

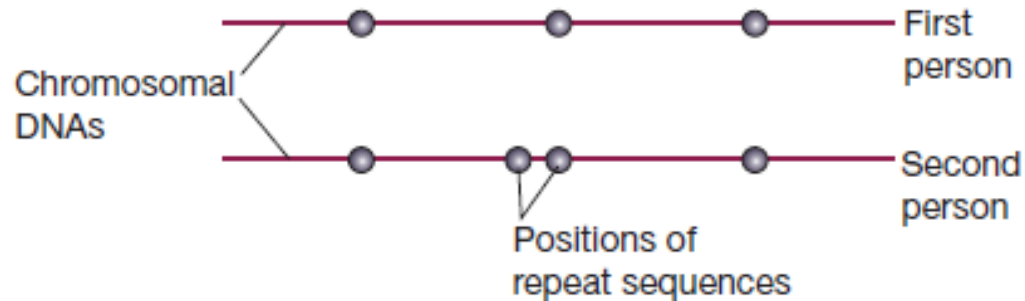
Application of Gene Cloning and DNA Analysis in Forensic Science



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Genetic fingerprinting: using HDRS by hybridization

(a) Polymorphic repeat sequences in the human genome



(b) Two genetic fingerprints



Lanes 1 and 2:
DNA from two
individuals

Genetic fingerprinting. (a) The positions of polymorphic repeats, such as hypervariable dispersed repetitive sequences, in the genomes of two individuals. In the chromosome segment shown, the second person has an additional repeat sequence. (b) An autoradiograph showing the genetic fingerprints of two individuals

