

Appendix 1: A Timeline of Some of the Species Identification Tests Available

Table A1.1: A list of many of the papers (Pap) published on the identification of species arranged by the year of publication. The reference, technique, number and name of species identified, target genes and if the primer sets are custom made or based on previous work are shown. Primers based on previous work are listed as they are referenced in the given paper.

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[1]	1983	Crystallization of Hb	Archaeological samples	N/A	N/A
[2]	1986	Hybridisation	14 (buffalo, bushbuck, waterbuck, eland, oryx, kongoni, wildebeest, topi, impala, Grant's gazelle, Thomson's gazelle, cattle, goat and sheep)	Thermostable muscle antigens	Custom antisera
[3]	1987	Hybridisation	18 (buffalo, bushbuck, waterbuck, eland, oryx, kongoni, wildebeest, topi, impala, Grant's gazelle, Thomson's gazelle, cattle, goat, sheep, camel, horse, pig and warthog)	Thermostable muscle antigens	Custom antisera
[4]	1988	Microscopy	19 (horse, deer, badger, squirrel, rabbit, llama group, dog, muskrat, fox, beaver, cat, chinchilla, mink, angora, cattle, goat, sheep, camel and cashmere)	Hair morphology	N/A
[5]	1989	Sequencing	110 (different species of animals)	12S rRNA, cyt <i>b</i> , control region	Custom
[6]	1990	Hybridisation	5 (chicken, sheep, goat, pig and cow)	nDNA	N/A
[7]	1990	RAPD	37 (24 strains of <i>Staphylococcus</i> , 11 strains of <i>Streptococcus pyogenes</i> and 3 varieties of <i>Oryza sativa</i>)	Total DNA	Custom
[8]	1991	PCR-RFLP, Sequencing	North American Ursids (phylogeny)	cyt <i>b</i>	[5, 9]
[10]	1991	Sequencing	16 (cow, sheep, pronghorn antelope, giraffe, fallow deer, black-tailed deer, Malay chevrotain, dromedary camel, pig, collared peccary, Grévy's zebra, long-beaked dolphin, black rhinoceros, elephant, narrow-snout dolphin and goat)	tRNA-Glu, cyt <i>b</i> , tRNA-Thr	[5], credit directly to S. Pääbo and custom
[11]	1992	Sequencing	Exact number not given (samples include: cow, pig, sheep, chicken, turkey, cod, salmon, mackerel, herring and other lab samples)	cyt <i>b</i>	[5]
[12]	1993	PCR-RFLP	2 (cow and buffalo)	nDNA	[13]
[14]	1994	HPLC	13 (human, pig, cow, cat, horse, hare, wolf, dog, fox, elk, fallow deer, reindeer and roe deer)	N/A	N/A

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[15]	1994	PCR-RFLP	2 (sheep and goat)	nDNA	[16]
[17]	1994	RAPD	9 (cow, goat, pig, dog, rat, rabbit, chicken, duck and human)	mtDNA	Custom
[18]	1994	Sequencing, PCR-RFLP	13 (cow, sheep, goat, serow, sika deer, pig, horse, rabbit, chicken, quail, tree-sparrow, dusky thrush and European thrush)	cyt <i>b</i>	Custom
[19]	1995	PCR-RFLP	18 (moose, springbok, roe deer, red deer, blesbok, kangaroo, reindeer, chamois, kudu, pig, cow, wild boar, buffalo, sheep, goat, horse, chicken and turkey)	cyt <i>b</i> , GH	[5, 10, 20-22]
[23]	1995	Sequencing	Cats and other carnivore species	12S rRNA, cyt <i>b</i>	Custom
[24]	1995	Size difference, Sequencing	5 (human, monkey, cat, dog and hamster)	nDNA	[25]
[26]	1996	RADP	8 (barramundi, Nile perch, john dory, mirror dory, silver dory, spikey oreo, warty oreo and smooth oreo)	nDNA	Custom
[27]	1997	PCR-RFLP	5 (San Joaquin kit fox, red fox, gray fox, coyote and dog)	cyt <i>b</i>	[5] and custom
[28]	1997	PCR-RFLP, Sequencing	9 (human, chimpanzee, gibbon, baboon, Japanese monkey, crab-eating monkey, rhesus monkey, green monkey, tufted capuchin monkey)	nDNA	[29]
[30]	1997	RAPD	1 (<i>Balaenoptera acutorostrata</i>)	nDNA	Custom
[31]	1997	RAPD, STRs	2 (Asiatic lions and Indian tigers)	nDNA	Operon Technologies and [32]
[33]	1997	Sequencing	54 (52 dog species and 2 wolf species)	HVI	Custom
[34]	1998	PCR-RFLP	Red deer	cyt <i>b</i>	Custom
[35]	1998	PCR-RFLP	Protocol for all species	cyt <i>b</i>	[5]
[36]	1998	PCR-RFLP	10 (cow, pig, wild boar, sheep, dog, cat, hare, rabbit, chicken and turkey)	cyt <i>b</i>	Custom
[37]	1998	PCR-RFLP	Red deer	tRNA-Glu, cyt <i>b</i>	[5] and custom
[38]	1998	RAPD	30 animal speices	nDNA	[39]
[40]	1998	RAPD	17 (cow, horse (six breeds), mule, donkey, buffalo, elk, reindeer, pig, sheep, goat, kangaroo and ostrich)	nDNA	[30]

