

# Supplementary case details for the Y Chromosome and its use in Forensic DNA Analysis

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## Important case examples of Y-STRs in criminal justice system

### *The Boston Strangler*

Eleven women were murdered in Boston between 1962 and 1964 and many were sexually assaulted. The nineteen-year old Mary Sullivan appears to be the last victim and Albert DeSalva apparently confessed to the crime, yet there was no other evidence and DNA from another male had later been linked to her body [1], placing doubts on his confession. DeSalva was murdered while in prison serving time for a number of rapes. Slides with DNA taken from Sullivan had not provided any useful DNA when first examined but had been retained and in 2013 a Y chromosome haplotype was produced, matching a paternally related nephew of DeSalva by testing DNA from a bottle he had discarded [2]. Matching DNA (presumably from the Y chromosome) was later recovered from DeSalva at exhumation.

### *Angie Dodge*

In 1996 the eighteen-year old Angie Dodge was raped and murdered. Christopher Tapp was a suspect and, although his DNA did not match with that found at the crime scene, he was convicted in 1997 in the belief that he was one of several involved. Tapp also 'confessed' although allegedly that was coerced. In 2014, investigators had submitted a 35 locus Y-STR haplotype to the Sorensen Y-chromosome database [3], which revealed a match at 34 loci. A court order was issued revealing the identity of that person, Michael Usry Snr. In the belief that the donor of the semen was likely to be a close relative (within three or four generations), police focused on family members before identifying Michael Usry Jnr as a likely candidate, because of his age, links to the area, and also possibly because he made 'dark' films involving murder. The accused Michael Usry was forced to provide a DNA sample and had to wait about one month before he was exonerated. Investigations continued into the provider of the DNA sample from the scene and in 2019, Brian Leigh Dripps was arrested and confessed, saying that he acted alone.

### *Marianne Vaatstra*

In 1999 sixteen-year-old Marianne Vaatstra was raped, and her throat cut in a brutal murder. In the area was an asylum seekers' centre and the local population believed that the murder was one more typical of a non-European, leading to local tension [4]. As part of the investigation, two foreign males raised suspicions, but both provided non-matching DNA, as did 162 others who also provided their DNA. Y-STR analysis, and a search of the YHRD database (albeit illegal in Dutch legislation), revealed that the DNA was most likely from a white male, of likely north-west European ancestry [5].

In 2012 the law in The Netherlands was changed to allow familial searching and an investigation of 802 individuals, selected for genetic, residence, or family name reasons was also unsuccessful. A large-scale dragnet was authorised involving over 7000 males invited to provide their DNA for DNA testing. Y-chromosome STR testing was undertaken of the volunteers, revealing a Y chromosome and subsequent autosomal match with a Dutch European who was found guilty of her murder in 2013.

## Y-STRs in cases of historical interest

### *Thomas Jefferson (1743-1826)*

Thomas Jefferson was the third president of the United States of America. In 1802 a disaffected political journalist published an accusation that Jefferson had fathered a child (Tom) with one of his slaves, Sally Hemings [6]. Sally Hemings had several more children in her lifetime who, it has been suggested, could also have been fathered by Jefferson or by a male child of Jefferson's sister.

In 1998 a group of geneticists [7] reported their findings of a study of Y chromosomes from living descendants of: Jefferson's paternal uncle (Field Jefferson); the alleged son of Thomas Jefferson and Sally (Thomas Woodson); another son of Sally's sons (Eston Hemings); and the paternal grandfather of the Jefferson's nephews (Carr family) through his sister. They made use of a series of eleven STRs, seven biallelic markers and a minisatellite MSY1 and concluded that the most likely explanation for their results was that Thomas Jefferson was the father of Eston Hemings, but not Tom's father; no links were found with the Carr's grandfather's family descendants. Although other potential explanations were aired, they viewed them unlikely.

In 2011 Jobling [8] pointed out that the 'Field' haplogroup, T1a, used as the Thomas Jefferson reference, was very rare and therefore this match was unlikely to be a coincidence, but there was also a possibility that any other male in the same patrilineal line as Field, alive at the time, such as Thomas Jefferson's brother, could be an alternative father. While the question of paternity cannot be resolved genetically, historically it has been documented that Thomas Jefferson and Sally Hemings were both present in the same place at the relevant time before the birth of several of her children.

As highlighted above, this investigation raised other issues: in addition to the disappointment by descendants of Thomas Woodson that they were not related to Jefferson, a more recent issue of non-paternity was also revealed.

### *Richard III (1483-1485)*

The investigation that took place of a skeleton excavated from a car park in Leicester, indicating that this was most likely the skeletal remains of Richard III, revealed through archaeological, osteological, radiocarbon and genetic analysis of mitochondrial DNA, also uncovered another surprise when his Y chromosome was analysed [9]. Y chromosome analysis of presumptive male descendants of Edward III (great-great-grandfather of Richard III) were shown not to match with that found in the skeleton. Some nineteen generations separated the individuals according to genealogy. With an estimated 16% possibility of a non-paternity event occurring in the intervening time (assuming an average 0.9% non-paternity rate for Western societies [10] this provides a reasonable explanation for the findings, but where this false paternity occurred has not been discovered and a more recent investigation of another male claiming to be a direct descendant of Edward III has not resolved the matter [11].