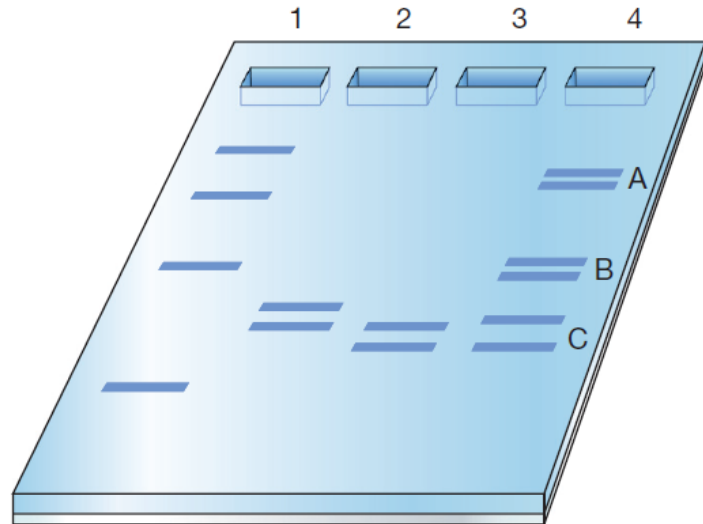
DNA profiling: By STRs

(a) Two alleles of an STR

....CACACACACA.... $n = 5$

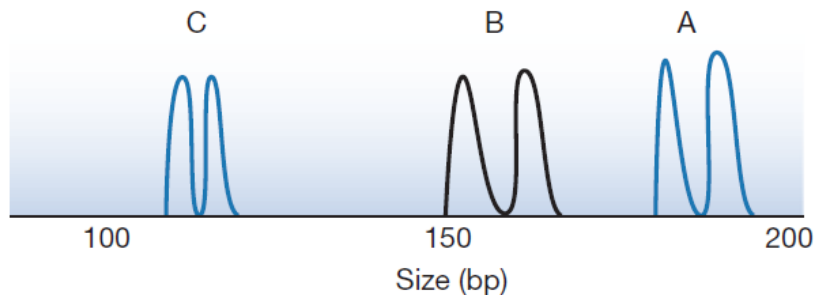
....CACACACACACA.... $n = 6$

(b) The results of PCR



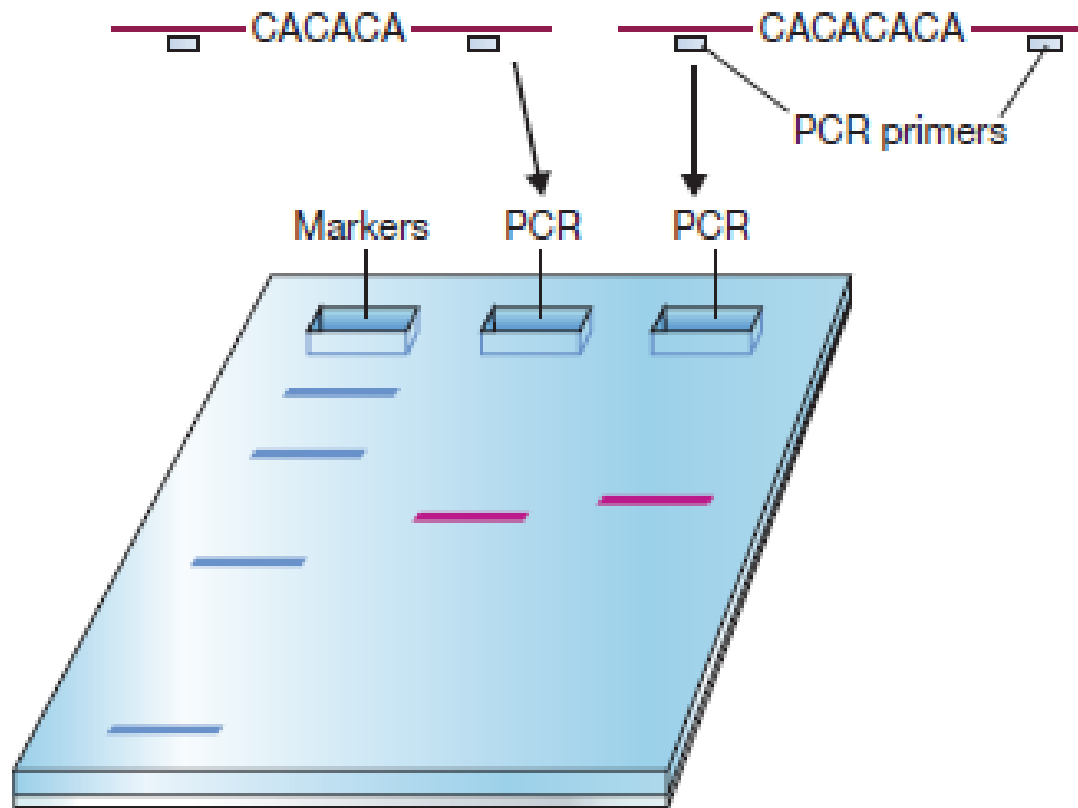
- 1 DNA size markers
- 2, 3 PCRs of a single STR in two individuals
- 4 Multiplex PCR of three STRs (A-C)

(c) Analysis of multiplex PCR results by capillary gel electrophoresis



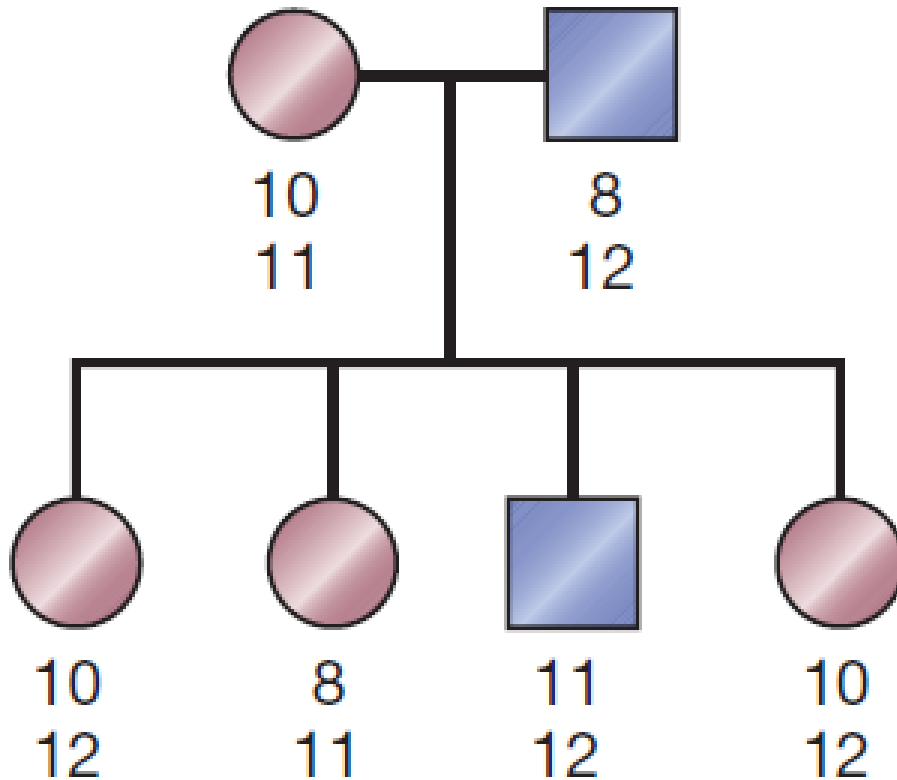
DNA profiling. (a) DNA profiling makes use of STRs which have variable repeat units. (b) A gel obtained after DNA profiling. In lanes 2 and 3 the same STR has been examined in two individuals. These two people have different profiles, but have a band in common. Lane 4 shows the result of a multiplex PCR in which three STRs have been typed in a single PCR. (c) Capillary gel electrophoresis can be used to determine the sizes of multiplex PCR products.