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[41]	1998	Species-specific primers	Cow	tRNA-Lys, ATP8, ATP6	Custom
[42]	1998	Species-specific satellite DNA probes	6 (chicken, turkey, horse, cow, sheep and pig)	nDNA	[15, 16, 43-48]
[49]	1998	Species-specific size differences	4 (horse, sheep, chicken, cow)	nDNA	Univ. of Nottingham
[50]	1999	PCR-RFLP	25 (alpine ibex, blesbok, buffalo, fallow buck, moose, chamois, gnu, hare, kangaroo, kudu, mouflon, nyala, sable antelope, roe deer, Chinese roe deer, Siberian roe deer, reindeer, cattle, red deer, sheep, pig, sika deer, springbok, wild boar and goat)	tRNA-Glu, cyt <i>b</i>	[37]
[51]	1999	RAPD	15 (human, rhesus monkey, langur, cow, buffalo, camel, sheep, rhino, goat, rat, mouse, alligator, bird, catfish and rabbit)	nDNA	[12, 52] and custom
[53]	1999	Sequencing	Musk deer phylogeny	cyt <i>b</i>	[10] and custom
[54]	1999	Sequencing	Frogs	12S rRNA, D-loop, COI, cyt <i>b</i>	[5, 55] and custom
[56]	1999	Sequencing	Casework samples of dog hairs	HVI	[33] and custom
[57]	1999	Sequencing	2 (<i>Cervus nippon</i> and <i>C. elaphus</i>)	cyt <i>b</i> , control region	Modified and unmodified [5, 10]
[58]	1999	Sequencing, human specific primers	5 (human, pig, chicken, horse and cow)	cyt <i>b</i> , D-loop	[5, 59]
[60]	1999	Species-specific primers	6 (goat, chicken, cow, sheep, pig and horse)	cyt <i>b</i>	Custom
[61]	1999	Specific primers	3 (cow, buffalo and yak)	nDNA	Custom
[62]	2000	PCR-RFLP	22 (cow, buffalo, pig, sheep, goat, red deer, horse, red kangaroo, rabbit, chicken, duck, emu, turkey, human, cat, dog, crocodile, barramundi, John Dory, Nile perch, salmon and tuna)	cyt <i>b</i>	[63, 64]
[65]	2000	PCR-RFLP	4 (lynx, bobcat, cougar and cat)	D-loop, 16S rRNA	[5, 8, 66]

