Appendix 6: Forensic Cases Using Species Identification

Case Against X

We, Adrian Matthew Thornton Linacre, B.Sc. D.Phil., a Senior Lecturer in Forensic Science at Strathclyde University, authorised under Section 280(1) of the Criminal Procedure (Scotland) Act 1995 and a Registered Forensic Practitioner, and I Shanan Tobe, Forensic Scientist, BSc MSc, hereby report as follows:

This statement, consisting of 2 pages, each signed by us, is true to the best of our knowledge and we make it knowing that, if it is tendered in evidence, we shall be liable to prosecution if we have wilfully stated in it anything which we know to be false or do not believe to be true.

Information Received

We understand that it is alleged that X subjected Y to sexual assaults. We further understand that a dog was involved in the assault and that the dog licked Y in the genital region. These acts were against the will of Y. The alleged incident was not reported immediately and that there was a two day time period between the alleged incident and the medical examination of Y and X. We were provided with swabs taken from Y being two vulva swabs, two vaginal swabs, and two perianal swabs. We were provided with swabs from X including a sulcus swab and penile shaft swab.

Instruction

We were asked to generate examine swabs provided from Forensic Alliance to determine whether there was cellular material attributable to a dog on any of the swabs.

Items Received

On 25th February 2005 the following items were received at the Centre for Forensic Science from Gail Westenbrink of Forensic Alliance:

SSP-2 1080399	Vulval swab (SSP2)
SSP-3 1080398	Low vaginal swab (SSP2)
SSP-4 1080397	Perianal swab (SSP4)
PL-1.A00233010	Sulcus swab (PL1)
PL-2.A00233008	Penile shaft swab (PL2)

Explanation of Species Test

All humans share approximately 99.5% of their DNA. This compares to approximately 98.7% similarity to the closest genetic relative of the human, the chimpanzee. There are therefore parts of the DNA that is a specific for that species. These sections of DNA are used in taxonomy to identify a particular species. One such region is the cytochrome b gene present on the mammalian mitochondrial genome

The mitochondrial genome is different to the regions of DNA examined in standard DNA testing, which are on chromosomes within the nucleus. There may be over a 1,000 mitochondria in each cell compared to one nucleus. This allows for DNA typing to be undertaken from only a few cells using the mitochondrial DNA compared to nuclear DNA.

The cytochrome B gene has been found to exhibit a different DNA sequence when compared between different species. The gene is 1,144 bases long within which there are 293 differences when comparing the human and dog versions of the cytochrome B gene.

The test used is to examine any cellular material using regions of DNA that are specific to dog and also a test that is specific to human. A DNA profile specific for dog will be produced if there are trace amounts of dog DNA present on any sample provided.

Results Obtained

Samples from Y

SSP2, SSP3 and SSP4 were tested for the presence of both human and dog DNA. Human DNA was present but no dog DNA could be detected.

Samples from X

PL1 and PL2 were tested for the presence of both human and dog DNA. Human DNA was present but no dog DNA could be detected.

Conclusions

Based upon the samples received and the tests conducted, there is no scientific support for the presence of dog DNA upon any of the samples from Y or X. This is either due to there being no cellular material from dog material ever being present on the swabs, or dog material was present as alleged but has been lost in the two day period between the alleged incident and the taking of the swabs.

Signed

Name	Adrian Matthew Thornton Linacre
Qualifications	BSc, DPhil, RFP
Occupation	Senior Lecturer in Forensic Science, University of Strathclyde

Signed

Name	Shanan Tobe
Qualifications	BSc, MSc
Occupation	Forensic Scientist, University of Strathclyde

Date 30th March 2005

DNA Testing
Requested by HFL, UK

We, Adrian Matthew Thornton Linacre, B.Sc. D.Phil., a Senior Lecturer in Forensic Science at Strathclyde University, authorised under Section 280(1) of the Criminal Procedure (Scotland) Act 1995, and a Registered Forensic Practitioner, and Shanan Samuel Tobe, B.Sc., M.Sc., employed as a Forensic Scientist at Strathclyde University, hereby report as follows:

This statement, consisting of 3 pages, each signed by us, is true to the best of our knowledge and we make it knowing that, if it is tendered in evidence, we shall be liable to prosecution if we have wilfully stated in it anything which we know to be false or do not believe to be true.

Instruction

Acting on instructions from HFL, of Newmarket Road, Fordham, Cambridgeshire, UK, we were provided with a sealed package labelled as containing horse hair and a sealed vial labelled as containing a urine sample. It is our understanding that the sample of horse hair was obtained from a known animal, but that the origin of the urine sample was in question. We were requested to produce a DNA profile from the samples provided and compare the resulting DNA profiles to determine whether they could have originated from the same source.

