

REFERENCES

- Adamson, J. S. 1954. Ecology of rabies in southern Rhodesia. *Bulletin of the World Health Organisation* **10**: 753-759.
- Aghomo, H.O. and Rupprecht, C.E. 1990. Further studies on rabies virus isolated from healthy dogs in Nigeria. *Veterinary Microbiology* **22**: 17-22.
- Alexander, K.A., Smith, J.S., Macharia, M.J. and King, A.A. 1993. Rabies in the Masai Mara, Kenya: preliminary report. *Onderstepoort Journal of Veterinary Research* **60**: 411-414.
- Alexander, D.J. and Brown, I.H. 2000. Recent zoonoses caused by Influenza A viruses. *Rev. Sci. Tech.* **19**(1): 197-225.
- Amengual, B., Whitby, J.E., King, A., Cobo, S, J. and Bourhy, H. 1997. Evolution of European bat lyssaviruses. *Journal of General Virology* **78**: 2319-2328.
- Anilionis, A., Wunner, W.H. and Curtis, P.J. 1981. Structure of the glycoprotein gene in rabies virus. *Nature* **294** (5838): 275-278.
- Anon., 1973. Department of Animal Health Annual Report 1973, Republic of Botswana.
- Artois, M., Masson, E., Barrat, J. and Aubert, M.F.A. 1993. Efficacy of three oral rabies vaccine-baits in the red fox: a comparison. *Veterinary Microbiology* **38**: 167-72.
- Artois, M., Cliquet, F., Barrat, J. and Schumacher, C.L. 1997. Effectiveness of SAG-1 oral vaccine for the long-term protection of red foxes (*Vulpes vulpes*) against rabies. *Veterinary Record* **140**: 57-9.
- Aubert, M.F.A., Masson, E., Artois, M. and Barrat, J. 1994. Oral wildlife rabies vaccination field trials in Europe, with recent emphasis on France. In: *Lyssaviruses* (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H.) Springer-Verlag, Berlin. pp 219-243.
- Baer, G.M. 1991. In: *The Natural History of rabies*. 2nd edition. CRC Press. (Eds. Campbell, B. and Charlton, K.M.) New York Academic Press. San Diego.
- Badrane, H., Bahloul, C., Perrin, P. and Tordo, N. 2001. Evidence of Two lyssavirus phylogroups with distinct Pathogenicity and Immunogenicity. *Journal of Virology* **75**: 3268-3276.
- Badrane, H. and Tordo, N. 2001. Host switching in Lyssavirus history from the Chiroptera to the Carnivora orders. *Journal of Virology*. **75**(17): 8096-8104.

- Bingham, J., Perry, B.D., King, A.A., Schumacher, C.L., Aubert, M., Kappeler, A., Foggin, C.M., Hill, F.W.G. and Aubert, A. 1993. Oral rabies vaccination of jackals: progress in Zimbabwe. *Onderstepoort Journal of Veterinary Research* **60**: 477-478.
- Bingham, J. 1999d. The Control of Rabies in Jackals in Zimbabwe. PHD Thesis, University of Zimbabwe, Harare, Zimbabwe.
- Bingham, J., Javangwe, S., Sabeta, C.T., Wandeler, A.I. and Nel, L.H. 2001. Report of isolations of unusual lyssaviruses (rabies and Mokola virus) identified retrospectively from Zimbabwe. *Journal of the South African Veterinary Association* **72**(2): 92-94.
- Bingham J. and Foggin, C.M. 1993. Jackal rabies in Zimbabwe. *Onderstepoort Journal of Veterinary Research* **60**: 365-366.
- Black, E.M., McElhinney, L.M., Lowings, J.P., Smith, J., Johnstone, P. and Heaton, P.R. 2000. Molecular methods to distinguish between classical rabies and the rabies-related European bat *Lyssaviruses*. *Journal of Virological Methods* **87**(1-2): 123-131.
- Blancou, J. 1988. Epizootiology of rabies: Eurasia and Africa, In: *Rabies*. (Eds Campbell, J.B. and Charlton, K.M.) Boston: Kluwer Academic Publishers: pp 243-265.
- Bos, L. 1999. Beijerinck's work on tobacco mosaic virus: historical context and legacy. *Philos Trans R Soc Lond B Biol Sci* **354**(1383): 675-685.
- Bourhy, H., Tordo, N., Lafon, M. and Sureau, P. 1989. Complete cloning and organisation of rabies-related virus, Mokola virus. *Journal of General Virology* **70**: 2063-2074.
- Bourhy, H., Sureau, P. and Tordo, N. 1990. From rabies to rabies-related viruses. *Veterinary Microbiology* **23**(1-4): 115-128.
- Bourhy, H., Kissi, B., Tordo, N., Badrane, H. and Sacramento, D. 1995. Molecular epidemiological tools and phylogenetic analysis of bacteria and viruses with special emphasis on lyssaviruses. *Preventive Veterinary Medicine* **25**: 161-181.
- Bourhy, H., Kissi, B. and Tordo, N. 1993a. Taxonomy and evolutionary studies on *Lyssaviruses* with special reference to Africa. *Onderstepoort Journal of Veterinary Research* **60**: 277-282.
- Bourhy, H., Kissi, B. and Tordo, N. 1993b. Molecular diversity of the *Lyssavirus* genus. *Virology* **194** : 70-81.
- Bourhy, H., Kissi, B., Audry, L., Smreczak, M., Sadkowska-Todys, M., Kulonen, K., Tordo, N., Zmudzinski, J.F. and Holmes, E.C. 1999. Ecology and evolution of rabies virus in Europe. *Journal of General Virology* **80**(10): 2545-2557.

- Bahloul, C., Jacob, Y., Tordo, N. and Perrin, P. 1998. DNA-based immunisation for exploring the enlargement of immunological cross-reactivity against the Lyssaviruses. *Vaccine* **16**(4): 417-425.
- Ballerd, W. and Krausman, P.R. 1997. Occurrence of rabies in wolves in Alaska. *Journal of Wildlife Diseases* **33**(2): 242-245.
- Barnejee, A.K., Rhodes, D.P. and Gill, D.S. 1984. Complete nucleotide sequence of the mRNA coding for the N protein of Vesicular Stomatitis Virus (New Jersey serotype). *Virology* **137**: 432-438.
- Barnejee, A.K. and Barik, S. 1992. Gene expression of Vesicular stomatitis virus genome RNA. *Virology* **183**: 417-428
- Benmansour, A., Brahimi, M., Tuffereau, C., Coulon, P., Lafay, F. and Flamand, A. 1992. Rapid sequence evolution of street rabies glycoprotein is related to the highly heterogeneous nature of the viral population. *Virology* **187**: 33-45.
- Benmansour, A., Paubert, G. Bernard, J. and Kinkelin, D. 1994. The polymerase-associated protein (M1) and the matrix protein (M2) from a virulent and avirulent strain of haemorrhagic septicemia virus (VHSV), a fish rhabdovirus. *Virology* **198**: 602-612.
- Benmansour, A., Leblin, H., Coulon, P., Tuffereau, C., Gaudin, Y., Flamand, A. and Lafay, F. 1991. Antigenicity of rabies virus glycoprotein. *Journal of Virology* **65**(8): 4198-4203.
- Bingham, J., Foggin, C.M., Wandeler, A.I. and Hill, F.W.G. 1999a. The epidemiology of rabies in Zimbabwe. 1. Rabies in dogs (*Canis familiaris*). *Onderstepoort Journal of Veterinary Research* **66**: 1-10.
- Bingham, J., Foggin, C.M., Wandeler, A.I. and Hill, F.W.G. 1999b. The epidemiology of rabies in Zimbabwe. 2. Rabies in jackals (*Canis adustus* and *Canis mesomelas*). *Onderstepoort Journal of Veterinary Research* **66**: 11-23.
- Bingham, J., Schumacher, C.L., Hill, F.W.G. and Aubert, A. 1999c. Efficacy of SAG-2 oral rabies vaccine in two species of jackal (*Canis adustus* and *Canis mesomelas*). *Vaccine* **17**: 551-558.
- Bingham, J. and Foggin, C.M. 1993. Jackal rabies in Zimbabwe. *Onderstepoort Journal of Veterinary Research* **60**: 365-366.
- Bingham, J., Foggin, C.M., Gerber, H., Hill, F.W.G., Kappeler, A., King, A.A., Perry, B.D. and Wandeler, A.I. 1992. Pathogenicity of SAD rabies vaccine given orally in chacma baboons (*Papio ursinus*). *Veterinary Record* **131**: 55-56.

- Bourhy, H., Kissi, B., Lafon, B., Sacramento, D. and Tordo, N. 1992. Antigenic and molecular characterisation of bat rabies virus in Europe. *Journal of Clinical Microbiology* **30**: 2419-2426.
- Brooks, R. 1990. Survey of the dog population and its level of rabies vaccination. *The Veterinary Record* **127**: 592-596.
- Brown, D.W. 1997. Threat to humans from virus infections of non-human primates. *Rev. Med. Vir.* **7**(4): 239-246.
- Brown, A.J. 1994. Methods of evolutionary analysis of viral sequences. In: *Evolutionary Biology of Viruses*. (Eds. Morse, S.S.) Raven Press, Oxford University Press, New York, pp 75-84.
- Brown, F., Dougon, G., Hoey, E.M., Martin, S.J., Rima, B.K. *et al.* 1993. In: *Vaccine*. (Eds James, K. and Morris, A.). John Wiley and Sons, New York. pp 71-87.
- Bruyere, V., Vuillaume, P., Cliquet, F. and Aubert, M. 2000. Oral rabies vaccination of foxes with one or two delayed distributions of SAG-2 baits during the spring. *Vet. Res.* **31**(3): 339-45.
- Bunn, T.O. 1988. Vaccines and vaccination of domestic animals. In: *Rabies*. (Eds Campbell, J.B. and Charlton, K.M.) Boston: Kluwer Academic Publishers: pp 323-333.
- Butler, J.R.A. 1998. The ecology of domestic dogs *Canis familiaris* in the communal lands of Zimbabwe. PHD thesis, University of Zimbabwe, Harare, Zimbabwe.
- Butler, J.R. and Bingham, J. 2000. Demography and dog-human relationships of the dog population in Zimbabwean communal lands. *Veterinary Record* **147**(16): 442-6.
- Cann, A.J. 1993. In: *Principles of Molecular Virology*, Academic Press, Harcourt Brace and Company Publishers: pp 208-215.
- Cartwright, B. and Brown, F.J. Serological relationships between different strains of vesicular stomatitis virus. 1972. *Journal of General Virology* **16**: 391-398.
- Ceccaldi, P.E., Fayet, J., Conzelman, K.K. and Tsiang, H. 1998. Infection characteristics of rabies virus variants with deletion or insertion in the pseudogene sequences. *Journal of Neurovirology* **4**(1): 115-119.
- Chaparro, F. and Esterhuysen, J.J. 1993. The role of the yellow mongoose (*Cynictis penicillata*) in the epidemiology of rabies in South Africa-preliminary results. *Onderstepoort Journal of Veterinary Research* **60**: 373-377.
- Charlton, K.M. 1988. The pathogenesis of rabies. In: *Rabies*. (Eds. Campbell, J.M. and Charlton, K.M.). Kluwer Academic Publishers, Boston, pp 101-150.

- Chenik, M., Schnell, M., Conzelman, K.K. and Blondel, D. 1998. Mapping the interacting domains between the rabies virus polymerase and phosphoprotein. *Journal of Virology* **72**(5): 1925-1930.
- Childs, J.E., Robinson, L.E., Sadek, R., Madden, A., Miranda, M.E. and Miranda, N.L. 1998. Density estimates of rural dog populations and an assessment of marking methods during a rabies vaccination campaign in the Philippines. *Preventive Veterinary Medicine* **33**: 207-18.
- Clark, K.A., Neill, S.U., Smith, J.S., Wilson, P.J., Whadford, V.W., and McKirahan, G.W. 1994. Epizootic canine rabies transmitted by coyotes in south Texas. *Journal of the American Veterinary and Medical Association* **204**(4): 536-540.
- Chomczynski, P. 1993. A reagent for the single-step simultaneous isolation of RNA, DNA and proteins from cell and tissue samples. *Biotechniques* **15**: 532-537.
- Chommel, B.B. 1993. The modern epidemiological aspects of rabies in the world. *Comp. Immun. Microbiol. Infect. Disease.* **16**(1):11-20.
- Cleaveland, S. and Dye, C. 1995. Maintenance of a microparasite infecting several host species: rabies in Serengeti. *Parasitology* **111**Suppl: S533-S547.
- Cleverly, D.Z. and Lenard, J. 1998. The transmembrane domain in viral fusion: Essential role for a conserved glycine residue in Vesicular Stomatitis Virus. *Proc. Natl. Acad. Sci, U.S.A.* **95**: 3425-3430.
- Coll, J.M. 1995. The glycoprotein G of rhabdoviruses. *Archives of Virology* **140**: 827-851.
- Coleman, P.G. and Dye, C. 1996. Immunisation coverage required to prevent outbreaks of dog rabies. *Vaccine* **14**: 185-185.
- Crawford-Mikza, L.K., Wadford, D.A. and Schurr, D.P. 1999. Molecular epidemiology of enzootic rabies in California. *Journal of Clinical Virology* **14**(3): 207-219.
- Central Veterinary Records (CVL) records, 2001. Harare, Zimbabwe.
- Cumming, D.H.M. 1982. A case history of the spread of rabies in an African country. *South African Journal of Science* **78**: 443-447.
- Curtis, A. 1999. Using a spatial filter and geographic information system to improve rabies surveillance data. *Emerging infectious diseases* **5**(5): 603-606.
- David, D., Yakobson, B., Smith, J.S. and Stram, Y. 2000. Molecular epidemiology of rabies virus isolates from Israel and other Middle- and Near-Eastern countries. *Journal of Clinical Microbiology* **38**(2): 755-762.

