The Sad But True Case of Earl Washington

DNA Analysis and the Criminal Justice System

by
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On the evening of June 4, 1982, a white 19-year-old housewife named Rebecca Williams returned home to her Culpeper, Virginia, apartment with her three small children. She didn’t lock the door behind her. A strange man entered her apartment and attacked her, stabbing her repeatedly, dragging her to a bedroom and raping her, and then stabbing her again before leaving the scene.

Williams staggered outside her apartment and neighbors and the police soon arrived. Before slipping into a coma and dying, Williams’ last words described the lone, black, bearded man who had attacked her.
On May 21, 1983, Earl Washington, a 22-year-old black man, was arrested in Warrenton, Virginia, on an unrelated case—burglary and malicious wounding. During two days of questioning by law enforcement officials from the Virginia State Police, Culpeper County, and Fauquier County, he confessed to the Williams murder (and to three other rapes).
Questioning and testimony revealed that Washington...

- **did not** know that Williams was white.
- **did not** know the address of the apartment where she was killed.
- **did not** know that he had raped her.
- thought Williams was **short** when in fact she was 5'8”.
- said he had stabbed her **two or three** times when she actually had been stabbed **thirty-eight** times.
- said there was **no one** else in the apartment when it was known that Williams’ **three children** were in the apartment on the day of the crime.
- **could not** identify Williams’ apartment without police assistance.

CQ1
Why did Earl Washington say that he raped and killed Rebecca Williams?
Why did Earl Washington say that he raped and killed Rebecca Williams?

He was mentally handicapped with an IQ of 69. To compensate for his disability, Earl would defer to authority figures and agree with them no matter what.

Earl Washington was found guilty and sentenced to death on January 20, 1984. His “confession” was the only piece of evidence linking Earl to the crime.
Is there a better way to prove a person’s guilt (or innocence) in these types of criminal cases?

**DNA Profiling**

1. Isolate DNA samples from crime scene and from suspects.
2. Analyze and compare amplified DNA from crime scene and suspects.
Step 1. Isolate DNA samples

• What biological specimens would yield DNA at a crime scene?

White blood cells, semen, skin, lip prints, saliva

• If you find just a few cells, that would not be enough DNA. We need to make more of it!

How?
• To make more DNA, use the **Polymerase Chain Reaction (PCR)**.

• **PCR** makes approximately 1 billion copies (DNA replication) after 30 cycles, using the little existing DNA molecules found on biological evidence as its template.
How PCR works

Cycle one yields two copies of DNA (new DNA in green)
Cycle two yields four copies of DNA

Cycle three yields eight copies of DNA

Cycle four yields sixteen copies of DNA

After 30 cycles you will have approximately 1 billion copies of DNA! Or $2^{30}$
Step 2. Analyze and compare DNA portions

• DNA can be visualized using **gel electrophoresis**
  DNA is loaded at top of gel
  An electric current is applied

Bigger (slower) molecules

Smaller (faster) molecules
DNA ladders are used to determine approximate sizes of DNA molecules.

Sizes (lengths) of DNA molecules (number of base pairs)

L – DNA ladder
1 – DNA sample 1
2 – DNA sample 2
3 – DNA sample 3

CQ4-CQ5
On August 16, 1985, Earl is transferred to the execution site at the Virginia State Penitentiary and he hears electric chairs being tested.

While Earl is there, another death-row inmate learns of his case and tells his lawyers about it. They take up his case pro bono.

Earl is awarded a stay of execution nine days before he is scheduled to die.
For years, Earl’s lawyers keep appealing to the courts that Earl was innocent but they did not succeed.

On October 25, 1993, a DNA test performed on semen from a blanket at the scene of the murder shows that it did not come from Earl. However, Virginia law states that new evidence cannot be used in a trial that has already concluded.

On January 14, 1994, Governor Douglas Wilder of Virginia changes Earl’s sentence to life imprisonment with possibility of parole.
In January 2000, Earl’s lawyers request that additional DNA testing (STR analysis) be performed on the biological sample from the murder scene.

What are STRs?
What is STR analysis?
Short Tandem Repeats

• STR → Short Tandem Repeat
  – Stretches of DNA that are repetitive

  AGAT AGAT AGAT AGAT AGAT AGAT AGAT AGAT AGAT AGAT

  10 total repeats

• STRs are usually highly variable between different people (that are unrelated) in their lengths
  – Someone might have 10 AGATs in a row, another could have 17 AGATs in a row.
  – These repeats occur at the same place in the genome.
Combined DNA Index System (CODIS)

As of January 2014, CODIS (a national database of DNA profiles) contains 12.5 million arrestee and criminal DNA profiles that have assisted in more than 224,800 investigations. All 13 STR regions are used in comparisons. The odds that two people match in all 13 STR regions in certain populations are 1 in 18 quadrillion.

http://www.fbi.gov/about-us/lab/codis

CQ7-CQ10
On October 2, 2000, Governor James Gilmore of Virginia released the STR analysis results that compared DNA from the Rebecca Williams’ crime scene and Earl’s DNA:

The DNA at the murder scene was NOT Earl’s.

Earl was granted an absolute and full pardon for the capital murder conviction.
Earl was released on Feb 12, 2001

He was in prison for 17 years and sentenced to die for something he did not do.

He currently is married and lives in Virginia Beach. He was awarded a $2.25M settlement.
Clicker Questions

Earl Washington

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Is there enough physical evidence to convict Earl Washington of this crime?
   a. yes
   b. no
   c. maybe
   d. don’t know

2. Which of the following does NOT pertain to the PCR process?
   a. Used to make copies of small samples of DNA.
   b. Requires Taq polymerase to add nucleotides.
   c. Converts DNA segments into approximately 1 billion RNA copies.
   d. Requires the use of primers and free nucleotides.

3. Which of the following is required in the PCR process?
   a. Taq polymerase
   b. primers
   c. free nucleotides
   d. DNA sample
   e. all of the above
   f. only b and c

4. What is the approximate size of the DNA molecule marked by the yellow arrow above?
   a. 62 base pairs
   b. 73 base pairs
   c. 68 base pairs
   d. 81 base pairs
5. If DNA samples were loaded at the top of a gel but the positive and negative poles were accidentally reversed, what would you expect to happen?
   a. All of the DNA molecules would move towards the top of the gel.
   b. All of the DNA molecules would continue moving towards the bottom.
   c. Small molecules would move toward the top and large molecules would move toward the bottom.
   d. Small molecules would move toward the bottom and large molecules would move toward the top.

6. A single STR may differ between two unrelated people by....
   a. sequence
   b. length
   c. location in genome
   d. both location and sequence

7. Which of the following does NOT pertain to CODIS?
   a. A national DNA profile database
   b. CODIS = Combined DNA Index System
   c. Contains over 12 million profiles
   d. Contains the DNA profiles of all US citizens.

8. Does suspect A have more or less repeats at TPOX than the crime scene DNA?
   a. more
   b. less
   c. the same
   d. cannot be determined
Which suspect likely left the crime scene evidence?

a. Suspect A  
b. Suspect B

Is the above STR analysis enough to convict suspect B with 100% certainty?

a. Yes, because all of the bands matched.  
b. Yes, because suspect B matches more bands than suspect A.  
c. No, because blood type tests should also have been performed.  
d. No, because there are 7 other STRs that may not match.