Items received

The following items were received at the Centre for Forensic Science on 7th April

Sample	Client Reference	HLF Reference	CFS Reference
Urine	1592	171664	229/05 U
Hair	2461EE	209313	229/05 H

Explanation of the Test

DNA is the genetic material found in all tissues and fluids of the body and therefore the DNA type in a hair cell will be the same as that in a skin cell. Cells contain two copies of their DNA, half inherited from their mother and half from their father; this is true for all mammalian species. The test conducted examines 17 hypervariable DNA regions, or loci, where the DNA varies in the number of repeat sections. These loci form the Stockmarks© commercial kit supplied by Applied Biosystems. If the number of repeats is the same at each loci for both samples, then it is possible the samples could come from a common source (the same animal). If one or more of the repeat numbers do not match between the two samples then they may be excluded at this locus from originating from a common source.

Conclusions

Based upon the samples provided and the tests conducted, when comparing the DNA profile obtained from the hair (229/05 H) to the urine (229/05 U), there are matching alleles between the hair and urine at all nine regions that produced a result. This would be the expected result if both the hair and the urine sample came from the same horse. If the hair and the urine sample came from two different horses then the two samples must match by chance. Based upon the results obtained it is our opinion that it is more likely that the hair and urine came from the same horse compared to coming from two different and unrelated horses.

Signed

Name	Adrian Linacre
Qualifications	BSc, DPhil
Employment	Senior Lecturer in Forensic Science
Date	12 May 2005

Signed

Name	Shanan Tobe
Qualifications	BSc, MSc in Forensic Science
Employment	Forensic Scientist
Date	12 May 2005

Table 1: DNA Results – Case 229/05

Locus	Control (bp)		Urine 229/05 U (bp)		Hair 229/05 H (bp)	
VHL20	94	96	85	96	85	96
HTG4	126	128	126		126	
AHT4	143	158	143	149	143	149
HMS7	174	185	NR		178	180
HTG6	79	95	79	85	79	85
AHT5	129	137	129	131	129	131
HMS6	157	168	NR		159	168
ASB23	190	206	NR		186	
ASB2	252	261	NR		245	251
HTG10	86	104	92	NR	92	97
HTG7	120	125	123	125	123	125
HMS3	157	164	148	161	148	161
HMS2	222	224	NR		224	
ASB17	109	111	97		97	
LEX3	139	144	NR		144	
HMS1	174		NR		176	182
CA425	240		NR		231	238

The figures provided in the table denote the size in base pairs of the major amplification product obtained. NR denotes that no result was obtained.

DNA Testing
Requested by HFL, UK

We, Adrian Matthew Thornton Linacre, B.Sc. D.Phil., a Senior Lecturer in Forensic Science at Strathclyde University, authorised under Section 280(1) of the Criminal Procedure (Scotland) Act 1995, and a Registered Forensic Practitioner, and Shanan Samuel Tobe, B.Sc., M.Sc., employed as a Forensic Scientist at Strathclyde University, hereby report as follows:

This statement, consisting of 2 pages, each signed by us, is true to the best of our knowledge and we make it knowing that, if it is tendered in evidence, we shall be liable to prosecution if we have wilfully stated in it anything which we know to be false or do not believe to be true.

Instruction

Acting on instructions from HFL, of Newmarket Road, Fordham, Cambridgeshire, UK, we were provided with a sealed package labelled as containing a urine sample. It is our understanding that the origin of the urine sample was in question. We were requested to determine the gender of the donor horse from the sample provided.

Items received

The following item was received at the Centre for Forensic Science on 24th November 2005.

Sample	HLF Reference	CFS Reference
Urine	6191EE	283/05

Conclusions

The sample in question produced a result with the female based test. Two peaks were obtained from this test. Based upon the sample provided and the test conducted, the sample in question is female. Since the test will only produce two peaks if the donor horse is female there are no probabilities associated with the result.

Signed

Name	Adrian Linacre
Qualifications	BSc, DPhil
Employment	Senior Lecturer in Forensic Science
Date	09 December 2005

Name	Shanan Tobe
Qualifications	BSc Hon., MSc
Employment	Forensic Scientist
Date	09 December 2005

Explanation of the Test

DNA is the genetic material found in all tissues and fluids of the body and therefore the DNA type in a hair cell will be the same as that in a skin cell. Cells contain two copies of their DNA, half inherited from their mother and half from their father; this is true for all mammalian species. DNA is inherited in the form of chromosomes and two of these chromosomes, X and Y, determine gender. If two X chromosomes are present then the mammal is female, if an X and a Y are present the mammal is male.
Two tests can be employed to determine the gender of a horse. One of the tests employed examines one hypervariable region specific to the X chromosome where the DNA varies in the number of repeat sections; the other examines a gene specific to the Y chromosome where the test will react only if the Y gene is present.
An expected result from a female is two reactions from the X chromosomes, one inherited from each the mother and father. This would produce two peaks if the animal was heterozygous and one peak if the animal was homozygous. An expected result for a male would be one reaction from the X chromosome, inherited from the mother, resulting in a single peak.
If only one peak is obtained, then the test specific to the Y chromosome is conducted. This test will only produce a result if the Y chromosome is present, indicating a male horse.