- De Mattos, C.A., De Mattos, C.C., Smith, J.S., Miller, E.T., Papo, S., Utrera, A. and Osburn, B.I. 1996. Genetic characterization of Rabies field Isolates from Venezuela. *Journal of Clinical Microbiology* **34**(6): 1553-1558.
- Delpietro, H.A., Larghi, O.P. and Russo, R.G. 2001. Virus isolation from saliva and salivary glands of cattle naturally infected with paralytic rabies. *Preventive Veterinary Medicine* **48**: 223-228.
- Desmezieres, E., Jacob, Y., Saron, M., Delpeyroux, F., Tordo, N. and Perrin, P. 1999. *Lyssavirus* glycoprotein expressing immunologically potent foreign B cell and cytotoxic T lymphocyte epitopes as prototypes for multivalent vaccines. *Journal of General Virology* **80**: 2343-2351.
- Dietzschold, B., Morimoto, K., Hooper, D.C., Smith, J.S., Rupprecht, C.E. and Koprowski, H. 2000. Genotypic and Phenotypic Diversity of Rabies Virus Variants involved in human rabies. *Journal of Human Virology* **3**(1): 50-57.
- Dietzschold, B., Rupprecht, C.E., Tollis, M., Mattei, J., Wiktor, T. J. and Koprowski, H. 1988. Antigenic diversity of the glycoprotein and nucleocapsid proteins of rabies and rabies-related viruses: implications for epidemiology and control of rabies. *Rev. Infect. Dis.* **10**: 5785-5798.
- Dietzschold, B., Wang, H., Rupprecht, C.E., Cellis, M., Tollis, H., Herber Katz, E. and Koprowski, H. 1987. Induction of protective immunity against rabies by immunization with rabies virus ribonucleoprotein. *Proc. Natl. Acad. Sci. U.S.A.*, **89**: 9165-9169.
- Dietzschold, B., Wunner, W.H., Wiktor, T.J., Lopes, A.D. *et al.* 1983. Characterisation of an antigenic determinant that correlates with pathogenicity. *Proceedings of the National Academy of Sciences, U.S.A.* **80**: 70-74.
- Domingo, E. and Holland, J.J. 1994. Mutation rates and rapid evolution of RNA viruses. In: *The Evolutionary Biology of Viruses*, (Eds Morse, S.S.). New York, Raven Press: pp 161-184.
- Domingo, E. and Holland, J.J. 1997. RNA virus mutations and fitness for survival. *Annual Review of Microbiology*. **51**: 151-175.
- Dopazo, J. 1994. Estimating errors and confidence intervals for branch lengths in Phylogenetic trees by a Bootstrap Approach. *Journal of Molecular Evolution* **38**(3):301-302.
- Drake, J.W. 1993. Rates of spontaneous mutations among RNA viruses. *Proceedings of the National Academy of Sciences, USA* **90**: 4171-4175.
- Drings, A., Jallet, C., Chambert, B., Tordo, N. and Perrin, P. 1999. Is there an advantage including the nucleoprotein in a rabies glycoprotein subunit vaccine? *Vaccine* **17**: 549-557.

- Edmonds, C.R. 1922. Diseases of animals in South Africa. Balliere, Tindall and Cox, London.
- Ermine, A., Larzui, D., Ceccaldi, P.E., Guesdon, J.L. and Tsiang, H. 1990. Polymerase chain amplification of rabies virus nucleic acids from total mouse brain RNA. *Molecular and Cellular Probes* **4**:189-191.
- Ertl, H.C.J., Dietzschold, B., Gore, M., Otros, L., Larson, J.K.; Wunner, H. and Koprowski, H. 1989. Induction of rabies virus-specific T-helper cells by synthetic peptides that carry dominant T-helper cell epitopes of the viral ribonucleoprotein. *Journal of Virology* **63**: 2885-2892.
- Familusi, J.B. and Moore, D.L. 1972. Isolation of a rabies-related virus from the cerebrospinal fluid. *African Journal of Medical Sciences* **3**: 93-96.
- Fekadu, M., Endeshaw, T., Alemu, W., Bogale., Teshager, T. and Olson, J.G. 1996a. Possible human-to-human transmission of rabies in Ethiopia. *Ethiopian Medical Journal* **34**(2): 123-127.
- Fekadu, M., Nesby, S.L., Shaddock, J.H., Schumacher, C.L., Linhart, S.B. and Sanderlin, D.W. 1996b. Immunogenicity, efficacy and safety of an oral rabies vaccine (SAG-2) in dogs. *Vaccine* **14**: 465-68.
- Fekadu, M., Shaddock, J.H., Sumner, J.W., Sanderlin, D.W., Knight, J.C., Esposito, J.J. and Baer, G.M. 1991. Oral vaccination of skunks with raccoon poxvirus recombinants expressing the rabies glycoprotein or the nucleoprotein. *Journal of Wildlife Diseases* **27**: 681-684.
- Fekadu, M., Shaddock, J.H., Sanderlin, D.W. and Smith, J.S. 1988. Efficacy of rabies vaccines against Duvenhage virus isolated from European house bats (*Eptesicus serotinus*), classic rabies and rabies-related viruses. *Vaccine* **6**(6): 533-539.
- Felsenstein, J. 1988. Evolutionary trees from DNA sequences: A maximum likelihood approach. *J. Mol. Evol.* **17**: 368-376.
- Felsenstein, J. 1981. Evolutionary trees from DNA sequences: a maximum likelihood approach. *Journal of Molecular Evolution* **17**: 368-376.
- Felsenstein, J. 1985. Confidence limits on phylogenies: an approach using the bootstrap. *Evolution* **39**:783-791.
- Felsenstein, J. 1989. Phylogenetic Inference Package (Phylip). *Cladistics* **5**: 164-166.
- Felsenstein, J. 1993. Phylip (Phylogeny Inference Package). Version 3.5c Department of Genetics, University of Washington, Seattle, W.A. U.S.A.

- Fitch, W.M. and Margoliash, E. 1967. Construction of phylogenetic trees. *Science* **155**: 279-284.
- Fitch, W.M. 1995. Use of evolutionary trees. *Phil. Trans. R. Soc. Lond.* **349**: 93-102.
- Fodor, I., Grabko, V.I., Khozinski, V.V. and Selimov, M.A. 1994. Nucleotide and deduced amino acid sequences of the glycoprotein gene of rabies virus vaccine strain Vnukovo-32. *Arch. Virol.* **135**: 451-459.
- Foggin, C.M. 1988. Rabies and rabies-related viruses in Zimbabwe: Historical, virological and ecological aspects. PHD thesis, University of Zimbabwe.
- Foggin, C.M. 1982. Atypical rabies virus in cats and a dog in Zimbabwe. *Veterinary Record* **110**: 338.
- Foggin, C.M. 1983. Mokola virus infection in cats and a dog in Zimbabwe. *Veterinary Record* **113**: 115.
- Fu, Z.F., Wunner, W.H. and Dietzschold, B. 1994. Immunoprotection by rabies virus nucleoprotein. In: *Lyssaviruses* (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H). Springer-Verlag, Berlin. pp 161-172.
- Fu, Z.F., Zheng, Y., Wunner, W.H., Koprowski, H. and Dietzschold, B. 1994. Both the N- and the C- terminal domains of the nominal phosphoprotein of rabies virus are involved in binding to the nucleoprotein. *Virology* **200**(2): 590-597.
- Fu, Z.F., Rupprecht, C.E., Dietzschold, B., Saikumar, P., Niu, H.S. *et al.* 1993. Oral vaccination of racoons (*Procyon lotor*) with baculovirus-expressed rabies virus glycoprotein. *Vaccine* **11**(9): 925-928.
- Fu, Z.F., Dietzschold, B., Schumacher, C.L., Wunner, W.H. and Koprowski, H. 1991. Rabies virus nucleoprotein expressed in and purified from insect cells is as efficacious as a vaccine. *Proc. Natl. Acad. Sci. U.S.A.* **88**(1): 2001-2005.
- Gascoyne, S.C., King, A.A., Laurenson, M.K., Borner, M., Schildger, B. and Barrat, J. 1993. Aspects of rabies infection and control in the conservation of the African wild dog (*Lycaon pictus*) in the Serengeti region, Tanzania. *Onderstepoort Journal of Veterinary Research* **60**: 415-420.
- Gaudin, Y., Ruigrok, R.W., Tuffereau, C., Knossow, M. and Flamand, A. 1992. Rabies virus glycoprotein is a trimer. *Journal of Virology* **187**: 627-632.
- Gaudin, Y., Tuffereau, C., Segretain, D., Knossow, M. and Flamand, A. 1991. Reversible conformational changes and fusion activity of rabies virus glycoprotein. *Journal of Virology* **65**(9): 4853-4859.

- Gaudin, Y., Tuffereau, C., Durrer, P., Brunner, J., Flamand, A. and Ruigrok, R. 1999. Rabies virus-induced membrane fusion. *Molecular Membrane Biology* **16**: 21-31.
- Gaudin, Y., Ruigrok, R.W.H., Knossow, M. and Flamand, A. 1993. Low-pH conformational changes of rabies virus glycoprotein and their role in membrane fusion. *Journal of Virology* **67**: 1365-1372.
- Gaudin, Y. 2000a. Rabies Virus-induced Fusion pathway. *The Journal of Cell Biology* **150**(3): 601-611.
- Gaudin, Y. 2000b. Reversibility in Fusion Protein Conformational Changes The Intriguing Case of Rhabdovirus-induced Membrane Fusion. In: *Subcellular Biochemistry, Fusion of Membranes and Related problems* **34**: 379-408.
- Gode, G.L. and Bhide, N.K. 1988. Two rabies deaths after corneal grafts from one donor. *The Lancet* **2**: 791.
- Gould, A.R., Hyatt, A. D., Lunt, R., Kattenbelt, J.A., Hengsberger, S. and Blacksell, S.D. 1998. Characterisation of a novel *lyssavirus* isolated from Pteropid bats in Australia. *Virus Research* **54**: 165-187.
- Greenwood, R.J., Newton, W.E., Pearson, G.L. and Schamber, G.J. 1997. Population and movement characteristics of radio-collared and striped skunks in North Dakota during an epizootic of rabies. *Journal of Wildlife Diseases* **33**(2): 226-241.
- Gupta, A.K., Blondel, D., Choudhary, S. and Banerjee, A.K. 2000. The phosphoprotein of rabies virus is phosphorylated by a unique cellular kinase and specific isomers of protein kinase C. *Journal of Virology* **74**(1): 91-8.
- Hanlon, C.A., Niezgod, M., Hamir, A. N., Schumacher, C., Koprowski, H. and Rupprecht, C.E. 1998. First North American Release of a Vaccinia-Rabies Glycoprotein Recombinant Virus. *Journal of Wildlife Diseases* **34**(2): 228-239.
- Hanna, J.N., Cerney, J.K., Smith, G.A., Tannenberg, E.G. *et al.*, 2000. Australian bat lyssavirus infection: a second human case with a long incubation period. *The Medical Journal of Australia* **172**(12): 597-599.
- Haupt, W. 1999. Rabies – risk of exposure and current trends in prevention of human cases. *Vaccine* **17**: 1742-1749
- Heaton, P.R., Johnstone, P., McElhinney, L.M. Cowley, R., O’Sullivan, E. and Whitby, J.E. 1997. Heminested PCR assay for detection of six genotypes of Rabies and rabies-related viruses. *Journal of Clinical Microbiology* **35**(11): 2762-2766.
- Higgins, D.G. and Sharp, P.M. 1988. CLUSTAL: a package for performing sequence alignment on a microcomputer. *Gene* **73**: 237-244.

- Hills, D.M. and Bull, J.J. 1993. An empirical test of bootstrapping as a method for assessing confidence in phylogenetic analysis. *Syst. Biol.* **42**: 182-192.
- Hoett, S.A. 1979. Human to human transmission of rabies virus by corneal transplant. *The New England Journal of Medicine* **300**: 603-604.
- Hoening, L.J. 1986. Triumph and controversy. Pasteur's preventive treatment of rabies as reported in *JAMA* **43**: 397-9.
- Holland, J.J., Torre, D. and Steinhauer, D.A. 1992. RNA virus populations as quasi-species. *Current Topics In Microbiology and Immunology* **176**: 1-21.
- Holland, J., Spindler, K., Horodyski, F., Grabau, E. and Nichol, S. 1982. Rapid evolution of RNA genomes. *Science* **215**: 1577-1585.
- Izeni, F., Barge, A., Baudin, F., Blondel, D. and Ruigrok, R.B.W. 1998. Characterisation of rabies virus nucleocapsids and recombinant nucleocapsid-like structures. *Journal of General Virology* **79**: 2909-2919.
- Ito, M., Arai, Y.T., Itou, T., Sakai, T. *et al.* 2001a. Genetic characterisation and geographic distribution of rabies virus isolates in Brazil: Identification of two reservoirs, Dogs and Vampire bats. *Virology* **284**: 214-222.
- Ito, N., Takayama, M., Yamada, K., Sugiyama, M. and Minamoto, N. 2001b. Rescue of Rabies virus from cloned cDNA and Identification of the Pathogenic-Related Gene: Glycoprotein gene is associated with virulence for adult mice. *Journal of Virology* **75**(19): 9121-9128.
- Jacob, Y., Badrane, H., Ceccaldi, P. and Tordo, N. 2000. Cytoplasmic dynein LC8 interacts with *Lyssavirus* phosphoprotein. *Journal of Virology* **74**(21): 10217-10222.
- Jacobs, J.A. 1997. Genetic analysis of rabies-related viruses in southern Africa, with emphasis on virus isolates associated with atypical infection patterns MSc thesis. University of Pretoria, Pretoria, South Africa.
- Jackson, A.C. 2000. Rabies. *The Canadian Journal of Neurological Sciences* **27**: 278-283.
- Jackson, A.C. 1997. In: *Viral Pathogenesis* (Eds. Nathanson, A., Ahmed, R., Gozalez-Scarano, F.) Philadelphia. Lippincott-Raven Press. pp 575-591.
- Jacob, Y., Real, E. and Tordo, N. 2000. Functional interaction map of lyssavirus phosphoprotein: identification of the minimal transcription domains. *Journal of Virology* **75**(20): 9613-9622.