Typing an STR by PCR



Studying kinship by DNA profiling

Inheritance of STR alleles within a family



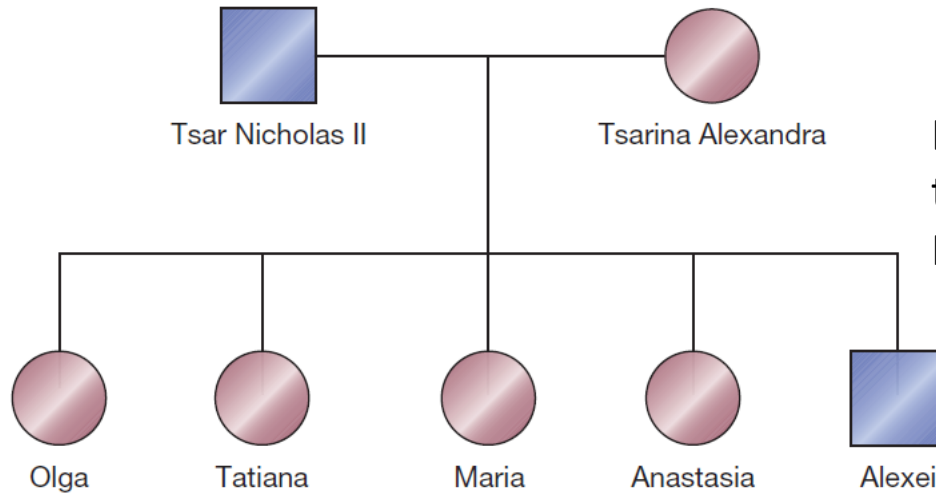
 Female

 Male

10 STR repeat
11 sizes

Short tandem repeat (STR) analysis of the Romanov bones

(a) The Romanov family tree



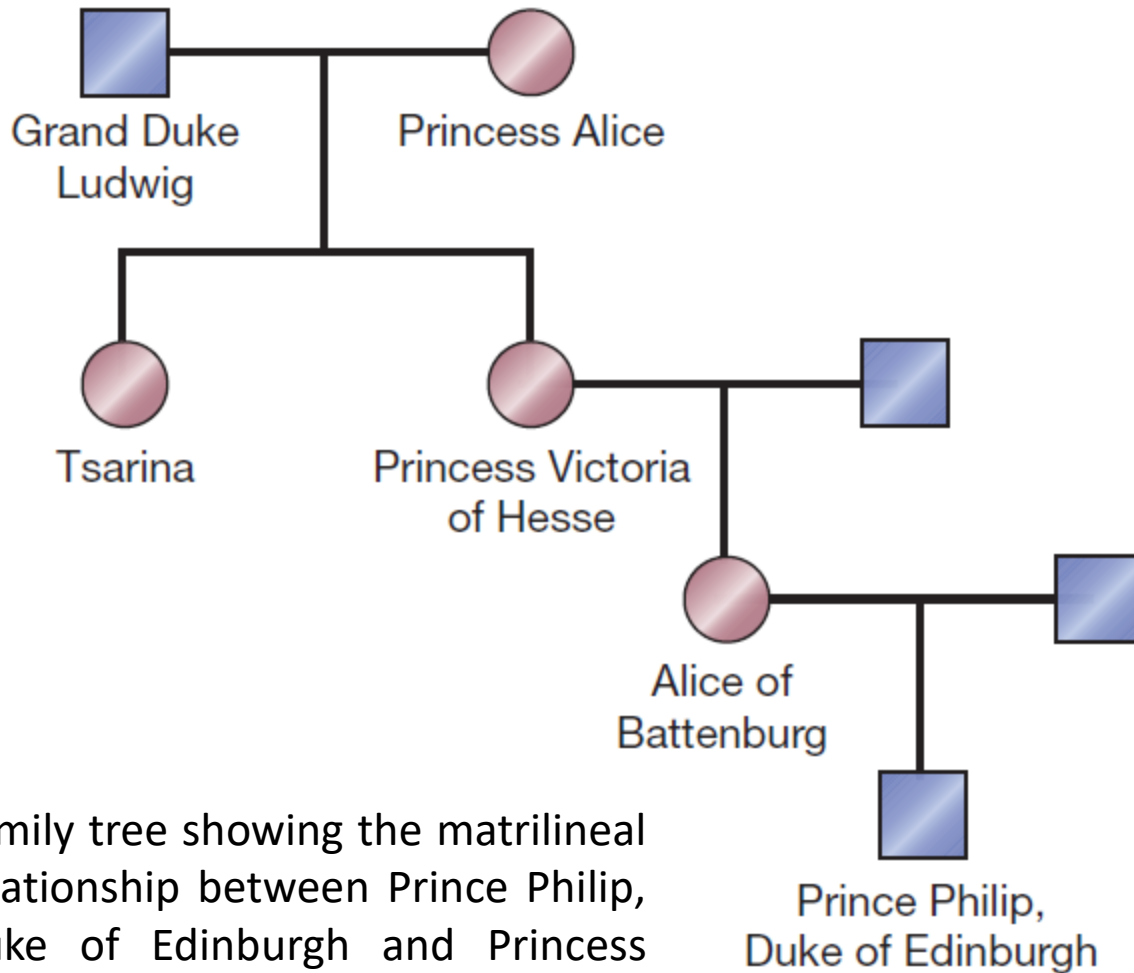
DNA profiling and the remains of the Romanovs, last members of the Russian ruling family

(b) The STR analysis

	STRs				
	VWA/31	THO1	F13A1	FES/FPS	ACTBP2
Child 1	15, 16	8, 10	5, 7	12, 13	11, 32
Child 2	15, 16	7, 8	5, 7	12, 13	11, 36
Child 3	15, 16	8, 10	3, 7	12, 13	32, 36
Female adult 1	15, 16	8, 8	3, 5	12, 13	32, 36
Female adult 2	16, 17	6, 6	6, 7	11, 12	not done
Male adult 1	14, 20	9, 10	6, 16	10, 11	not done
Male adult 2	17, 17	6, 10	5, 7	10, 11	11, 30
Male adult 3	15, 16	7, 10	7, 7	12, 12	11, 32
Male adult 4	15, 17	6, 9	5, 7	8, 10	not done

Short tandem repeat (STR) analysis of the Romanov bones. (a) The Romanov family tree. (b) The results of the STR analysis. Data taken from Gill et al. (1994)