9th August 2006

Endemol UK plc
Shepherds Building Central
Charecroft Way
Shepherds Bush
London
W14 0EE

Dear Errol,

Species Testing

I refer to the sample received on the 2nd of August and your instruction to determine the species present. The blood sample produced a positive result for the presence of sheep (*Ovis aries*) but a negative result for all the other European mammals tested. A positive result is based upon a DNA product at 113 base pairs for sheep. Based upon the test conducted it is my opinion that the blood sample originated from a sheep.

Attached is graphical representation of our findings. If you have any questions please contact me directly.

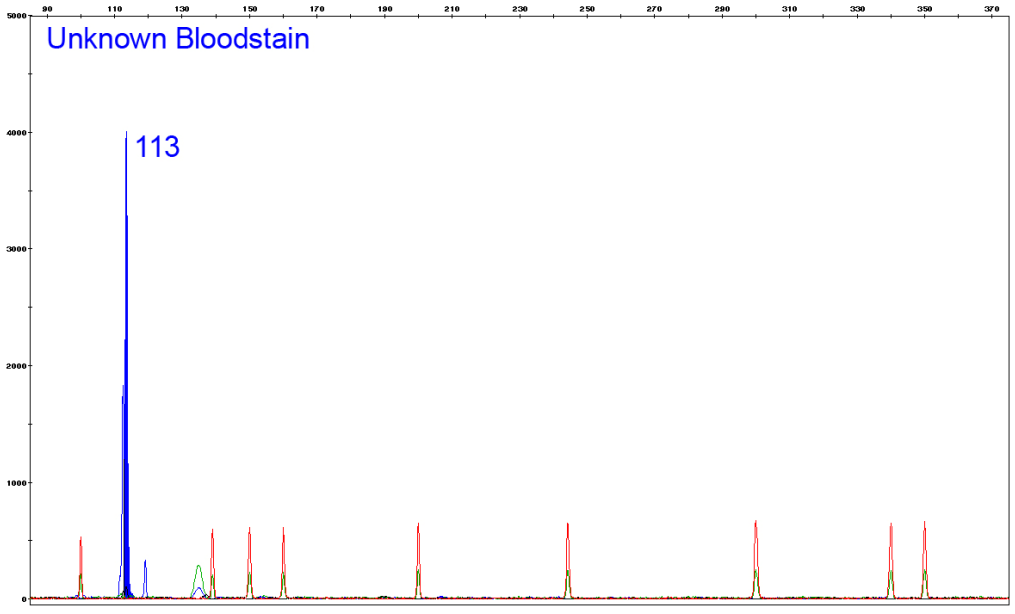
The cost for this test was £350.00 (+vat). Please confirm that the address provided is the correct address to which the invoice should be sent.

I trust that this is sufficient for your needs. I look forward to being of service in the near future.

Yours sincerely

Shane Tobe


Sheep (O. aries)
113


Unknown Bloodstain
113

Case Against XX

I, Adrian Matthew Thornton Linacre, B.Sc. D.Phil., a Senior Lecturer in Forensic Science at Strathclyde University, authorised under Section 280(1) of the Criminal Procedure (Scotland) Act 1995, and a Registered Forensic Practitioner, and I Shanan Tobe, B.Sc. M.Sc., hereby report as follows:

Instruction

Acting under the instructions of Amanda Pirie, of the Scottish Forensic Services, based at Howden Hall, we were asked to examine a sample to determine if there is any scientific evidence that the sample originated from a European badger (*Meles meles*).

Purpose

We understand that a chrome bar has been examined at the Scottish Forensic Services laboratory at Howden Hall in Edinburgh for the presence of blood. A sample was collected from part of the chrome bar that tested positive for blood and was sent to the Centre for Forensic Science at the University of Strathclyde. We were asked to undertake a species-specific test to determine if there is any scientific evidence to indicate that cellular material from the European badger (*M. meles*) was present on the chrome bar.

Items Received

On 10th May 2007 a sample (Bloodstain 07-1200-LB) was received at the Centre for Forensic Science. The item comprised a swab sealed within a tamperproof evidence bag.

The sample was removed and a portion used to generate a DNA profile using a species specific test.

Results

No DNA profile indicating the presence of *M. meles* was obtained from the sample taken from the chrome bar.

The positive control, containing a known amount of *M. meles* DNA, produced the expected results indicating that the test was working.