- Jaftha, J.B. 1997. Molecular genetic analysis of some enzootic rabies viruses of southern Africa. MSc thesis, University of Pretoria, Pretoria, South Africa.
- Jallet, C., Jacob, Y., Bahloul, C., Drings, A., Desmezieres, E., Tordo, N. and Perrin, P. 1999. Chimeric Lyssavirus glycoproteins with increased Immunological potential. *Journal of Virology* **73**(1): 225-233.
- Joshi, D.D. and Bogel, K. 1988. Role of Lesser Developed Nations in Rabies Research. *Reviews of Infectious Diseases* Supplement **10**: S600-S603.
- Kalmovarin, N., Tirawatnpang, T., Rattanasiwamoko, R., Tirawatnpang, S. Panpanich, T., Hemachudha, T. 1993. Diagnosis of rabies by polymerase chain reaction with nested primers. *Journal of Infectious Diseases* **167**: 207-210.
- Kapsa, R., Siregar, N., Quigley, A., Ojaimi, J., Katsabanis, S., Sue, C. and Bryne, E. 1997. The polymerase chain reaction in the study of mitochondrial genetics. *J. Biochem. Biophys. Methods*. **36**: 31-50.
- Kat, P.W., Alexander, K.A., Smith, J.S. and Munson, L. 1995. Rabies and African wild dogs in Kenya. *Proceedings of the Royal Society of London* **262**: 229-233.
- Kawai, A. and Morimoto, K. 1994. Functional aspects of lyssavirus proteins. In: *Lyssaviruses* (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H.) Springer-Verlag, Berlin. pp 27-41.
- Kemp, G.E., Causey, O.R., Moore, D.L., Odelola, A. and Fabiyi, A. 1972. Mokola virus. Further studies on IbAn 27377, a new rabies-related etiologic agent of zoonosis in Nigeria. *American Journal of Tropical Medicine and Hygiene* **21**: 356-359.
- Kennedy, D.J. 1988. An outbreak of rabies in north-western Zimbabwe 1980 to 1983. *Veterinary Record* **122**: 129-133.
- Kihm, U., Flamand, A., Pastoret, P.P. and Peterhans, E. 1992. Round table on epidemiology and control of fox rabies. *Veterinary Microbiology* **33**: 297-301.
- Kimura, M. 1980. A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* **16**: 111-120.
- King, A.A. and Turner, G.S. 1993. Rabies - A review. *Journal of Comparative Pathology* **108**: 1-39.
- King, A.A. and Crick, J. 1988. Rabies-related viruses. In: *Rabies* (Eds. Campbell, J.P. and Charlton, K.M.). Kluwer Academic Press. pp 177-199.

- King, A.A., Meredith, C. D. and Thomson, G.R. 1993. Canid and viverrid viruses in South Africa. *Onderstepoort Journal of Veterinary Research* **60**: 295-299.
- King, A., Davies, P. and Lawrie, A. 1990. The rabies viruses of bats. *Veterinary Microbiology* **23**: 165-174.
- King, A.A., Meredith, C.D. and Thomson, G.R. 1994. The biology of southern African *lyssavirus* variants. In: *Lyssaviruses*. (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H.) Berlin. Springer-Verlag Publishers. pp 267-295.
- Kissi, B., Tordo, N. and Bourhy, H. 1995. Genetic polymorphism in the rabies virus nucleoprotein gene. *Virology* **209**(2): 526-537.
- Kissi, B., Badrane, H., Audry, L., Lavenu, A., Tordo, N., Brahim, M. and Bourhy, H. 1999. Dynamics of rabies virus quasispecies during serial passages in heterologous hosts. *Journal of General Virology* **80**(8): 2041-2050.
- Kitala, P.M., McDermoth, J.J., Kyule, M.N. and Gathuma, J.M. 2000. Community-based active surveillance for rabies in Machakos District, Kenya. *Prev. Vet. Med.* **44**(1-2): 73-85.
- Kouznetzoff, A., Buckle, M. and Tordo, N. 1998. Identification of a region of the rabies virus N protein involved in direct binding of the viral RNA. *Journal of General Virology* **79**: 1005-1013.
- Krebs, J.W., Rupprecht, C.E. and Childs, J.E. 2000a. Rabies surveillance in the United States during 1999. *Journal of the American Veterinary Medical Association* **217**(12): 1799-1811.
- Krebs, J.W., Wilson, M.L. and Childs, J.E. 1995. Rabies epidemiology, prevention and future research. *Journal of Mammalogy* **76**(3): 681-694.
- Krebs, J.W., Smith, J.S., Rupprecht, C.E. and Childs, J.E. 2000b. Mammalian Reservoirs and Epidemiology of Rabies Diagnosed in Human Beings in the United States, 1981-1998. *Tropical Veterinary Diseases of the Annals of the New York Academy of Sciences* **916**: 345-353.
- Lafay, F., Benejean, J., Tuffereau, C., Flamand, A. and Coulon, P. 1994. Vaccination against rabies: construction and characterisation of SAG2, a double avirulent derivative of SAD_{Berne}. *Vaccine* **12**: 317-320.
- Lafon, M. 1994. Immunobiology of lyssaviruses. In: *Lyssaviruses* (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H.) Springer-Verlag, Berlin. pp 145-160.
- Landergreen, U., Kaiser, R., Caskey, C.T. and Hood, L. 1998. DNA diagnostics-Molecular Techniques and automation. *Science* **242**: 229-36.

- Larson, J.K. and Wunner, W.H. 1990. Nucleotide and deduced amino acid sequences of the nominal nonstructural phosphoprotein of the ERA, PM and CVS-II strains of rabies virus. *Nucleic Acids Research* **18**(23): 7172.
- Laurenson, K., Esterhuysen, J., Stander, P. and Heerden, J van. 1997. Aspects of rabies epidemiology in Tsumkwe District, Namibia. *Onderstepoort Journal of Veterinary Research* **64**: 39-45.
- Lawrence, J.A. 1980. The effects of war on the control of diseases of livestock in Rhodesia (Zimbabwe). *Veterinary Record* **107**: 82-85.
- Le Blois, H., Tuffereau, C., Blancou, J., Artois, M., Aubert, A. and Flamand, A. 1990. Oral immunisation of foxes with avirulent rabies virus mutants. *Veterinary Microbiology* **23**:259-266.
- Lecoq, H. 2001. Discovery of the first virus, the tobacco mosaic virus: 1892 or 1898? In *CR Acad Sci III* **324**(10): 929-933.
- Le Gonidec, G., Rickenbach, A., Robin, Y. and Heme, G. 1978. Isolation of a strain of Mokola virus in Cameroon. *Annual Microbiology* **129**(2): 245-9.
- Le Guenno, B. 1997. Haemorrhagic fevers and ecological perturbations. *Arch. Virol.* **13**: 191-199
- Lentz, T.L., Burrage, T.G., Smith, A.L., Crick, J. and Tigner, G.H. 1982. Is the acetylcholine receptor a rabies virus receptor? *Science* **215**: 183-184.
- Levy, J.A., Fraenkel-Conrat, H. and Owens, R. 1994 In: *Virology*. 3rd Edition. (Eds. Brake, D.K. and DeLuca, M.). Prentice-Hall, New Jersey.
- Li, W.H. and Grauer, D. 1991. What is molecular evolution? In: *Fundamentals of Molecular Evolution* (Eds. Li, W.H. and Grauer, D.). Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, pp 1-2.
- Linhart, S.B., King, R., Zamir, S., Naveh, U., Davidson, M. and Perl, S. 1997. Oral rabies vaccination of red foxes and golden jackals in Israel: preliminary bait evaluation. *Rev Sci. Tech.* **16**(3): 874-80.
- Lodmell, D.L. and Ewalt, L.C. 2001. Post-exposure DNA vaccination protects mice against rabies virus. *Vaccine* **19**: 2468-2473.
- Lodmell, D.L., Ray, N.B., Parnell, M.J., Ewalt, L.C., Hanlon, C.A., Shaddock, J.H., Sanderlin, D.S. and Rupprecht, C.E. 1998. DNA immunisation protects nonhuman primates against rabies virus. *Nature Medicine* **4**(8): 949-952.

- Loza-Rubio, E., Aguilar-Setien, A., Bahloul, C., Brochier, B., Pastoret, P.P. and Tordo, N. 1999. Discrimination between Epidemiological Cycles of rabies in Mexico. *Archives of Medical Research* **30**: 144-149.
- Maas, B. 1993. Bat-eared fox behavioural ecology and the incidence of rabies in the Serengeti National Park. *Onderstepoort Journal of Veterinary Research* **60**: 389-393.
- Masson, E., Bruyere-Masson, V., Vuillaume, P., Lemoyne, S. and Aubert, M. 1999. Rabies oral vaccination of foxes during the summer with the VRG vaccine bait. *Vet. Res.* **30**(6): 595-605.
- Masson, E., Cliquert, F., Aubert, M., Barrat, J., Aubert, A., Artois, M. and Schumacher, C.L. 1996. Safety study of the SAG2 rabies virus mutant in several non-target species with a view to its future use for the immunisation of foxes in Europe. *Vaccine* **16**: 1506-1510.
- Matter, H.C., Schumacher, C.L., Kharmachi, H., Hammami, S., Tlatli, A., Jemli, J. *et al.* 1998. Field-evaluation of 2 bait delivery systems for the oral immunization of dogs against rabies in Tunisia. *Vaccine* **16**(7): 657-665.
- Maxam, A.M. and Gilbert, W. 1977. A new method for sequencing DNA. *Proc. Natl. Acad. Sci. U.S.A.* **74**: 560-564.
- McDade, J.E. and Anderson, B.E. 1996. Molecular epidemiology: Applications of nucleic acid amplification and sequence analyses. *Epidemiologic Reviews* **18**(1): 90-7.
- McColl, K.A., Gould, A.R., Selleck, P.W., Hooper, P.T., Westbury, H.A. and Smith, J.S. 1993. Polymerase chain reaction and other laboratory techniques in the diagnosis of long incubation of rabies in Australia. *Aus. Vet. J.* **70**(3): 84-9.
- McColl, K.A., Tordo, N. and Setien, A.A. 2000. Bat *lyssavirus* infections. *Reviews Sci. Tech Off.Int.Epiz.* **19**(1): 177-196.
- Mebatsion, T., Cox, J.H. and Frost, J.W. 1992. Isolation and characterisation of 115 street rabies virus isolates from Ethiopia by using monoclonal antibodies: identification of 2 isolates of Mokola and Lagos Bat viruses. *The Journal of Infectious Diseases* **166**: 972-977.
- Mebatsion, T., Cox, J.H. and Conzelmann, K.K. 1993. Molecular analysis of rabies-related viruses from Ethiopia. *Onderstepoort Journal of Veterinary Research* **60**(4): 289-294.
- Mebatsion, T., Weiland, F. and Conzelmann, K.K. 1999. Matrix protein of rabies virus is responsible for the assembly and budding of bullet-shaped particles and interacts with the transmembrane spike glycoprotein. *Journal of Virology* **73**(1): 242-250.

