



# AUSTRALIAN ARMY

## UNRECOVERED WAR CASUALTIES - ARMY

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### DNA ANALYSIS: a colour coded, simple guide to the DNA process

The discovery of human remains of serviceman is unique in that the circumstances surrounding their losses in war have left us with a pool of possible identities when human remains are recovered. In the past, the establishment of individual identity has been dependent solely on material, circumstantial and anthropological evidence. These tried and tested tools will continue to play a significant part in the identification process, but DNA analysis is now an additional tool in the identification tool kit. While it may not prove possible to extract DNA from all recovered human remains, DNA analysis has no chance of success without living relatives coming forward to provide DNA Family Reference Samples (FRS) for comparison. The process can be complex but the following gives a much simplified explanation of what is involved.

#### The genetic indicators

DNA analysis to establish identity relies on the way our genetic material is inherited from one generation to another. In most cases two genetic profiling markers - **Y Chromosome** and **Mitochondrial DNA** – are used as the basis for analysis:

- **Y-STR** = STR stands for Single Tandem Repeats and is a scientific term that describes Y Chromosome sequencing. The Y-Chromosome is passed directly from **fathers** to **sons only**.
- **Mitochondrial DNA** = passed from the **mother** to both **male** and **female** children equally.

These markers are used because they do not co-mingle or mutate at a high rate and as a result the pattern of inheritance is passed down from one generation to another, essentially, unchanged.

Details of these **Y-STR** and **Mitochondrial DNA** markers are determined when samples taken from human remains are examined and a DNA profile is formed. This profile can be compared with the FRS profiles from living family members.

#### Who to sample? – establishing the lineage

Not all living family members are suitable FRS donors – some will not have the required markers (they will be 'non-informative'). The most successful results will be achieved from comparison with family members from the direct **male** and **female** lineage. This must be established through an examination of the family lineage (family tree).

#### Direct lineage

If the serviceman had children, direct lineage can be established through:

- His **male descendants only** (**Y-STR** passed down from the serviceman – there will be no inherited Mitochondrial DNA in his female descendants because it is inherited from their mother).

If the serviceman had no children (and many of them didn't), direct lineage can be established either through:

- His **brother's male descendants** (shared **Y-STR** passed down from the **serviceman's father**).
- His **sister's male and female descendants** (**Mitochondrial DNA** passed down from the **serviceman's mother and beyond through a female only line**).

If the serviceman had no siblings, direct lineage can be determined either through:

- His **uncle's male descendants** (**Y-STR** passed down from the **serviceman's paternal grandfather**)
- His **aunt's male and female descendants** (**Mitochondrial DNA** passed down from the **serviceman's maternal grandmother**)

## Indirect lineage

If no male or female lineage can be traced (the serviceman's parents had no siblings, the serviceman had no siblings or children), comparison may still be possible by looking at the indirect lineage. This may involve going back into the family tree to find a common ancestor from whom the **Y-STR** or **Mitochondrial DNA** might have been passed down. These relatives may be quite distant.

## The DNA profiles

The DNA profiling process (**Y-STR** and **Mitochondrial DNA**) is undertaken in specialised forensic laboratories. All FRS profiles are kept in a secure and discrete database.

Collected FRS profiles collected from recovered human remains are compared to:

- The DNA profile of recovered human remains; and
- The DNA profiles held in the elimination database that contains the profiles of the all individuals who may have come into contact with the human remains. *This comparison excludes any third party DNA contamination during sample collection.*

Successful matches will provide one piece of the total collected evidence of an investigation that may be presented to an Identification Board. Other evidence might include historical, artefact and other scientific evidence (archaeological, anthropological and odontological).

If donor consent is provided, FRS profiles may be retained and anonymous profiles may be used in future DNA research specifically intended to improve the chances of identifying the human remains of recovered servicemen.

## It's never too late

Relatives of Australian servicemen who remain unaccounted for can telephone 1800 019 090 or email [army.uwc@defence.gov.au](mailto:army.uwc@defence.gov.au) with their contact details and the name of the serviceman.

### The DNA Sample Kit:

Those relatives identified from a family tree as being suitable DNA FRS donors will be sent a kit containing:

- 1 x DNA Donor Details Form
- 1 x UWC-A Donor Consent Form (Reverse of DNA Donor Details Form)
- 2 x Sterile swabs
- 2 x Pre-labelled bar-coded 1.5ml sterile safe lock vials
- 1 x Pre-addressed envelope (postage paid (Australia only) return envelope)

### Providing the Sample:

- Ensure no food/drink consumed for 30 mins prior to collection
- **Only** the person providing the sample should handle the kit.
- The person providing the sample should be careful **not** to touch the collection pad at the end of the swab.
- The sterile swabs (2) are rubbed around the inside of the cheeks, to collect cells
- The swabs are then placed and sealed in the pre-labelled bar-coded 1.5ml sterile safe lock vials (2).
- The donor consent form is completed and signed.
- The vials (2) and completed and signed consent form are returned to UWC-A in the pre-addressed envelope.