is a genome?
5. What does similarity between two genomes tell you about the relationship of the two individuals?
6. What else can DNA profiling be used for (apart from fighting crime)?

**Questions about DNA – answers**

***Finding***

1. Who runs the DNA databank?

*The national DNA Profile Databank is run by Environmental Science and Research (ESR).*

1. Where is DNA found?

*DNA is found in all cells (except red blood cells).*

1. What percentage of DNA is identical between different people?

*99% of DNA is identical between different people.*

1. Who has access to the DNA databank?

*The New Zealand Police and ESR scientists have access to the DNA databank.*

1. What percentage of crimes has ESR been able to link to profiles on the DNA databank?

*ESR has linked 70% of unsolved crimes to profiles on the DNA databank.*

1. What category of sample did Jarrod Mangels supply the Police with when he was arrested in Nelson?

*Jarrod Mangels supplied the police with a voluntary DNA sample when he was arrested in Nelson.*

***Interpreting***

1. What percentage of an individual’s DNA would you expect to be unique to them?

*You would expect about 1% of an individual’s DNA to be unique to them.*

1. Why don’t forensic scientists sequence a person’s whole genome?

*To sequence a person’s whole genome would take too long and would be expensive. Instead, forensic scientists look at shorter DNA sequences that are highly variable between individuals and not any of the 99% that is identical in every human.*

1. Why do people who work for ESR or the New Zealand Police have their profiles on the DNA databank?

*People who work for ESR or the New Zealand Police have their profiles on the DNA databank so that, if any contamination of the crime scene samples occurs, the source can readily be identified.*

1. Who might think the databank is a good thing or a bad thing and why?

* *The general public might think it’s a good thing if it helps catch criminals.*
* *Criminals might think it’s a bad thing if it leads to them being caught.*
* *ESR scientists might think it is a good thing because it gives them a job.*
* *Police might think it is a good thing because it gives them another tool to help solve crimes.*
* *Some people might not want genetic information to be held on record in such a manner, especially if regulations regarding access could be changed in the future.*

***Thinking***

1. Do you think the DNA databank has been successful? Why/why not?

* *Yes – it has been used successfully in 70% of New Zealand’s unsolved crimes.*
* *No – to be truly useful, it needs to have profiles on record for everyone who commits a crime, and this will not happen, especially with the current limitations on the collection of DNA samples.*

1. Only ESR and the Police are allowed access to the DNA databank. Should anyone else (such as employers or insurance companies) be allowed to see it? Why/why not?

* *Yes – employers should have access to DNA profiles when selecting candidates for a job so that they can base their appointment on the genetic make-up of the applicant.*
* *No – employers should not have access to DNA profiles when selecting candidates for a job as this could lead to discriminating on the basis of genes.*
* *Yes – insurance companies should have access to DNA so that they can find out whether a person is at risk of developing a particular illness.*
* *No – insurance companies should not have access to DNA profiles in case the profiles might give information that a person is disposed to a disease they might never get.*

1. Half-way through his trial, Jarrod Mangels confessed to the murder of Maureen McKinnel and apologised to her family. Do you think he would have been convicted on the strength of the forensic evidence if he hadn’t confessed?

*Students could argue either way – totally up to their imagination.*

1. Would you give a voluntary sample to the DNA databank? Why/why not?

*Students could argue either way – should stimulate some discussion!*

***Extra for experts***

1. Describe the structure of DNA.

*DNA is a long, double-stranded molecule shaped in a helix. Each strand is made of repeating units called nucleotides. A nucleotide is made up of a deoxyribose sugar, a phosphate group and one of the four bases (A, T, G or C). The bases pair up with a matching base on the other strand of DNA so that A always pairs with T and G always pairs with C.*

1. What is the genetic code and how does it differ among different living things?

*The genetic code is the sequence of bases that contain the instructions for the sequence of amino acids, which make up proteins. A sequence of three bases (either A, T, G and C) codes for one amino acid.*

1. What is a short tandem repeat (STR), and how is it used to get a DNA profile?

*Short tandem repeats (STRs) are small sequences of DNA that are repeated one after another in a specific region of DNA. The number of repeats varies between people. A DNA profile counts the number of repeats in several regions of the DNA where STRs occur.*

1. What is a genome?

*A genome is the complete base sequence of all the genetic material in a chromosome for an organism.*

1. What does similarity between two genomes tell you about the relationship of the two individuals?

*The more similar two genomes are, the more closely related two individuals are likely to be.*

1. What else can DNA profiling be used for (apart from fighting crime)?

*DNA profiling can also be used to identify victims of disasters, for example, tsunami victims in Indonesia or to determine parentage.*