- Mercier, P.L., Jacob, Y. and Tordo, N. 1997. The complete Mokola virus genome sequence: structure of the RNA-dependent RNA polymerase. *Journal of General Virology* **78**: 1571-1576.
- Meltzer, M.I. and Rupprecht, C.E. 1998a. A review of the economics of the prevention and control of rabies Part 1: Global impact and rabies in humans. *Pharmacoeconomics* **14**(4): 365-383.
- Meltzer, M.I. and Rupprecht, C.E. 1998b. A review of the economics of the prevention and control of rabies Part 2: Rabies in dogs, livestock and Wildlife. *Pharmacoeconomics* **14**(5): 481-498.
- Meredith, C.D., Nel, L.H. and Von Teichman, B.F. 1996. A further isolation of Mokola virus in South Africa. *Veterinary Record* **138**: 119-120.
- Meredith, C.D., Rossouw, A.P. and Van Praag Koch, H. 1971. An unusual case of human rabies thought to be of Chiropteran origin. *South African Medical Journal* **45**: 767-769.
- Meslin, F.X., Fishbean, D. and Matter, H. 1994. Rationale and prospects for rabies elimination in developing countries. In: *Lyssaviruses* (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H.), Berlin, Springer-Verlag). pp 1-26.
- Meslin, F.X. and Kaplan, M.M. 1996. An overview of laboratory techniques in the diagnosis and prevention of rabies and in rabies research. In: *Laboratory techniques in rabies* (Eds. Meslin, F.X., Kaplan, M.M. and Koprowski, H.) World Health Organisation, Geneva.
- Mi, S., Lee, X., Li, X, P., Veldman, G.M., Finnery, H. *et al.* 2000. Syncytin is a captive retroviral envelope protein involved in human placental morphogenesis. *Nature* **403**: 785-789.
- Miyamoto, M. and Cracraft, J. 1991. Phylogenetic Inference, DNA sequence analysis, and the Future of Molecular Systematics. In: *Phylogentic analysis of DNA sequences*. M.M. Miyamoto and J. Cracraft (Editors), Oxford University Press, New York, pp 3-17.
- Montano Hirose, J.A., Bourhy, H. and Lafon, M. 1990. A reduced panel of anti-nucleocapsid monoclonal antibodies for bat rabies identification in Europe. *Research Virology* **141**: 571-581.
- Morimoto, K., Patel, M., Corisdeo, S., Hooper, D.C., Fu, Z.F., Rupprecht, C.E., Koprowski, H. and Dietzschold, B. 1996. Characterisation of a unique variant of bat rabies virus responsible for newly emerging human cases in North America. *Proc. Natl. Acad. Of Sciences, U.S.A.* **93**: 5653-5658.

Morimoto, K., Hooper, D.C., Carbough, H., Fu, Z.F., Koprowski, H. and Dietzschold, B. 1998. Rabies virus quasi-species: implications for pathogenesis. *Proc. Natl. Acad. Sc. U.S.A.* **95**: 3152-3156.

Morimoto, K., Ohkubo, A. and Kawai, A. 1989. Structure and transcription of the glycoprotein gene of attenuated HEP-Flury strain of rabies virus. *Virology* **173**: 465-477.

Mullis, K.B. 1990. The unusual origin of the polymerase chain reaction. *Scientific American* April: 36-43.

Mrak, R. E. and Young, L. 1994. Rabies encephalitis in Humans. *Journal of Neuropathology and Experimental Neurology* **53**(1): 1-10.

Murphy, F.A. 1985. The pathogenesis of rabies infection. In *World's Debt to Louis Pasteur*. Alan R. Liss Inc. pp 153-169.

Murphy, F.A., Fauquet, C.M., Bishop, D.H.L., Ghabriel, S.A. *et al* 1995. In: *Virus Taxonomy: Sixth Report of the International Committee on Taxonomy of viruses*. Springer-Verlag Publishers, New York.

Myrvik, Q.N. and Weiser, R.S. 1988. The impact of microbiology on the health of man. In: *Fundamentals of Medical mycology and bacteriology*. Lea and Febiger, Philadelphia, U.S.A: pp 2-15.

Nadin-Davis, S.A., Casey, G.A. and Wandeler, A. 1993. Identification of regional variants of the rabies virus within the Canadian Province of Ontario. *Journal of General Virology* **74**: 829-837.

Nadin-Davis, S.A., Huang, S.A., Armstrong, J., Casey, G.A., Bahloul, C., Tordo, N. and Wandeler, A.I. 2001. Antigenic and genetic divergence of rabies viruses from bat species indigenous to Canada. *Virus Research* **74**: 139-156.

Nadin-Davis, S.A. 1998. Polymerase chain reaction protocols for rabies virus discrimination. *Journal of Virological Methods* **75**: 1-8.

Nadin-Davis, S.A., Sampath, M.I., Casey, G.A., Tinline, R.R. and Wandeler, A. 1999. Phylogeographic patterns exhibited by Ontario rabies virus variants. *Epidemiol. Infect.* **123**: 325-336.

Nadin-Davis, S.A., Huang, W. and Wandeler, A.I. 1997. Polymorphism of rabies viruses within the phosphoprotein and matrix protein genes. *Archives of Virology* **142**(5): 979-992.

Nadin-Davis, S.A., Huang, W. and Wandeler, A.I. 1996. The design of polymerase chain reactions for discrimination of raccoon rabies virus strains from indigenous rabies viruses of Ontario. *Journal of Virological Methods* **57**: 1-14.

- Nadin-Davis, S.A., Sheen, M., Abdul-Malik, M., Elmgren, L., Armstrong, J. and Wandeler, A.I. 2000. A panel of monoclonal antibodies targeting the phosphoprotein identifies a highly variable epitope of value for sensitive strain discrimination. *Journal of Clinical Microbiology* **38**(4): 1397-1403.
- Nei, M. 1994. Relative efficiencies of different tree-making methods for molecular data. In: *Phylogenetic Analysis of DNA sequences*. (Eds. Miyamoto, M.M. and Cracraft, J.). Oxford University Press, New York, pp 90-128.
- Nel, L.H., Bingham, J., Jacobs, J.A. and Jaftha, J.B. 1998. A nucleotide-specific polymerase chain reaction assay to differentiate rabies virus biotypes in South Africa. *Onderstepoort Journal of Veterinary Research* **65**: 297-303.
- Nel, L., Jacobs, J., Jaftha, J. and Meredith, C. 1997. Natural Spillover Of a Distinctly Canidae-Associated Biotype of rabies virus in an expanded Wildlife host range in southern Africa. *Virus Genes* **15**(1): 79-82.
- Nel, L.H., Thomson, G.R. and von Teichman, B.F. 1993. Molecular epidemiology of rabies virus in South Africa. *Onderstepoort Journal of Veterinary Research* **60**: 301-306.
- Nel, L., Jacobs, J., Jaftha, J., von Teichman, B. and Bingham, J. 2000. New cases of Mokola virus infection in South Africa: a genotypic comparison of Southern African virus isolates. *Virus Genes* **20**(2): 103-106.
- Newton, C.R. and Graham, A. 1994. In: *PCR*. Bios Scientific Publishers, Oxford, U.K.
- Noah, D.L., Drenzek, C.L., Smith, J.S., Krebs, J.W., Orciari, L., Shaddock, J., Sanderlin, D. *et al.* 1998. Epidemiology of Human Rabies in the United States, 1980 to 1996. *Annals of Internal Medicine* **128**(11): 922-930.
- Novella, I.S., Duarte, E.A., Elena, S.F., Mayo, A., Domingo, E. and Holland, J.J. 1995. Exponential increases of RNA virus fitness during large population transmissions *Proc. Natl. Acad. Sci U.S.A.* **92**: 5841-5844.
- Orciari, L.A., Niezgoda, M., Hanlon, C.A., Shaddock, J.H., Sanderlin, D.W., Yager, P.A. and Rupprecht, C.E. 2001. Rapid clearance of SAG-2 rabies virus from dogs after oral vaccination. *Vaccine* **19**(31): 4511-4518.
- Onderstepoort Veterinary Institute (OVI) report, 2000. Onderstepoort, Pretoria, South Africa.
- Page, R. 1996. Treeview: An application to display phylogenetic trees on personal computers. *Comp. Appl. Biosci.* **12**: 83-88.

- Page, R.D.M. and Holmes, E.C. 1996. In: *Molecular Evolution: a phylogenetic approach*. Blackwell Scientific Publishers: pp 178-185.
- Park, J.Y., Peters, C.J., Rollin, P.E., Ksiazek, T.G., Gray, B., Waites, K.B. and Stephensen, C.B. 1997. Development of a reverse transcription-polymerase chain reaction assay for diagnosis of Lymphocytic choriomeningitis Virus Infection and its use in a prospective surveillance study. *Journal of Medical Virology* **51**: 107-114.
- Perrin, P., Jacob, Y. and Tordo, N. 2000a. DNA-based immunisation against Lyssaviruses. *Intervirology* **43**: 302-311.
- Perrin, P., Jacob, Y., Aguilar-Setien, A., Loza-Rubio, E., Jallet, C., Desmezieres, E., Aubert, M., Cliquet, F. and Tordo, N. 2000b. Immunisation of dogs with a DNA vaccine induces protection against rabies virus. *Vaccine* **18**: 479-486.
- Philippe, V., Bruyere, V. and Aubert, M. 1998. Comparison of the effectiveness of two protocols of antirabies bait distribution for foxes (*Vulpes vulpes*). *Vet. Res.* **29**: 537-546.
- Prehaud, P., Coulon, P., Diallo, A., Martinier-Edelist, C. and Flamand, A. 1989. Characterisation of a new temperature sensitive and avirulent mutant of the rabies virus. *Journal of General Virology* **70**: 133-143.
- Prescott, L.M., Harley, J.P. and Klein, D.A. 1996. In: *Microbiology*. (Eds. Siuers, E.M., Stanton, T. and Wilde, J.L). Brown Publishers, U.S.A.
- Pringle, C.R. 1995. The order Mononegavirales: evolutionary relationships and mechanisms of virus evolution. (Eds. Gibbs, A., Calisher, C.H. and Garcia-Arenal, F). Cambridge University Press, U.K. pp 426-437.
- Ravkov, E.V., Smith, J.S. and Nichol, S.T. 1995. Rabies virus glycoprotein contains a long 3' noncoding region which lacks pseudogene properties. *Virology* **206**: 718-723.
- Ray, N.B., Power, C., Lynch, W.P., Ewalt, L.C. and Lodmell, D.L. 1997a. Rabies viruses infect primary cultures of murine, feline and human microglia and astrocytes. *Archives of Virology* **142**: 1011-1019.
- Ray, N.B., Ewalt, L.C. and Lodmell, D.L. 1997b. Nanogram quantities of plasmid DNA encoding the rabies virus glycoprotein protect mice against lethal rabies virus infection. *Vaccine* **15**(8): 892-895.
- Rhodes, C.J., Atkinson, R.P., Anderson, R.M. and MacDonald, D.W. 1998. Rabies in Zimbabwe: reservoir dogs and the implications of disease control. *Philosophical Transactions of the Royal Society of London Bulletin of Biological Science* **353**(1371): 999-1010.

- Rohde, R.E., Neill, S.U., Clark, K.A and Smith, J.S. 1997. Molecular epidemiology of rabies epizootics in Texas. *Clinical and Diagnostic Virology* **8**(3): 209-217.
- Rupprecht, C.E. and Kieny, M.P. 1988. Development of a vaccinia-rabies glycoprotein recombinant vaccine. In: Rabies. (Eds. Campbell, J.B. and Charlton, K.M.) Boston: Kluwer Academic Publishers: pp 335-364.
- Rupprecht, C.E., Hanlon, C.A., Niezgoda, M. *et al.* 1993. Recombinant rabies vaccines: efficacy in free-ranging animals. *Onderstepoort Journal of Veterinary Research* **60**: 463-468.
- Rupprecht, C.E., Smith, J.S., Fekadu, M. and Childs, J.E. 1995. The ascension of wildlife rabies: a cause for public health concern or intervention? *Emerging infectious diseases* **1**: 107-114.
- Rupprecht, C.E., Blass, L., Smith, K., Orciari, L.A., Niezgoda, M., Hanlon, C.A. *et al* 2001. Human infection due to recombinant vaccinia-rabies glycoprotein virus. *New England Journal of Medicine* **345**(8): 582-586.
- Sacramento, D., Bourhy, H. and Tordo, N. 1991. PCR technique as an alternative method for diagnosis and molecular epidemiology of rabies virus. *Molecular and Cellular Probes* **5**: 229-240.
- Sacramento, D., Badrane, H., Bourhy, H. and Tordo, N. 1992. Molecular epidemiology of rabies virus in France: comparison with vaccine strains. *Journal of General Virology* **73**: 1149-1158.
- Saiki, R.K., Gelfand, D.H., Stoffel, S. *et al.* 1988. Primer directed enzymatic amplification of DNA with a thermostable DNA polymerase. *Science* **239**: 487-91.
- Saitou, N. and Nei, M. 1987. The neighbour-joining method: a new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* **4**: 406-425.
- Saluzzo, J.F., Rollin, P.E., Daugard, C., Digoutte, J.P., Georges, A.J. and Sureau, P. 1984. Premier isolement du virus Mokola a partir d'une rongeur (*Lophuromys sikapusi*). *Annales de Institut Pasteur Virologie* **135E**: 57-66.
- Sanger, F., Nicklen, S. and Coulson, R.A. 1977. DNA sequencing with chain-terminating inhibitors. *Proc. Natl. Acad. Sci. USA* **74**: 5463-5467.
- Schneider, M.C., Santosburgoa, C., Aron, J., Munoz, B., Ruizvelazco, S. and Vieda, W. 1996. Potential force of infection of human rabies transmitted by vampire bats in the Amazonian region of Brazil. *American Journal of Tropical Medicine and Hygiene* **55**(6): 680-4.