A test in which bovine DNA was added to the sample taken from the chrome bar produced the expected bovine result when tested with bovine specific DNA test indicating that the lack of a *M. meles* result was not due to the inhibition of the test.

Conclusions

No DNA attributable to *M. meles* was detected on the sample provided.

If *M. meles* DNA had been present at amounts greater than 1 pico gram we would have expected a corresponding result to have been generated.

Signed

Name	Adrian Mathew Thornton Linacre
Qualifications	BSc, DPhil, RFP
Employment	Senior Lecturer in Forensic Science, University of Strathclyde
Date	29 May 2007

Name	Shanan Tobe
Qualifications	BSc, MSc in Forensic Science
Employment	Research Staff, Centre for Forensic Science, University of Strathclyde
Date	29 May 2007

Species Specific Test

The complete complement of DNA for an individual is responsible in part for the physical appearance of the organism. All humans look more like each other than they do to their nearest genetic relative, the great apes, because we all share DNA in common compared to these other species. When developing a species-specific test it is these regions of DNA that are examined.

To be useful in species testing the regions of DNA chosen must show little intra species variation but do show sufficient inter species variation to be able to distinguish between two closely related species. Additionally it is valuable if there are multiple copies of the DNA and that it will withstand environmental insult. For these reasons the DNA regions used in species testing are on the mitochondrial genome.

The DNA test used in species testing examines a gene sequence that meets the criteria for species testing. The test used in this case is designed to detect the presence of DNA sequences specific to *M. meles*, and no other mammalian species, that are found on the cytochrome b gene of the mammalian genome. Further tests are performed as part of the same reaction that will detect the presence of human DNA and DNA from eight other mammalian species.

The test conducted is highly sensitive and will produce a positive result at concentrations less than a thousandth of the amount used in standard DNA testing. DNA at a concentration of 1 pico gram (10^{-15}) of a gram will generate a detectable result. The amount of DNA added to the test is not quantified unless stated as most quantification methods are based upon the analysis of human DNA.

Case For Edinburgh Zoo

I, Adrian Matthew Thornton Linacre, B.Sc. D.Phil., a Senior Lecturer in Forensic Science at Strathclyde University, authorised under Section 280(1) of the Criminal Procedure (Scotland) Act 1995, and a Registered Forensic Practitioner, and I Shanan Tobe, B.Sc. M.Sc., hereby report as follows:

Instruction & Purpose

We were asked by Edinburgh Zoo to determine if a beaver, currently under their keeping, was either a European beaver (*Castor fiber*) or an American beaver (*Castor canadensis*). Mammalian species identification can be confirmed by microscopy of hairs, but with closely related species this may not be possible. There are regions of DNA that show variation even with closely related species allowing identification of the species to be possible. We were asked to use a DNA test on samples labelled as being taken from a beaver to determine if it was *C. fiber* or *C. canadensis*.

Items Received

On 14th April the following items were received in the post from PC Douglas Ogilvie of Tayside Police:

2 x buccal swabs
Hair sample
Dried blood in vial

Species Specific Test

The complete complement of DNA for an individual is responsible in part for the physical appearance of the organism. All humans look more like each other than they do to their nearest genetic relative, the great apes, because we all share DNA in common compared to these other species. When developing a species-specific test it is one of these regions of DNA that is examined.

To be useful in species testing the regions of DNA chosen must show little intra species variation but do show sufficient inter species variation to be able to

distinguish between two closely related species. Additionally it is valuable if there are multiple copies of the DNA and that it will withstand environmental insult. For these reasons the DNA regions used in species testing, and taxonomy, are on the mitochondrial genome.

The DNA test used in species identification examines a gene sequence that meets the criteria for species testing. The test used in this case is designed to detect the presence of DNA sequences specific to either *C. fiber* or *C. canadensis* that are found on the cytochrome b gene of the mammalian genome. Based upon previous scientific studies, there are a series of DNA bases on the cytochrome b gene that are specific to *C. fiber* and no other mammal. Equally there are a series of DNA bases on this same gene that appear to be specific to *C. canadensis*. The identification of a species is based upon the presence of these DNA bases.

Examination & Results

A buccal swab was used to generate a DNA profile. This DNA profile was that expected if the source of the DNA was from *C. fiber*. There is no indication that the DNA came from *C. canadensis*.

The other items were not examined.

Conclusion

Based upon the sample provided and the test conducted, in our opinion the buccal swab sample provided by PC Ogilvie came from a European beaver (*Castor fiber*).

Signed	
Name	Adrian Mathew Thornton Linacre
Qualifications	BSc, DPhil, RFP
Employment	Senior Lecturer in Forensic Science, University of Strathclyde

Signed	
Name	Shanan Tobe
Qualifications	BSc, MSc in Forensic Science
Employment	Research Staff, Centre for Forensic Science, University of Strathclyde
Date	15th June 2007