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[67]	2000	RAPD	Pig	nDNA	[68]
[69]	2000	Sequencing	28 (snake species)	cyt <i>b</i>	[5] and unpublished by R. Lawson
[70]	2000	Sequencing	3 (cow, tiger and lion)	12S rRNA	[5]
[71]	2000	Sequencing	44 (different species)	cyt <i>b</i>	[11]
[72]	2000	Species-specific primers	Cow	tRNA-Lys, ATP8, ATP6	[41]
[73]	2001	ELISA, PCR, species-specific primers	2 (pig and cow)	Antigens, tRNA-Glu, cyt <i>b</i>	[50, 60]
[74]	2001	QPCR	Pig	nDNA	[50] and custom
[75]	2001	Sequencing	27 bat species	ND1	A. Janke Per. Com.
[76]	2001	Sequencing	10 (<i>Calliphora albifrontalis</i> , <i>C. augur</i> , <i>C. dubia</i> , <i>C. hilli hilli</i> , <i>C. maritime</i> , <i>C. stygia</i> , <i>C. vicina</i> , <i>Chrysomya rufifacies</i> , <i>Ch. Varipes</i> and <i>Onesia tibialis</i>)	COI, COII	[77-79]
[80]	2001	Sequencing	19 (Formosan: (gem faced civets, muntjacs, sika deer, sambars, serows, pangolins and macaque), leopard cats, tigers, clouded leopards, lion, water buffalo, cat, dog, sheep, cow, mouse, pig and human)	cyt <i>b</i>	[5, 10]
[81]	2001	Sequencing	27 (26 European bat species and 1 other bat species)	ND1	Custom
[82]	2001	Species-specific primers	2 (cow and water buffalo)	cyt <i>b</i>	Custom
[83]	2001	Species-specific primers	Pig	nDNA	Custom
[84]	2001	Species-specific primers	4 (cow, chicken, pig and sheep)	Not stated (NADH, tRNA-Lys, COII)	[41] and custom
[85]	2002	Microscopy	Human	Computer recognition of hair patterns	N/A

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[86]	2002	PCR-RFLP	9 (<i>Bos taurus</i> , <i>B. indicus</i> , <i>B. javanicus</i> , <i>B. gaurus</i> , <i>B. grunniens</i> , <i>Bison bison</i> , <i>Bi. bonasus</i> , <i>Bubalus bubalis</i> and <i>Syncerus caffer</i>)	Total DNA	Custom
[87]	2002	RAPD	3 (cow, sheep and goat)	nDNA	Custom
[88]	2002	Sequencing	Giant panda	D-loop	Custom
[89]	2002	Sequencing	3 (<i>Beryx splendens</i> , <i>B. mollis</i> and <i>B. decadactylus</i>)	16S rRNA	[55] and custom
[90]	2002	Sequencing	30 (mammalian species common to the UK)	cyt <i>b</i>	Custom
[91]	2002	Species-specific primers	Goose	cyt <i>b</i>	Custom
[92]	2003	Nested PCR, sequencing	5 (<i>Rhinoceros unicornis</i> , <i>R. sondaicus</i> , <i>Dicerorhinus sumatrensis</i> , <i>Ceratotherium simum</i> and <i>Diceros bicornis</i>)	cyt <i>b</i>	[5, 10, 80]
[93]	2003	PCR-RFLP	7 (cow, sheep, goat, deer, elk, horse and pig)	Not stated	[41, 84, 94]
[95]	2003	PCR-RFLP	21 species and subspecies of the family <i>Cervidae</i>	nDNA	Custom
[96]	2003	PCR-RFLP	3 (pig, goat and cow)	12S rRNA	Custom
[97]	2003	Semi-nested PCR, sequencing	3 (dog, cat and cow)	cyt <i>b</i> , HVI	[33, 71]
[98]	2003	Sequencing	Dog	Control region	[33, 99] and custom
[100]	2003	Sequencing	Panther	cyt <i>b</i>	[101]
[101]	2003	Sequencing	222 (human and 221 animal species)	cyt <i>b</i>	Custom
[102]	2003	Sequencing, fragment size variations	10 (pig, chicken, horse, cow, cat, dog, sheep, goat, rat and Bengal tiger)	β -Actin, TP53, cyt <i>b</i> , D-loop, 28S rRNA	[58, 103] and custom
[104]	2003	Species-specific primers	Tiger	cyt <i>b</i>	[5] and custom
[105]	2003	Species-specific primers	3 (cow, goat and sheep)	12S rRNA, 16S rRNA	Custom
[106]	2003	Species-specific primers	5 (goose, mule duck, chicken, turkey and pig)	12S rRNA	Custom