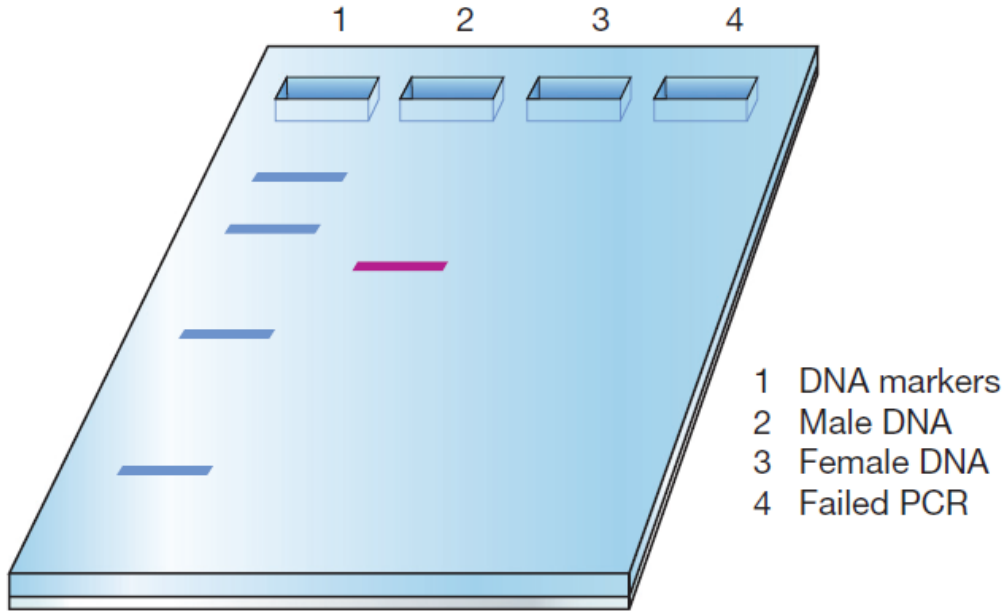
Mitochondrial DNA analysis



Family tree showing the matrilineal relationship between Prince Philip, Duke of Edinburgh and Princess Victoria of Hesse, the Tsarina's sister. Males are shown as blue squares, and females as red circles.

Sex identification by DNA analysis

Sex identification by PCR of a Y-specific DNA sequence

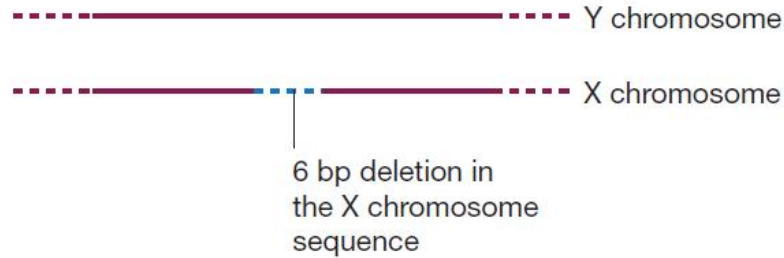


Sex identification by PCR of a Y-specific DNA sequence. Male DNA gives a PCR product (lane 2), but female DNA does not (lane 3). The problem is that a failed PCR (lane 4) gives the same result as female DNA.

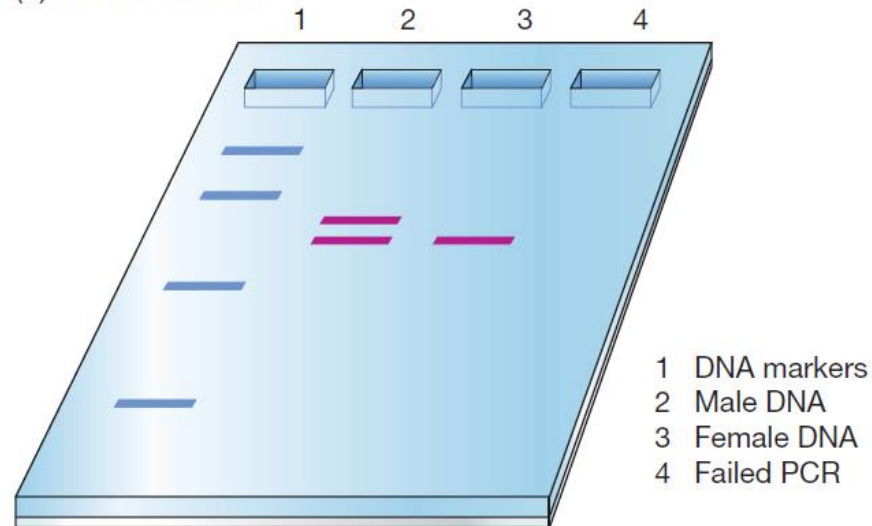
Sex identification by DNA analysis

Sex identification by PCR of part of the amelogenin gene

(a) Part of the amelogenin gene



(b) Results of PCR



Sex identification by PCR of part of the amelogenin gene. (a) An indel in the amelogenin gene. (b) The results of PCRs spanning the indel. Male DNA gives two PCR products, of 106 and 112 bp in the standard system used in forensics and biomolecular archaeology. Female DNA gives just the smaller product. A failed PCR gives no products and so is clearly distinguishable from the two types of positive result.

Thank You