- Schneider, L.G., Dietzschold, B., Dierks, R.E., Matthaeus, W., Enzmann, P.J. and Stromhmaeir, K. 1973. Rabies group specific ribonucleoprotein antigen and a test system for grouping and typing of Rhabdoviruses. *Journal of Virology* **11**: 748-755.
- Schneider, L.G. and Cox, J.H. 1994. Bat *Lyssaviruses* in Europe. In: *Lyssaviruses* (Eds. Rupprecht, C.E., Dietzschold, B. and Koprowski, H.) Springer-Verlag, Berlin, pp207-218.
- Schneider, L.G. 1995. Rabies virus vaccines. *Dev. Biol. Stand.* **84**: 49-54.
- Schoen, G., Iseni, F., Marrabis, M., Blondel, D. and Ruigrok, K.W. 2001. Structure of recombinant rabies virus nucleoprotein and identification of the phosphoprotein binding site. *Journal of Virology* **75**(1): 490-498.
- Schumacher, C.L., Coulon, A., Lafay, F., Benejean, J., Aubert, M.F.A., Barrat, J., Aubert, A. and Flamand, A. 1993. SAG-2 oral rabies vaccine. *Onderstepoort Journal of Veterinary Research* **60**: 459-62.
- Seif, I., Pepin, M., Blancou, J., Coulon, P. and Flamand, A. 1985. Change in pathogenicity and amino acid substitution in the glycoprotein of several spontaneous and induced mutants of the CVS strain of rabies virus. In: *Nonsegmented negative strand viruses*, Academic Press, pp 294-300.
- Seghaier, C., Cliquet, F., Hammami, S., Aoiuna, T., Tlatli, A. and Aubert, M. 1999. Rabies mass vaccination campaigns in Tunisia: are vaccinated dogs correctly immunised? *Am. J. Trop. Med. Hyg.* **61**(6): 879-84.
- Setien, A.A., Brochier, B., Tordo, N., De Paz, O., Desmettre, P., Pahorpe, D. and Pastoret, P.P. 1998. Experimental rabies infection and oral vaccination in vampire bats. *Vaccine* **16**(11-12): 1122-1126.
- Shope, R.E., Murphy, F.A., Harrison, A.K., Causey, O.R., Kemp, G.E., Simpson, D.I.H. and Moore, D.L. 1970. Two African viruses serologically and morphologically related to rabies virus. *Journal of Virology* **6**: 690-692.
- Skinner, J.D. and Smithers, R.H.N. 1990. *The mammals of the Southern African Subregion*, Second edition. University of Pretoria, Pretoria.
- Smith, J.S., Orciari, L.A., Yager, P.A., Seidel, H.D. and Warner C.K. 1992. Epidemiologic and historic relationships among 87 rabies virus isolates as determined by limited sequence analysis. *The Journal of Infectious Diseases* **166**: 296-307.
- Smith, J.S. 1988. Monoclonal antibody studies of rabies in insectivorous bats of the United States. *Reviews of Infectious Diseases* **10**: S637-S643.

Smith, J.S., Yager, P.A. and Orciari, L.A. 1993. Rabies in wild and domestic carnivores of Africa: Epidemiological and historical associations determined by limited sequence analysis. *Onderstepoort Journal of Veterinary Research* **60**: 307-314.

Smith, J. S. and Seidel, H. D. 1993. Rabies: A new look at an old disease. *Pro.Med Virol. Basel Karger*. **40**: 82-106.

Smith, J.S. 1996. New aspects of rabies with Emphasis on Epidemiology, Diagnosis and Prevention of the Disease in the United States. *Clinical Microbiology* **9**(2): 166-176.

Smith, J.S. and Baer, G.M. 1988. Epizootiology of rabies: The Americas. In: Rabies (Eds. Campbell J.B. and Charlton, K.M.) Boston: Kluwer Academic Publishers. pp 267-299.

Smith, J.S., Orciari, L.A. and Yager, P.A. 1995. Molecular epidemiology of rabies in the United States. *Seminars in Virology* **6**: 387-400.

Smith, J.S., Fishbein, D.B., Rupprecht, C.E. and Clark, K. 1991. Unexplained rabies in three immigrants in the United States. *The New England Journal of Medicine* **166**: 205-211.

Smith, J.M. 1998. Reconstructing evolutionary history. In: Evolutionary genetics, 2nd edition, Oxford University press, pp 299-306

Smithers, R.H.N. 1983. Mammals of the southern African subregion, Pretoria, University of Pretoria, pp736.

Sneath, P.H.A and Sokal, R.R. 1973. In: *Numerical taxonomy*, W.H. Freeman, San Francisco.

Snyman, P.S. 1940. The study and control of vectors of rabies in South Africa. *Onderstepoort Journal of Veterinary Science and Animal Husbandry* **166**: 296-307.

Speare, R., Skerrat, L., Foster, R., Berger, L. *et al.* 1997. Australian bat lyssavirus infection in three fruit bats from north Queensland. *Comm. Dis. Intell.* **21**: 117-120.

Steele, J.H. and Fernandez, P.J. 1991. History of rabies and global aspects: In: *The Natural History of Rabies, 2nd Edition*. Edited by Baer, G.M. CRC Press, Boca Raton, pp 1-24.

Swanepoel, R., Barnard, B.J.H., Meredith, C.D., Bishop, G.C., Bruchner, G.K., Foggin, C.M. and Hubschle, O.J.B. 1993. Rabies in southern Africa. *Onderstepoort Journal of Veterinary Research* **60**: 323-346.

- Swanepoel, R. 1994. In: *Infectious diseases of livestock with special reference to southern Africa. Volume one* (Edited by Coetzer, J.A.W., Thomson, G.R. and Tustin, R.C.) Oxford, pp 493-552.
- Swofford, D.L. 1993. PAUP (phylogenetic analysis using parsimony). Version 3.1. Laboratory of Molecular Systematics, Smithsonian Institution, Washington D.C.
- Swofford, D.L. and Olsen, G.J. 1990. Phylogeny reconstruction. In: *Molecular Systematics*. (Eds. Hillis, D.M. and Moritz, C.) Sinauer Associates, Sunderland, Massachusetts.
- Taylor, P.J. 1993. A systematic and population genetic approach to the rabies problem in the yellow mongoose (*Cynictis penicillata*). *Onderstepoort Journal of Veterinary Research* 60: 379-87.
- Thomson, G.R. and Meredith, C.D. 1993. Rabies in bat-eared foxes in South Africa. *Onderstepoort Journal of Veterinary Research* 60: 399-403.
- Thompson, J.D., Higgins, D.G. and Gibson, T.J. 1994. ClustalW: improving the sensitivity of progressive multiple alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acids Research* 22: 4673-4680.
- Thouloze, M., Lafage, M., Schachner, M., Hartmann, U., Cremer, H. and Lafon, M. 1998. The neural adhesion molecule is a receptor for rabies virus. *Journal of Virology* 72(9): 7181-7190.
- Tordo, N., Haan, P.D. Goldbach, R. and Poch, O.I. 1992. Evolution of negative-stranded RNA genomes. *Seminars in Virology* 3: 341-357.
- Tordo, N., Poch, O., Ermine, A. and Keith, G. 1986a. Primary structure of leader RNA and nucleoprotein genes of the rabies genome: segmented homology with VSV. *Nucleic Acids Research* 14(6): 2671-2683.
- Tordo, N., Poch, O., Ermine, A., Keith, G. and Rougeon, F. 1986b. Walking along the rabies genome: is the G-L intergenic region a remnant gene. *Proceeding of The National Academy of Science, U.S.A.* 83: 3914-3918.
- Tordo, N., Charlton, K. and Wandeler, A. 1997. Rhabdoviruses: rabies. In: *Topley and Wilson's Principles of bacteriology, virology and immunity*. 9th edition. (eds W.W.C. Topley, Wilson, G.S. and L. Collies). London. pp 665-692.
- Tordo, N., Poch, O., Ermine, A., Keith, G. and Rougeon, F. 1988. Completion of the rabies virus genome sequence determination: highly conserved domains along the L (polymerase) proteins of unsegmented negative-strand RNA viruses. *Virology* 165: 565-576.

- Tordo, N. 1996. Characteristics and molecular biology of the rabies virus. In: *Laboratory techniques in Rabies*, Fourth edition (Eds. Meslin, F.X., Kaplan, M.M. and Koprowski, H.). WHO, Geneva: pp 28-51.
- Tordo, N. and Kouknetzorff, A. 1993. The rabies virus genome: An overview. *Onderstepoort Journal of Veterinary Research* **60**: 263-269.
- Tremlett, J.G., Wibberley, G. and King, A.A. 1994. Rabies virus typing – preliminary survey in Botswana. *Tropical Animal Health and Production* **26**: 157-60.
- Tsiang, H. 1993. Pathophysiology of rabies virus infection of CNS. *Adv. Vir. Res.* **42**: 375-412.
- Tuffereau, C., Leblois, H., Benejean, J., Coulon, P., Lafay, F. and Flamand, A. 1989. Arginine or lysine in position 333 of ERA or CVS glycoprotein is necessary for rabies virulence in adult mice. *Virology* **172**: 206-212.
- Tuffereau, C.J., Benejean, D., Blondel, B., Kieffer, A. and Flamand, A. 1998. Low affinity nerve-growth factor receptor can serve as a receptor for rabies. *EMBO Journal* **17**: 7250-7259.
- Vangryszerre, W. and Clercq, W. 1996. Rapid and sensitive polymerase chain reaction based detection and typing of foot-and-mouth disease virus in clinical samples and cell culture isolates, combined with other genomically and/or asymptotically related viruses. *Archives of Virology* **141**: 331-344.
- Von Maltitz, L., 1950. Rabies in the northern districts of South West Africa. *Journal of the South African Veterinary Medical Association* **21**: 4-12.
- Von Teichman, B.F., Thomson, G.R., Meredith, C.D. and Nel, L.H. 1995. Molecular epidemiology of rabies virus in South Africa: evidence for two distinct virus groups. *Journal of General Virology* **76**: 73-82.
- Von Teichman, B.F., de Koker, W.C., Bosch, S.J.E., Bishop, G.C., Meredith, C.D. and Bingham, J. 1998. Mokola virus infection: description of recent South African cases and a review of the virus epidemiology *J. S. Afr. Vet. Ass.* **69**(4): 169-171.
- Vos, A., Neubert, A., Aylan, O., Schuster, P. *et al.* 1999. An update on safety studies of SADB19 rabies virus vaccine in target and non-target species. *Epid. Inf.* **123**: 165-175.
- Vuillaume, P., Bruyere, V. and Aubert, M. 1998. Comparison of the effectiveness of two protocols of antirabies bait distribution for foxes (*Vulpes vulpes*). *Vet. Res.* **29**: 537-546.
- Van Vuuren, B.J. and Robison, T.J. 1997. Genetic population structure in the yellow mongoose, *Cynictis penicillata*. *Molecular Ecology* **6**(12): 1147-53.

- Wandeler, A. I. 1993. Wildlife rabies in perspective. *Onderstepoort Journal of Veterinary Research* **60**: 347-350.
- Wandeler, A. I. and Perry, B.D. 1993. The delivery of oral rabies vaccine to dogs: an African perspective. *Onderstepoort Journal of Veterinary Research* **60**: 451-457.
- Wiktor, T.J., Groygy, E., Schlumberger, H.D., Sokol, F. and Koprowski, H. 1973. Antigenic properties of rabies virus components. *Journal of Immunology* **110**: 269-276.
- Wandeler, A. I. 1991. Oral immunisation of wildlife. In: *The History of Rabies*, 2nd Edition. (Eds. Baer, G.M.). CRC Press, Boca Raton. pp 485-503.
- Warner, C.K., Schurr, T.G. and Fekadu, M. 1996. Molecular characterisation of carrier rabies isolates. *Virus Research* **41**: 133-140.
- Weir, B.S. 1990. In: *Genetic Data Analysis*. Sinauer Associates, Sunderland Massachusetts: pp 222-289.
- Whitby, J.E., Heaton, P.R., Whitby, H.E., O'Sullivan, E. and Johnstone, P. 1997a. Rapid detection of rabies and rabies-related viruses by RT-PCR and enzyme-linked immunosorbent assay. *Journal of Virological Methods* **69**: 63-72.
- Whitby, J.E., Johnstone, P. and Sillero-Zubiri, C. 1997b. Rabies virus in the decomposed brain of an Ethiopian wolf detected by nested reverse transcription polymerase chain reaction. *Journal of Wildlife Diseases* **33**(4): 912-5.
- Whitby, J.E., Heaton, P.R., Black, E.M., Wooldridge, M., McElhinney, I.M. and Johnstone, P. 2000. First isolation of a rabies-related virus from a Daubenton's bat. *Veterinary Record* **147**(14): 385-8.
- Whitt, M.A., Buonocore, L., Prehaud, C. and Rose, J.K. 1991. Membrane fusion activity, oligomerization and assembly of rabies virus glycoprotein. *Journal of Virology* **185**(2): 681-688.
- WHO. 1984. WHO expert Committee on Rabies: WHO Technical Report. WHO, Geneva.
- WHO. 1991. WHO expert Committee on Rabies: WHO Technical Report. WHO, Geneva.
- WHO. 1992. WHO expert Committee on Rabies: WHO Technical Report. WHO, Geneva.
- WHO. 1989. WHO expert Committee on Rabies: WHO Technical Report. WHO, Geneva.