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[107]	2003	Species-specific primers, SYBR Green	4 (cow, pig, chicken and ruminants)	undisclosed	Custom
[108]	2004	AFLP, PCR-RFLP	2 (2 cow breeds)	nDNA	[109] and custom
[110]	2004	Microscopy	36 (various mammal species)	Hair morphology	N/A
[111]	2004	PCR, sequencing, species-specific primers	Cow	12S rRNA	Custom
[112]	2004	PCR-RFLP	9 (cow, horse, donkey, pig, sheep, dog, cat, rabbit, chicken and human)	cyt <i>b</i>	[71]
[113]	2004	PCR-RFLP	14 (cow, pig, wild-boar, chicken, turkey, duck, quail, deer, roe-deer, ostrich, rabbit, sheep, goat and horse)	cyt <i>b</i>	[5]
[114]	2004	Real-time PCR, Melt curve analysis	Tiger	cyt <i>b</i>	Custom
[115]	2004	RT-PCR, species-specific primers	5 (pig, cow, sheep, chicken and turkey)	cyt <i>b</i>	Custom
[116]	2004	Sequencing	Red deer phylogeny	cyt <i>b</i>	Custom
[117]	2004	Sequencing	6 (<i>Ophiophagus hannah</i> , <i>Naja naja</i> , <i>Ptyas mucosus</i> , <i>Bungarus multicinctus</i> , <i>Zaocys dhumnades</i> and <i>Python molurus</i>)	cyt <i>b</i>	[5]
[118]	2004	Sequencing	3 (pig, cow and chicken)	cyt <i>b</i>	[71]
[119]	2004	Sequencing	5 (cow, buffalo, sheep, goat and mithun)	12S rRNA	Modified [5]
[120]	2004	Species-specific primers	4 (pig, cow, sheep and goat)	12S rRNA	Custom
[121]	2004	Species-specific primers	4 (ruminant, poultry, fish and pork)	12S rRNA, tRNA-Val, 16S rRNA	Custom
[122]	2004	STR	4 (<i>Panthera leo persica</i> , <i>P. leo leo</i> , <i>P. tigris tigris</i> and <i>P. pardus</i>)	Ple 46 (nDNA)	Custom
[123]	2005	Nested PCR, Sequencing	Dog	Control region	Custom

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[124]	2005	PCR-RFLP	5 (<i>Xiphias gladius</i> , <i>Makaira nigricans</i> , <i>M. indica</i> , <i>Istiophorus platypterus</i> and <i>Tetrapturus audax</i>)	cyt <i>b</i>	Custom
[125]	2005	PCR-RFLP	6 (<i>Membras martinica</i> , <i>Menidia menidia</i> , <i>Chirostoma humboldtianum</i> , <i>C. estor</i> , <i>C. lucius</i> and <i>C. promelas</i>)	16S rRNA	[55]
[126]	2005	Pyrosequencing	11 (human, rabbit, sheep, hare, cow, horse, pig, salmon, turkey, duck and chicken)	12S rRNA	Custom
[127]	2005	RT-PCR	6 (pig, cow, sheep, chicken, ostrich and turkey)	ND5 (ND6 in birds), cyt <i>b</i> , 18S rRNA	Custom
[128]	2005	Sequencing	Peacock	cyt <i>b</i>	[101]
[129]	2005	Sequencing	8 (<i>Calliphora lata</i> , <i>C. vicina</i> , <i>Lucilia cuprina</i> , <i>L. illustris</i> , <i>L. sericata</i> , <i>Chrysomya pinguis</i> , <i>Parasarcophaga crassipalpis</i> and <i>P. similis</i>)	COI	Modified [76]
[130]	2005	Sequencing	69 (vertebrate species)	16S rRNA, COI	[55, 131, 132]
[133]	2005	Species-specific primers	2 (pig and horse)	cyt <i>b</i>	[60]
[134]	2005	TaqMan	Pig	12S rRNA	Custom (but check when get the food chem. One)
[135]	2006	Microscopy	6 (human, cow, pig, sheep, rabbit and rat)	Histology of bone	N/A
[136]	2006	Microscopy	5 (blue wildebeest, impala, jackal, springbok and zebra)	Computer recognition of hair patterns	N/A
[137]	2006	Nested PCR, sequencing	1 (<i>Kachuga tecta</i>)	cyt <i>b</i>	[10] and custom
[138]	2006	PCR-RFLP	9 (<i>Pleuranacanthus sceleratus</i> , <i>Triodon macropterus</i> , <i>Chelonodon patoca</i> , <i>phoeroides pachygaster</i> , <i>Arothron hispidus</i> , <i>A. stellatus</i> , <i>A. manilensis</i> , <i>A. mappa</i> , and <i>A. Nigropunctatus</i>)	16S rRNA	[55]
[139]	2006	PCR-RFLP	2 (buffalo and cow)	cyt <i>b</i> , SSR	[140]
[141]	2006	PCR-RFLP	6 (<i>Cervus elaphus</i> , <i>Dama dama</i> , <i>Capreolus capreolus</i> , <i>Bos taurus</i> , <i>Ovis aries</i> and <i>Capra hircus</i>)	12S rRNA	Custom
[142]	2006	RAPD	Members of the kangaroo superfamily	nDNA	Custom