### *HH Holmes (1861-1896)*

Born Herman Webster Mudgett, HH Holmes is probably one of America's most prolific killers, confessing to 27 murders but suspected of many more; some believe that he was also the person responsible for the Whitechapel murders. He was convicted and hanged in 1896, requesting that his coffin be buried deep in concrete for fear of grave robbers [12]. Rumours abounded however that Mudgett had escaped the gallows and his great-great grandson commissioned an investigation with the aim of proving that. Historical dental examination, however, matched with medical examination reports from Holmes and the Y23 chromosome haplotype from the skeleton also matched that of his descendant [13]. While the rumours of Holmes escaping his execution are now proven to be unfounded, this analysis has not resolved other conspiracy theories.

### *Baronetcy of Stichill*

The baronetcy of Stichill was granted to Robert Pringle (and male heirs of his body) by Charles II in 1683. The 8<sup>th</sup> Baron was Sir Norman Robert Pringle (1871-1919) and he had three sons Norman Hamilton Pringle 9<sup>th</sup> Baron and Ronald Steuart Pringle being the first two registered. Norman Hamilton Pringle's son, Sir Steuart Robert Pringle became the 10<sup>th</sup> Baron (figure 1S). In 2009 Ronald Steuart Pringle's son, Norman Murray (Murray), the then current Baron's first cousin, initiated a 'Pringle' surname study with the stated aim of discovering which of any living Pringles might be entitled to be the Clan Chief, the last claimant to this Scottish clan having died in 1738.

Whether or not that would ever have been a realistic approach to answer the question, Murray approached Pringles to give their DNA for a Y chromosome study with that aim. Sir Steuart, although not interested in being the Clan Chief because of the associated responsibilities, was finally persuaded. The Y chromosome study revealed that there must have been an issue of non-paternity such that the 9<sup>th</sup> Baron could not have been the biological son of the 8<sup>th</sup> Baron and that he had wrongly inherited the title, as therefore had the 10<sup>th</sup> Baron, Sir Steuart himself. As a result of the revelation Murray Pringle issued a claim to the baronetcy and in 2016 Murray Pringle became Sir Norman Murray Archibald MacGregor Pringle, 10<sup>th</sup> Baronet as the result of a Privy Council Judgement [14].

The claim was fought by the son of the then 10<sup>th</sup> Baronet on several grounds, which were dismissed, but it does raise important issues:

Consent is an important consideration in any genetic testing. The Human Genetics Commission publication on Direct-to-Consumer Genetic Testing [15] states:

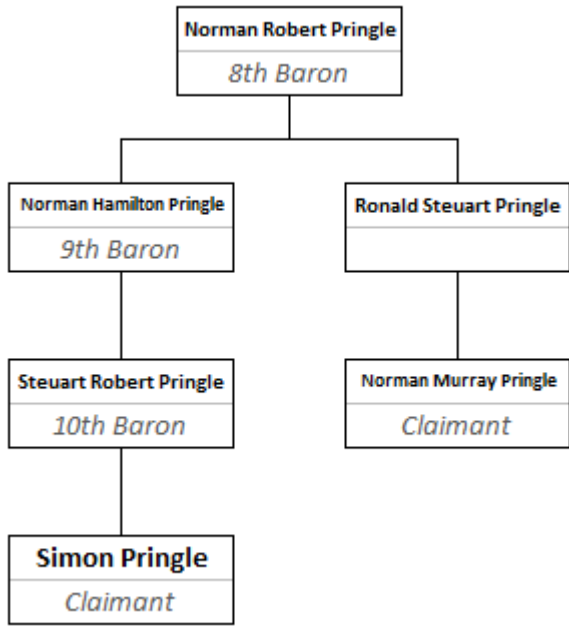
*A genetic test should be carried out only after the person concerned has given free and informed consent. Informed consent can only be provided when a consumer has received sufficient relevant information about the genetic test to enable them to understand the risks, benefits, limitations and implications (including the implications for purchasing insurance) of the genetic test.*

While consent was given for the purposes of determination of who might be the most senior person in the clan of Pringles, it was argued by Simon Pringle (son of Sir Stuart who had recently died) that this did not extend to consent to question his baronetcy. The court, however, stated that while the processes might have breached the Data Protection Law in some respects, Sir Steuart should have been aware "that if his DNA excluded him from a claim to be the clan chief, it might also form the basis of a challenge to his entitlement to the Baronetcy".

A wider issue has been opened by this judgement allowing anyone to challenge the holder of a hereditary title by providing Y chromosome lineage evidence that questions the veracity of a historic family tree.

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Supplement Figure

Figure 1S: Baronetcy of Stichill – family tree illustrating position of claimants to the 11<sup>th</sup> Baronetcy (Simon Pringle) and 10<sup>th</sup> Baronetcy (Norman Murray Pringle)