- WHO. 1994. WHO expert Committee on Rabies: WHO Technical Report. WHO, Geneva.
- WHO. 1999. World Survey of rabies for the year 1997. WHO, Geneva. **33**: 1-29.
- Wiktor, T.J., Flamand, A. and Koprowski, H. 1980. Use of monoclonal antibodies in the diagnosis of rabies virus infection and differentiation of rabies and rabies-related viruses. *Journal of Virological Methods* **1**: 33-46.
- Wiktor, T.J., Macfarlan, R.I., Foggin, C.M. and Koprowski, H. 1984. Antigenic analysis of rabies and Mokola virus from Zimbabwe using monoclonal antibodies. *Dev Biol. Stand.* **57**: 199-211.
- Wiktor, T.J., Macfarlan, R.I., Reagan, K.J., Dietzschold, B., Curtis, P.J., Wunner, W.H., Kieny, M.P., Lathe, R., Lecocq, J.P. and Mackett, M. 1984. Protection from rabies by a vaccinia virus recombinant containing the rabies virus glycoprotein gene. *Proc. Natl. Acad. Sci. USA* **81**(22): 7194-8.
- Wiktor, T.J. 1985. Historical Aspects of Rabies. In: *World's debt to Pasteur*. Allan R. Liss. Inc. 141-151.
- Wilhelm, U. and Schneider, L.G. 1990. Oral immunisation of foxes against rabies: practical experiences of a field trial in the Federal Republic of Germany. *Bulletin of the World Health Organisation* **68**: 87-92.
- Winkler, W.G., Fashineli, T.R., Leffingwell, L., Howard, P. and Conomy, P. 1973. Airborne rabies transmission in a laboratory worker. *Journal of the American Medical Association* **226**: 1219-1221.
- Wunner, W.H., Larson, J.K., Dietzschold, B. and Smith, C.L. 1988. The molecular biology of rabies viruses. *Reviews of Infectious Diseases* **10**: S771-84.
- Wunner, W.H. 1991. The chemical composition and molecular structure of rabies viruses. In: Baer GM (ed) *The Natural History of rabies*, 2nd edition. CRC Press, Boca Raton. pp 31-67.
- Wunner, W.H. and Reagan, K.J. 1984. Characterisation of saturable binding sites for rabies virus. *Journal of Virology* **50**: 691-697.
- Wunner, W.H., Dietzschold, B., Curtis, P.J. and Wiktor, T.J. 1983. Rabies subunit vaccines. *Journal of General Virology* **64**: 1649-1656.
- Yang, J., Hooper, D.C., Wunner, W.H., Koprowski, H., Dietzschold, B. and Fu, Z.F. 1998. The specificity of rabies virus RNA encapsidation by nucleoprotein. *Virology* **242**: 107-117.

Zumpt, I. and Hassel, R.H. 1982. The yellow mongoose as a rabies vector of the central plateau of South Africa. *South African Journal of Science* **78**: 417-418.

APPENDIXES

Appendix 1: An alignment of the nucleotide sequences of the G-L intergenic region and the flanking regions of canid viruses from Zimbabwe and South Africa included in this investigation. The nucleic acid sequences were compared with that of PV. Only altered base sites are shown to the nucleotide variance between the different canid isolates. Dots indicate areas of sequence homology.

	1	11	21	31	41	50
pv	TCAATCGATC	-GGAAC-CTA	-CACA-ACAC	AATCTCAGA-	GGGACAGGGA	
o615/91	-----C.	.A..GT....	..GA....G.	.T....G...	.....
o491/98	.....C.	.A...T....	..G....G.	.G....G...	.....
c938	.....C.	.A...T....	..G....G.	.G....G...	.....
j544	.....C.	.A...T....	..G....G.	.G....G...	.....
j598	.....C.	.A...T....	..G....G.	.G....G...	.....
j669	.....C.	.A...T....	..G....TG.	.G....G...	.....
o462	.....C.	.A...T....	..G....G.	.G....G...	.....
d20548	.....C.	.A...T....	..G....G.	.G....G...	.....
d352	.....C.	.A..GT....	..GA....G.	.G....G...	.....
j602	.....C.	.A...T....	..G....G.	.G....G...	.....
d19366	.....C.	.A..GT....	..GG....G.	.G.A..G...	.....
j19344	.....C.	.A...T....	..G....G.	.G....G...	.....
j717	.....C.	.A...T....	..G....TG.	.G....G...	.....
j596	.....C.	.A..GT....	..GA....G.	.G....G...	.....
j631	.....C.	.A...T....	..G....TG.	.G.G..G...	.....
j673	.....C.	.A...T....	..G....TG.	.G....G...	.....
j982/97	.....C.	.A...T....	..G....TG.	.G....G...	.....
wd800/97	..G....C.	.A...T....	..G....G.	.G....G...	.....
wd884/97	..G....C.	.A...T....	..G....G.	.G....G...	.....
d224/98	.....C.	.A..GT....	..GA....G.	.G....G...	.....
j1403	.....C.	.A...T....	..G....G.	.G....G...	.....
675/99	.....C.	.A...T....	..G....G.	.G....G...	.....
d820	.....C.	.A...T....	..G....TG.	.G....G...	.....
j446	.....C.	.A...T....	..G....TG.	.G....G...	..T.....	
j773	..G....C.	.A...T....	..G....G.	.G....G...	.....
j19273	.....C.	.A..GT....	..GG....G.	.G....G...	.....
d19347	.....C.	.A..GT....	..GG....G.	.G....G...	.....G	
d19385	.....C.	.A..GT....	..GG....G.	.G....G...	.....G...	
d16234	.....C.	.A...T....	..G....G.	.G....G...	.....
d14702	.....C.	.A...T....	..G....G.	.G....G...	.....
j14917	.....C.	.A...T....	..G....G.	.G....G...	.....
j24137	.....C.	CA...T....	..G....G.	.G....G...	.....
j21533	.....C.	.A...T....	..G....G.	.G....G...	.....
d16838	C.....GC.	CA...T.T..	..G....G.	.G....GAG.	--.....A.	
j14937	...G...C.	.A.C.T....	..G....G.	.T..TGAGA	.....
j17711	.....C.	.A...T....	..G....G.	.G....G...	.....
j19319	.....C.	.A...T....	..G....G.	.G....G...	.....
j19301	.....C.	.A...T....	..G....G.	.G....G...	.....



j19286C. .A...T.T... .G....G. .G....G... ..
j17722C. .A...T.T... .G....G. .G....G... ..
d20034C. .A...T.T... .G....G. .G....G... ..
d24465C. .A..GT.... .GG....G. .G....G... ..
j23667C. .A..GT.... .GG....G. .G....G... ..
j23357C. CA..GT.... .GG....G. .G....G... ..
j21819C. .A..GT.... .GG....G. .G....G... ..
j21111C. .A..GT.... .GG....G. .G....G... ..
j22642C. .A..GT.... .GG....G. .G.T..G... ..
j21532C. .A..GT.... .GG....G. .G....G... ..G...
j21147C. .A..GT.... .GG....G. .G....G... A.....
j23578C. .A..GT.... .GG....G. .G....G... ..
j23895C. .A..GT.... .GG....G. .G....G... ..
d24132C. .A..GT.... .GG....G. .G....G... ..
d21428C. .A..GT.... .GG....G. .G....G... ..
d24299C. .A..GT.... .GG....G. .G....G... ..
d23652C. .A..GT.... .GG....G. .G....G... ..
j23275C. .A..GT.... .GG....G. .G....G... ..
j24307C. .A..GT.... .GG....G. .G....G... ..
d21467C. .A..GT.... .GG....G. .G....G... A.....
d16387C. .A..GT.... .G....G. .G....G... ..
d16254C. .A..GT.... .G....G. .G....G... ..
d24505C. .A..GT.... .GG....G. .G....G... ..T....
j23374C. CA...T.... .G...TG. .G....G... ..
j21579C. .A...T.... .G...TG. .G....G... ..
d21869C. .A..GT.... .GG..C.G. .G....G... ..
d22547C. .A..GT.... .GG..C.G. .G....G... ..
d16347C. .A..GT.... .GG..C.G. .G....G... ..
d21057C. .A..GT.... .GG..C.G. .G....G... ..
d20896C. .A...T.... .G....G. .G....G... ..
d20813 .T.....C. .A...T.... .G....G. .G....G... ..
d20519C. .A..GT.... .GG..C.G. .G....G... ..
d21570A..A. .A...T.... .G....G. .G....G... ..
j19901C. .A..GT.... .GG....G. .G....G... ..G...
d332C. .A..GT.... .GA...G. .G....G... ..
d733-C. .A..GT.... .GG....G. .G....G... ..A-
o469C. .A...T.... .G....G. .G....G... ..
d310C. .A...T.... .G....G. .G....G... ..
d203C. .A...T.... .G....G. .G....G... -.....
o578/95C. .A...T.... .G....G. .G...GG... ..
j504/96C. .A...T.... .G...T.G. .G....G... ..
o214/98C. .A...T.... .G....G. .G....G... ..
o774/95C. .A...T.... .G....G. .G....G... ..
o414/96C. .A...T.... .G....G. .G....G... ..T
o377C. .A...T.... .G....G. .G....G... ..
j101C. .A..GT.... .GAC...G. .G....G... ..
d57C. .A..GT.... .GAC...G. .G....G... ..
j378C. .A..GT.... .G....G. .G...AG... ..
d56C. .A...T.... .G....G. .G....G... ..
d8/96C- CA...T.... .G...TG. .G....G... ..
d95/755C. .A..GT.... .GA...G. .G....G... ..
306/98C. .A...T.... .G....G. .G....G... ..
527/98C. .A...T.... .G....G. .G....G... ..
d77A...T.... .G....G. .G....G... ..
j1627 ..G....C- CA...T.T... .G....G. .G....G... ..

	51	61	71	81	91	100
pv	-GGGAGGTGT	CAGTCACT--	-CCCC--AA	AGCGGGAAGA	TCATATCTTC	
o615/91	..A.....	.G.....	.T.....	.....G	.....G	.....G
o491/98	..A.....	.G.....	.T.....	.....G	.....G	.....G
c938	..A.....	.G.....	.T.....	.....G	.....G	.....G
j544	..A.....	.G.....	.T.....	.....G	.....G	.....G
j598	..A.....	.G.....	.T.....	.....G	.....G	.....G
j669	..A..G..	.G.....	.T.....	.....G	.....G	.....G



o462 ...A.....G.....T.....G.....
 d20548 ...A.....G.....T.....G.....
 d352 ...A.....G.....T.....G.....
 j602 ...A.....G.....T.....G.....
 d19366 ...A.....G.....T.....A...G.....
 j19344 ...A.....G.....T.....G.....
 j717 ...A...G..G.....T.....G.....
 j596 ...A.....G.....T.....G.....
 j631 ...A...G..G.....T.....G.....
 j673 ...A...G..G.....T.....G.....
 j982/97 ...A...G..G.....T.....G.....
 wd800/97 ...A.....G.....T.....AG.....
 wd884/97 ...A.....G.....T.....AG.....
 d224/98 ...A.....G.....T.....G.....
 j1403 ...A.....G.....T.....G.....
 675/99 ...A.....T.....G.....
 d820 ...A...G..G.....T.....G.....
 j446 ...A.....G.....T.....G.....
 j773 ...A.....G.....T...C...AG.....
 j19273 ...A.....G.....T.....A...G.....
 d19347 ...A.....G.....T.....A...G.....
 d19385 .TAA.....G.....T.....A...G.....
 d16234 ...A.....G.....T.....G.....
 d14702 ...A.....G.....T.....G.....
 j14917 ...A.....G.....T.....G.....
 j24137 ...A.....G.....T.....G.....
 j21533 ...A.....G.....T.....G.....
 d16838 ...A.....G.....T...C...G.....
 j14937 ...A.....G.....T.....G.....
 j17711 ...A.....G.....T.....G.....
 j19319 ...A.....G.....T.....G.....
 j19301 ...A.....G.....T.....G.....
 j19286 ...A.....G.....T.....G.....
 j17722 ...A.....G.....T.....G.....
 d20034 ...A.....G.....T.....G.....
 d24465 ...A.....G.....T.....A...G.....
 j23667 ...A.....G.....T.....A...G.....
 j23357 ...A.....G.....T.....A...G.....
 j21819 ...A.....G.....T.....A...G.....
 j21111 ...A.....G.....T.....A...G.....
 j22642 ...A.....G.....TGGG.....A...G.....
 j21532 ...A.....G.....T.....A...G.....
 j21147 ...A.....G.....T.....A...G.....
 j23578 ...A.....G.....T.....A...G.....
 j23895 ...A.....G.....T.....A...G.....
 d24132 ...A.....G.....T.....A...G.....
 d21428 ...A.....G.....T.....A...G.....
 d24299 ...A.....G.....T.....A...G.....
 d23652 ...A.....G.....T.....A...G.....
 j23275 ...A.....G.....T.....A...G.....
 j24307 ...A.....G.....T.....A...G.....
 d21467 ...A.....G.....T.....A...G.....
 d16387 ...A.....G.....T.....A...G.....
 d16254 ...A.....G.....T.....A...G.....
 d24505 ...A.....G.....T.....A...G.....
 j23374 ...A...G..G.....T...C...G.....
 j21579 ...A...G..G.....T.....G.....
 d21869 ...A.....G.....T.....G.....
 d22547 ...A.....G.....T.....T...G.....
 d16347 ...A.....G.....T.....G.....
 d21057 ...A.....G.....T.....G.....
 d20896 ...A.....G.....T.....G.....
 d20813 ...A.....G.C.....T.....G.....
 d20519 ...A.....G.....T.....G.....
 d21570 ...A.A....G.....T.....G.....