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[143]	2006	RAPD, Sequencing	3 (garden lizard, house lizard, Olive Ridely turtle)	16S rRNA, nDNA, mtDNA	Amersham Pharmacia Biotech and custom
[144]	2006	RT-PCR, melt-curve analysis	6 (<i>Dasyurus maculatus</i> , <i>D. viverrinus</i> , <i>Sarcophilus harrisii</i> , <i>Felis catus</i> , <i>Canis familiaris</i> and <i>Vulpes vulpes</i>)	tRNA-Phe	Custom
[145]	2006	Semi-nested PCR-RFLP	6 (<i>Lutjanus sanguineus</i> , <i>L. erythropterus</i> , <i>L. argentimaculatus</i> , <i>L. malabarius</i> , <i>Lethrinus leutjanus</i> and <i>Pinjalo pinjalo</i>)	12S rRNA	Custom
[146]	2006	Sequencing	4 (<i>Homo sapiens</i> , <i>Balaenoptera musculus</i> , <i>Canis familiaris</i> and <i>Ovis aries</i>)	12S rRNA, 16S rRNA, Cyt <i>b</i> , ND1, ND2, ND5	Custom
[147]	2006	Sequencing	Casework samples	cyt <i>b</i>	[71]
[148]	2006	Sequencing	Casework sample	cyt <i>b</i> , control region	Custom
[149]	2006	Species-specific primers	Cow	ND1	[84]
[150]	2006	Species-specific primers	Elephant	D-loop, SRY	Custom
[151]	2006	Species-specific STRs	5 (dog, cat, rat, mouse and human)	Amelogenin, UK111, FCA43, RR02, D13Mit	[32], two from industry sources, NCBI and custom
[152]	2006	STR	1 (<i>Puma concolor</i>)	nDNA	Custom
[153]	2007	Mass spectrometry	4 (dog, raccon dog, rabbit and cat)	Hair	N/A
[154]	2007	Microscopy	16 (rat, hare, badger, racoon dog, cat, dog, pig, cow, goat, sheep, deer, horse, water buffalo, bear, nonhuman primates, and human)	Histology of bone	N/A
[155]	2007	Morphology	2 (<i>Lepus capensis</i> and <i>L. victoriae</i>)	Bone Morphology	N/A
[156]	2007	Morphology, nested PCR	3 (squid, Arripidae and Sillaginidae)	Morphology, 16S rRNA , nDNA	Custom

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[157]	2007	Nested PCR, species-specific primers	14 (human, cynomolgus monkey, African green monkey, mouse, rat, Syrian hamster, Chinese hamster, guinea pig, rabbit, dog, cat, cow, pig and chicken)	cyt <i>b</i> , 12S rRNA, 16S rRNA, tRNA-Phe	Custom
[158]	2007	PCR-RFLP	3 (buffalo, cow and sheep)	cyt <i>b</i> , SSR	[140]
[159]	2007	PCR-RFLP	8 (<i>Thunnus thynnus</i> , <i>T. alalunga</i> , <i>T. obesus</i> , <i>T. albacares</i> , <i>Euthynnus pelamis</i> (<i>Katsuwonus pelamis</i>), <i>E. affinis</i> , <i>Auxis thazard</i> and <i>Sarda orientalis</i>)	cyt <i>b</i>	[5] and custom
[160]	2007	PCR-RFLP	5 (<i>Xiphias gladius</i> , <i>Makaira nigricans</i> , <i>M. indica</i> , <i>Istiophorus platypterus</i> and <i>Tetrapturus audax</i>)	cyt <i>b</i>	[124]
[161]	2007	Pyrosequencing	28 (species of mammal)	12S rRNA, 16S rRNA	Custom
[162]	2007	RAPD, sequencing	9 (buffalo, cow, chicken, pig, goat, frog, fish, snake and leopard)	16S rRNA, ND4, nDNA	[49, 54, 163, 164]
[165]	2007	Real-time PCR, species-specific primers	5 (cow, sheep, pig, chicken and turkey)	cyt <i>b</i>	Modified and unmodified [115]
[166]	2007	RT-PCR	Cow and mammal	12S rRNA	Custom
[167]	2007	RT-PCR	Goat and mammal	12S rRNA	Custom
[168]	2007	RT-PCR	Canine	nDNA	Custom
[169]	2007	Sequence, SNPs	Dog species	Control region	Custom
[170]	2007	Sequencing	47 species (in the genera <i>Cladotanytarsus</i> , <i>Micropsectra</i> , <i>Parapsectra</i> , <i>Paratanytarsus</i> , <i>Rheotanytarsus</i> , <i>Tanytarsus</i> and <i>Virgatanytarsus</i>)	COI	[171] as cited by [170]
[172]	2007	Sequencing	18 (human, cow, horse, sheep, pig, dog, mouse, chicken, ostrich, turkey, lizard, bullfrog, medaka, salmon, puffer fish, carp, sea squirt and sea cucumber)	12S rRNA, 16S rRNA	Custom
[173]	2007	Sequencing	41 (species of bat)	ND1	[81]
[174]	2007	Sequencing, CHD	4 (horse, roe deer, cow and pheasant)	cyt <i>b</i> , CHD	[175, 176]
[177]	2007	Sequencing, species-specific PCR	5 (human, cow, pig, dog and cat)	16S rRNA	Custom

Pap	Year	Technique	Number of Species and Names	Target Gene(s)	Primers from
[178]	2007	Sequencing, STR	Clouded leopard phylogeny	ATP8, cyt <i>b</i> , control region, nDNA	[179, 180] and modified [181]
[182]	2007	SNPs	5 (<i>Thunnus alalunga</i> , <i>T. albacares</i> , <i>T. obesus</i> , <i>T. thynnus</i> and <i>Katsuwonus pelamis</i>)	cyt <i>b</i>	Custom
[183]	2007	SNPs	3 (human, dog and cat)	cyt <i>b</i>	Custom
[184]	2007	Species and genus-specific primers	2 (muscovy duck and duck species)	12S rRNA	[106] and custom
[185]	2007	Species-specific primers	3 (cow, sheep and goat)	12S rRNA	Custom
[186]	2007	Species-specific primers	3 (<i>Rupicapra rupicapra</i> , <i>Capra pyrenaica</i> and <i>Ovis ammon</i>)	D-loop	Custom
[187]	2007	Species-specific primers	3 (<i>Cervus elaphus</i> , <i>Dama dama</i> and <i>Capreolus capreolus</i>)	12S rRNA	Custom
[188]	2007	Species-specific primers	2 (red deer and human)	cyt <i>b</i>	Modified [80] and custom
[189]	2007	Species-specific primers	2 (<i>Placopecten magellanicus</i> , <i>Chlamys islandica</i>)	COI	Custom
[184]	2007	Species-specific primers	4 (Mallard duck, Muscovy duck, Mule duck, Common Teal)	12S rRNA	[106]
[190]	2007	Species-specific primers	Pig	12S rRNA	[106]
[191]	2007	Species-specific primers	3 (horse, donkey and pig)	mtDNA	Custom

Appendix 1 References

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