j19901	...A.....	.G.....	.T.....	.....A..G	.....
d332	...A.....	.G.....	.T.....	.....G	.....
d733	-.A.....	.G.....	.T.....	.....A..G	.....
o469	...A.....	.G.....	.T.....	.....G	.....
d310	...A.....	.G.....	.T.....	.....G	.....T..	
d203	...A.....	.G.....	.T.....	.....G	.....
o578/95	...A.....	.G.....	.....	.....G	.....
j504/96	...A.....	.G.....	.T.....	.....G	.....
o214/98	...A.....	.G.....	.T.....	.....G	.....
o774/95	...A.....	.G.....	.T.....	.....G	.....
o414/96	...A.....	.G.....	.T.....	.....G	.....
o377	...A.....	.G.....	.T.....	.....G	.....
j101	...A.....	.G.....	.T.....	.....G	.....
d57	...A.....	.G.....	.T.....	.....G	.....
j378	...A.....	.G.....	.T.....	.....G	.....
d56	...A.....	.G.....	.T.....	.....G	.....
d8/96	...A..G..	.G.....	.T.....	.....G	.....
d95/755	...A.....	.G.....	.T.....	.....G	.....
306/98	...A.....	.G.....	.T.....	.....G	.....
527/98	...A.....	.G.....	.T.....	.....G	.....
d77	...A.....	.G.....	.T.....	.....G	.....
j1627	...A.....	.G..G...	.T..C...	.....G	.....
	101	111	121	131	141	150
pv	ATGGG-AATC	A-TACAAGA-	GCGGGG-TG	AGACCGGACT	-GTGAGAGCT	
o615/91	.....G..	....T....	.T.....	....TA..T.	.....A....	
o491/98	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
c938	.....G..	....TC....	.T.....	....TA..T.	.....A....	
j544	.....G..	....T....	.T.....	....TA..T.	.....A....	
j598	.....G..	....T.A..	.T.....	....TA....	....A.A....	
j669	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
o462	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
d20548	.....G..	....T.A..	.T.....	....A....	....A.A....	
d352	.....G..	T..T.A..	.T.....	....TA....	....A.A....	
j602	.....G..	....T.A..	.T.....	....TA....	....A.A....	
d19366	.....G..	....T.A..	.T.....	....TA..T.	....A.A.AT.	
j19344	.....G..	....T.A..	.T.....G..	....A....	....A.A....	
j717	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
j596	.....G..	....T.A..	.T.....	....TA....	....A.A....	
j631	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
j673	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
j982/97	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
wd800/97	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
wd884/97	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
d224/98	.....G..	....T.A..	.T.....	....TA....	....A.A....	
j1403	.....G..	....T.A..	.T.....	....T-	....A....	
675/99	.....G..	....T.A..	.T.....	....TA....	....A.A....	
d820	.....G..	....T.A..	.T.....	....TA..T.	....A.A....	
j446	.....G..	....T.A..	.T.....	....AA..T-	....A.A....	
j773	.....G..	....T.A..	.T.....	....TA..G-	....A.A....	
j19273	.....G..	....T.A..	.T.....	....TA..T.	....A.A.AT.	
d19347	.....G..	....T.A..	.T.....	....TA..T.	....A.A.AT.	
d19385	.....G..	....T.A..	.T.A.....	....TA..T.	....A.A.AT.	
d16234	.....G..	....T.A..	.T.....	....TA....	....A.A....	
d14702	.....G..	....T.A..	.T.....	....TA....	....A.A....	
j14917	.....G..	....T.A..	.T.....	....TA....	....A.A....	
j24137	.....G..	....T.A..	.T.....	....TA....	....A.A....	
j21533	.....G..	....T.A..	.T.....	....TA....	....A.A....	
d16838	.....G..	....T.A..	.T.....	....A....	....A.A....	
j14937	.....G..	....T.A..	.T.....	....A....	....A.A....	
j17711	.....G..	....T.A..	.T.....	....A....	....A.A....	
j19319	.....G..	....T.A..	.T.....	....A....	....A.A....	
j19301	.....G..	....T.A..	.T.....	....A....	....A.A....	
j19286	.....G..	....T.A..	.T.....	....TA....	....A.A....	



j17722G.. T...T..A.. .T..... TA....A....
d20034G..T..A.. .T..... TA....A.A....
d24465G..T..A.. .T..... TA..T.A.A.AT.
j23667G..T..A.. .T..... TA..T.A.A.AT.
j23357G..T..A.. .T..... TA..T.A.A.AT.
j21819G..T..A.. .T..... TA..T.A.A.AT.
j21111G..T..A.. .T..... TA..T.A.A.AT.
j22642G..T..A.. .T..... TA..T.A.A.AT.
j21532G..T..A.. .T..... TA..T.A.A.AT.
j21147G..T..A.. .T..... TA..T.A.A.AT.
j23578G..T..A.. .T..... TA..T.A.A.AT.
j23895G..T..A.. .T..... TA..T.A.A.AT.
d24132G..T..A.. .T..... TA..T.A.A.AT.
d21428G..T..A.. .T..... TA..T.A.A.AT.
d24299G..T..A.. .T..... TA..T.A.A.AT.
d23652G..T..A.. .T..... TA..T.A.A.AT.
j23275G..T..A.. .T..... TA..T.A.A.AT.
j24307G..T..A.. .T..... TA..T.A.A.AT.
d21467G..T..A.. .T..... TA..T.A.A.AT.
d16387G..T..A.. .T..... TA..T.A.A.AT.
d16254G..T..A.. .T..... TA..T.A.A.AT.
d24505G..T..A.. .T..... TA..T.A.A.AT.
j23374G..T..A.. .T..... TA..T.A.A....
j21579G..T..A.. .T..... TA..T.A.A....
d21869G..T..... .T..... TA..T.A.A....
d22547G..T..... .T..... TA..T.A.A....
d16347G..T..... .T..... TA..T.A.A....
d21057G..T..... .T..... TA..T.A.A....
d20896G..T..A.. .T..... .A....A.A....
d20813G..T..A.. .T..... TA....A.A....
d20519G..T..... .T..... TA..T.A.A....
d21570G..T..A.. .T..... TA....A.A....
j19901G.G..T..A.. .T.A..... TA..T.A.A.AT.
d332G..T..A.. .T..... TA....A.A....
d733G..T..A.. .T..... TA..T.A.A.A.A.
o469G..T..A.. .T..... TA..T.A.A....
d310G..T..A.. .T..... TA....A.A....
d203G..T..A.. .T..... TA....A.A....
o578/95G..T..A.. .T..... TA..T.A.A....
j504/96G.. .A..T..A.. .T..... .AT....A.A....
o214/98G..T..A.. .T..... TA..T.A.A....
o774/95G..T..A.. .T..... TA..T.A.A....
o414/96G.. T...T..A.. .T..... TA..T.A.A....
o377G..T..A.. .T.....C.TA....A.A....
j101G.. T...T..A.. .T..... TA....A.A....
d57G.. T.....A.. .T..... TA....A.A....
j378G.. T...T..A.. .T..... TA....A.A....
d56G..T..A.. .T..... TA....A.A....
d8/96G..T..A.. .T..... TA..T-A.A....
d95/755G.. T...T..A.. .T..... TA....A.A....
306/98G..T..A.. .T..... TA....A.A....
527/98G..T..A.. .T..... TA....A.A....
d77G..T..A.. .T..... TA....A.A....
j1627G..T..A.. .T..... TA....A.A....

	151	161	171	181	191	200
pv	GGCCG---T	CCTTTCAACG	ATCCAA-GTC	CT-GAAGATC	ACCTCCCCTT	
o615/91	.T.A....	.....G...	C.T.....T	....G.G..	.....
o491/98	.T.A....	.....GC..	C-.....T	.....G..	.....
c938	.T.....	.....G...	C.T.....T	.....G..	.....
j544	...A....	.....G...	C.T.G...T	.....G..	.....
j598	.T.A....	.....G...	C.T.....T	.....G..	.....
j669	.T.A....	.....G...	C.T.....T	.....G..	..T.....	
o462	.T.A....	.....G...	C.T.....T	.....G.G..	.....



d20548 ..T.A.....G...C.T.....T.C.....G...C.
 d352 ..T.A.....G...C.T.....T.....G...
 j602 ..T.A.....G...C.T.....T.....G...
 d19366 ..T.A.....T...G...C.T.....T.....G...
 j19344 ..T.A.....G...-C.T.....T.C...G.G...T--
 j717 ..T.A.....G...C.T.....T.....G...T...
 j596 ..T.A.....G...C.T.....T.....G...
 j631 ..T.A.....AG...C.TA...T.....G...
 j673 ..T.A.....G...C.T.....T.....G...T...
 j982/97 ..T.A.....G...C.T.....T.....G...
 wd800/97 ..T.A.....G...C.T.....T.....G...
 wd884/97 ..T.A.....G...C.T.....T.....G...
 d224/98 ..T.A.....G...C.T.....T.....G...
 j1403 ..T.A.....G...C.T.C...T.....G...T.-
 675/99 ..T.A.....G...C.T.....T.....G...
 d820 ..T.A.....G...C.T.....T.....G...
 j446 ..T.A.....G...C.T.....T.....G...
 j773 ..T.A.....G...C.T.....T.....G...
 j19273 ..T.A.....G...C.T.....T.GA.G.G...T.G
 d19347 ..T.A.....T...G...C.T.....T.GA.G.T-
 d19385 ..T.A.....T...G...C.T.....T.GA.G.T-
 d16234 ..T.A.....G...C.T.....T.....G...
 d14702 ..T.A.....G...C.T.....T.....G...
 j14917 ..T.A.....G...C.T.....T.....G...
 j24137 ..T.A.....G...C.T.....T.....G...
 j21533 ..T.A.....G...C.TA...T.....AG...
 d16838 ..T.A.....TG...C.T.....T.C...G...C.
 j14937 ..T.A.....G...C.T.....T.C...G...C.
 j17711 ..T.A.....G...C.T.....T.C...G...C.
 j19319 ..T.A.....G...C.T.....T.C...G...C.
 j19301 ..T.A.....G...C.T.....T.C...G...C.
 j19286 ..T.A.....G...C.T.....T.....G...
 j17722 ..T.A.....G...C.T.....T.....G...
 d20034 ..T.A.....G...C.T.....T.....G...
 d24465 ..T.A.....G...C.T.C...T.T...G...
 j23667 ..T.A.....G...C.T.C...T.T...G...
 j23357 ..T.A.....G...C.T.C...T.T...G...
 j21819 ..T.A.....G...C.T.C...T.T...G...
 j21111 ..T.A.....G...C.T.C...T.T...G...
 j22642 ..T.A.....G...C.T.C...T.T...G...
 j21532 ..T.A.....G...C.T.C...T.T...G...
 j21147 ..T.A.....G...C.T.C...T.T...G...
 j23578 ..T.A.....G...C.T.C...T.T...G...
 j23895 ..T.A.....G...C.T.C...T.T...G...
 d24132 ..T.A.....G...C.T.C...T.T...G...
 d21428 ..T.A.....G...C.T.C...T.T...G...
 d24299 ..T.A.....G...C.T.C...T.T...G...
 d23652 ..T.A.....G...C.T.C...T.T...G...
 j23275 ..T.A.....G...C.T.C...T.T...G...
 j24307 ..T.A.....G...C.T.C...T.T...G...
 d21467 ..T.A.....G...C.T.C...T.T...G...
 d16387 ..T.A.....C.G...C.T.....T.....G...
 d16254 ..T.A.....C.G...C.T.....T.....G...
 d24505 ..T.A.....T.C.G...C.T.....T.....G...
 j23374 ..T.A.....G...C.T.....T.....G...
 j21579 ..T.A.....G...C.T.....T.....G...
 d21869 ..T.A.....G...C.T.....T.....G...T...
 d22547 ..T.A.....G...C.T.....T.....G...T...
 d16347 ..T.A.....G...C.T.....T.....G...T...
 d21057 ..T.A.....G...C.T.....T.....G...T...
 d20896 ..T.A.....G...C.T.....T.C...G...C.
 d20813 ..T.....G...C.T.....CT.....G...
 d20519 ..T.A.....G...C.T.....T.....G...T...
 d21570 ..T.A.....G...C.T.....T.....T...A.....C
 j19901 ..T.A.....T...G...C.T.....T.GA.G.G-...T.G



```

d332 ..T.A.....G... C.T.....T .....G.. .....
d733 ..T.A.....G... C.T.C.....T T.....G.. .....
o469 ..T.A.....GC... CCT.....T .....G.. .....
d310 ..T.A.....TG... C.T.....T .....G.. .....
d203 ..TTA.....G... C.T.....T .....G.. .....
o578/95 ..T.A.....G... C.T.....T .....G.. .....
j504/96 ..T.A.....G... C.T.....T .....G.. .....
o214/98 ..T.A.....AG... C.T.....T .....G.. C.....
o774/95 ..T.A.....G... C.T.....T .....AG.. .....
o414/96 ..T.A.....G... C.....T .....G.. .....
o377 ..T.A.....G... C.T.....T .....G.. .....
j101 ..T.A.....G... C.T.....T .....G.. .....
d57 ..T.A.....G... C.T.....T .....G.. .....
j378 ..T.A.....G... C.T.....T .....G.. .....
d56 ..T.A.....G... C.T.....T .....G.. .....
d8/96 .....A.....G... C.T.....T .....G.. .....
d95/755 ..T.A.....G... C.T.....T .....G.. .....
306/98 ..T.A.....G... C.T.....T .....G.. .....
527/98 ..T.A.....G... C.T.....T .....G.. .....
d77 ..T.A.....G... C.T.....T .....G.. .....
j1627 ..T.A.....G... C.T.....T .....G.. .....

      201          211          221          231          241          250
      |            |            |            |            |            |
pv    GGGGGGTT-- --CTTTTGA AAAA----- --AAACCT-- ---GGGTCA
o615/91 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
o491/98 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
c938 -.....-.....G.G GGG.A..... -...-G-CT ...A.....
j544 -.....-.....G.. GGG.A..... -...-T..CT .....
j598 -.....-.....CG.G GGG.G..... -...-T..TT ...A...T.
j669 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
o462 -.....-.....G.G GGG..... -...-T..CT ...A.....
d20548 .....-.....G.G GG..G..... -...-T..T. ...A.....
d352 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
j602 -.....-.....G.G GGG.G..... -...-T.... -.....
d19366 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
j19344 -.....-.....G.G GGG.G..... -...-T..T. ...A...-
j717 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
j596 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
j631 -.....-.....G.G GGG.A..... -...-T..CT ...AA...
j673 -.....-.....G.G GGG.A..... -...-T..CT ...A.....
j982/97 .....-.....G.G GGG..... -...-T..CT ...A.....
wd800/97 .....-.....G.G GGG.A..... -...-T..CT ...A.....
wd884/97 .....-.....G.G GGG.A..... -...-T..CT ...A.....
d224/98 .....-.....G.G GGG.A..... -...-T..CT ...A.....
j1403 -.....-.....G.G GGGTC..... -...-T... ..A.....
675/99 -.....-.....G.G GGGGG..... -...-T..TT ...A...T.
d820 .....-.....G.G GGG.ATC... -...-CT ...A.....
j446 -.....-.....G.G GGG..... -...-CT ...A.....
j773 -.....-.....G.G GGG..... -...-CT ...A.....
j19273 ..T-----G.G GGG..... -...T..CT T...A.....
d19347 ..T-----G.G GGG..... -...T..CT G.-A.....
d19385 ..T-----G.G GGG..... -...T..CT G.-A.....
d16234 ..T-----G.G GGG.G..... -...-T..TT ...A.....
d14702 ..T-----G.G GG..G..... -...-T..TT T...A.....
j14917 ..T-----G.G GGG.G..... -...-T..TT ...A.....
j24137 ..T-----G.G GGG.G..... -...-T..CT ...A.....
j21533 .....-.....G.G GGG..... -...-GT..TT ...A.....
d16838 .....-.....G.G GGG..... -...-GT..T. ...A.....
j14937 .....-.....G.G GGG..... -...-GT..T. ...A.....
j17711 .....-.....G.G GGGG..... -...-GT..T. ...A.....
j19319 .....-.....G.G GGG..... -...-GT..T. ...A.....
j19301 .....-.....G.G GGG..... -...-GT..T. ...A.....
j19286 .....-.....G.G GGG..... -...-GT..TT ...A...T
j17722 .....-.....G.G GGG..... -...-GT..TT ...A...T

```



```

d20034 .....G.G GGG.....--GT..TT ....A...T
d24465 .....CG.G GGG.....T..CT ....A....
j23667 .....CG.G GGG.....T..CT ....A....
j23357 .....CG.G GGG.....T..CT ....A....
j21819 .....CG.G GGG.....T..CT ....A....
j21111 .....CG.G GGG.....T..CT ....A....
j22642 .....CG.G GGG.....T..CT ....A....
j21532 .....CG.G GGG.....T..CT ....A....
j21147 .....CG.G GGG.....T..CT ....A....
j23578 .....CG.G GGG.....T..CT ....A....
j23895 .....CG.G GGG.....T..CT ....A....
d24132 .....CG.G GGG.....T..CT ....A....
d21428 .....CG.G GGG.....T..CT ....A....
d24299 .....CG.G GGG.....T..CT ....A....
d23652 .....CG.G GGG.....T..CT ....A....
j23275 .....CG.G GGG.....T..CT ....A....
j24307 .....CG.G GGG.....T..CT ....A....
d21467 .....CG.G GGG.....T..CT ....A....
d16387 .....G.G GGG.....T..CT ....A....
d16254 .....G.G GGG.....T..CT ....A....
d24505 ..T-----G.G GGG.....T..CT ....A....
j23374 .....G.G GGG.....T..CT ....A....
j21579 .....G.G GGG.....T..CT ....A....
d21869 .....G.G GGG.....T..CT ....A....
d22547 .....G.G GGG.....T..CT ....A....
d16347 .....G.G GGG.....T..CT ....A....
d21057 .....G.G GGG.....T..CT ....A....
d20896 .....G.G GGG.....GT..T. ....A....
d20813 .....G.G GGG.....GT..TT ....A....
d20519 .....G.G GGG.....T..CT ....A....
d21570 .A..T-----G.G GGG.A.....T..CT T...A....
j19901 ..TT-----G.G GGG.....T..CT T..-A....
d332 .....G.G GGG.ATC...-----CT ....A....
d733 .....CG.G GGG.ATC...-----CT ....A....
o469 .....G.G GGGGATC...-----CT ....A....
d310 .....G.G GGG.GTC...-----TT ....A...T.
d203 .....G.G GGG.GTC...-----TT ....A....
o578/95 .....G.G GGG.ATC...-----CT ....A....
j504/96 .....G.G GGG.....-----CCT ....A...T.
o214/98 .....G.G GGG.T.....-----CT ....A....
o774/95 .....G.G GGG.A.....-----T..CT ....A....
o414/96 .....G.G GGG.....-----T..CT ....A....
o377 .....G.G GGG.ATC...-----CT ....A....
j101 .....G.G GGG.GTC...-----CT ....T....
d57 .....G.G GGG.ATC...-----CT ....A....
j378 .....G.G GGG.ATCT..TCTG---...-A....
d56 .....G.G GGG.GTC...-----TT ....A...T.
d8/96 .....G.G GGG.....-----CT ....A....
d95/755 .....G.G GGG.A.....-----T..CT ....A....
306/98 .....G.G GGG.G.....-----CT TT..A...T.
527/98 .....G.G GGG.G.....-----CT TT..A...T.
d77 .....G.G GGG.GTC...-----TT ....A...T.
j1627 .....G.G GGG.....-----TT ....A....

251      261      271      281      291      300
|         |         |         |         |         |
pv  ATA-GTCCTC C---TTGAAC T-CCATGCAA CTGGG-TAGA TT-----
o615/91 .C.....A.....A.....A.....A.....A.....
o491/98 .C.....C.....A.....A.....A.....A.....
c938 .C.....C.....A.....A.....A.....A.....
j544 .C.....A.....A.....A.....A.....A.....
j598 .CG.....A.....A.....A.....A.....A.....
j669 .C.....A.....A.....A.....A.....A.....
o462 .C.....C.....A.....A.....A.....A.....
d20548 .CG.....A.....A.....A.....A.....A.....

```



d352	.C.....			.A.....	--.....
j602	---,-----			.A.....	--.....
d19366	.C.....	T.....		.A.....	--.....
j19344	.G.....	T.....	-- C.T.....	.AA.....	--.....
j717	.C.....			.A...G...	--.....
j596	.C..T.....			.A.....	--.....
j631	.C....A...			.A.A.....	--.....
j673	.C.....			.A...G...	--.....
j982/97	.C.....			.A.....	--.....
wd800/97	.C.....			.A.....	--.....
wd884/97	.C.....			.A.....	--.....
d224/98	.C.....		T.....	.A.....	--.....
j1403	.C.....			.A.....	--.....
675/99	.CG.....			.A.....	--.....
d820	.C.....			.A.....	--.....
j446	.C.....			.A.....	--.....
j773	.C.....			.A.....	--.....
j19273	.C.....	T.....	..T.....	.A.....	.C.....
d19347	.C.....	T.....		.A.....	
d19385	.C.....	T.....		.A.....	
d16234	.G.TC....	.C.....		.A.....	
d14702	.G.....			.A.....	
j14917	.G.....			.A.....	
j24137	.AG.....			.A.....	
j21533	.G.....			.G.....	C.....
d16838	.CG.....	T.....		.A.....	
j14937	.CG.....			.A.....	
j17711	.CG.....			.A.....	
j19319	TCG.....			.A.....	
j19301	.CG.....			.A.....	
j19286	.CG.....			.A.....	
j17722	.CG.....			.A.....	
d20034	.CG.....			.A.....	
d24465	.C.....	T.....		.A.....	
j23667	.C.....	T.....		.A...G...	
j23357	.C.....	T.....		.A.....	
j21819	.C.....	T.....		.A.....	
j21111	.C.....	T.....		.A.....	
j22642	-C.....	T.....		.A.....	
j21532	.C.....	T.....		.A.....	
j21147	.C.....	T.....		.A.....	
j23578	.C.A.....	T.....		.A.....	
j23895	.C.....	T.....		.A.....	
d24132	.C.....	T.....		.A.....	
d21428	.C.....	T.....		.A.....	
d24299	.C.....	T.....		.A.....	
d23652	.C.....	T.....		.A.....	
j23275	.C.....	T.....		.A.....	
j24307	.C.....	T.....		.A.....	
d21467	.C.....	T.....	G.....	.A.....	
d16387	.C.....	T.....		.A.....	
d16254	.C.....	T.....		.A.....	
d24505	.C.....	T.....		.A.....	
j23374	.C.....			.A...G...	
j21579	.C.....			.A.....	
d21869	.C.....			.A.....	
d22547	.C.....			.A.....	
d16347	.C.....			.A.....	
d21057	.C.....			.A.....	
d20896	.CG.....			.A.....	
d20813	.G.....			.A.....	
d20519	.C.....			.A.....	
d21570	.C.....			.A.....	
j19901	.C.....	T.....	..T.....	.A.....	.C.....
d332	.C.....			.A.....	--.....



d733	.C.....	T.....			.A.....	--.....
o469	.C.....	.C...T			.A.....	--.....
d310	.CG.....				.A.....	--.....
d203	.G.....				.A.....	--.....
o578/95	.C.....				.A.....	--.....
j504/96	.CG.....				.A.....	--.....
o214/98	.C.....				.A.....	--.....
o774/95	.C.....				.A.....	--.....
o414/96	.C.....				.A.....	--.....
o377	.C.....C.		G.....		.A.....	--.....
j101	.C.....				.A.....C.	--.....
d57	.C.....				.A.....	--.....
j378	.CG.A....				.A.....	--.....
d56	.CG.....				.A.....	--.....
d8/96	.C.....				.A.....	--.....
d95/755	.C.....				.A.....	--.....
306/98	.CG.....				.A.....	--.....
527/98	.CG.....				.A.....	--.....
d77	.CG.....				.A.....	--.....
j1627	.CG.....				.A.....	--.....
	301	311	321	331	341	350
pv	----CAAGA-	-GTCATGA-G	AT-----TTT	CATTAATCCT	CTCA-GTTG-	
o615/91	.TC.....		.C.....		.A.....	
o491/98	.TC.....		.C.....C.		.A.....	
c938	.TT.....		C.....		.A.....	
j544	.TT...G.		.C.....		.A.....	
j598	.TT...G.		.C.....		.A.....	
j669	.TT..G.G.		.A.C.....		.A.....	
o462	.TC.C..A		.C.....		.A.....	----
d20548	.TT...G.		.C.....		.A.....	
d352	.TT.....		C.....		.A.....	
j602	.TT...G.		.C.....		.A.....	
d19366	.TT.....		C.....		.A.....	
j19344	.TT..-G.		.A.C.....		---TA.	-.
j717	.TT..G.G.		.A.C.....		.A.....	
j596	.TT.....		C.....		.A.....	
j631	.TT..G..		.A.C.....		.A.....	
j673	.TT..G.G.		.A.C.....		.A.....	
j982/97	.TT..G..		.A.C.....		.A.....	
wd800/97	.CT..A..		.A.C.....		.A.....	-.
wd884/97	.CT..A..		.A.C.....		.A.....	
d224/98	.TT.....		C.....		.A.....	
j1403	.TT...G.		.C.....		.A.....	
675/99	.TT...G.		.C.....	.C.....	.A..C.....	
d820	.TT..G..		.A.C.....		.A.....	
j446	.TT.....		-		.A.....	
j773	.CT.....		.A.C.....		.A.....	
j19273	...-..A		.C.....		-.A.....	-G...
d19347			.C.....		.A.....	
d19385			.C.....		.A.....	.A.....
d16234	.....G.		.C.....		.A.....	
d14702	.....G.		.C.....		.A.....	
j14917	.....G.		.C.....		.A.....	
j24137	.....G.		.C.....		.A.....	
j21533	.....G.		.C.....		.A.....	
d16838	.....G.		.C.....		.A.....	
j14937	.....G.		.C.....		.A.....	
j17711	.....G.		.C.....		.A.....	
j19319	.....G.		.C.....		.A.....	
j19301	.....G.		.C.....		.A.....	
j19286	.....G.		.C.....		.A.....	
j17722	.....G.		.C.....		.A.....	
d20034	.....G.		.C.....		.A.....	



```

d24465 .....C.....A.....
j23667 .....A.....C.....A.....
j23357 .....C.....A.....
j21819 .....C.....A.....
j21111 .....C.....A.....G
j22642 .....C.....A.....
j21532 .....C.....A.....
j21147 .....C.....A.....
j23578 .....C.....A.....GA.
j23895 .....C.....A.....
d24132 .....C.....A.....
d21428 .....C.....A.....
d24299 .....C.....A.....
d23652 .....A.....C.....A.....
j23275 .....A.....C.....ATC T.....
j24307 .....C.....A.....
d21467 .....C.....A.....
d16387 .....C.....A.....
d16254 .....C.....A.....
d24505 .....C.....A.....
j23374 .....G.....A.....C.....A.....
j21579 .....G.....A.....C.....T.....A.....
d21869 .....C.....A.....
d22547 .....C.....A.....
d16347 .....C.....A.....
d21057 .....C.....A.....A.....
d20896 .....G.....T.....C.....A.....
d20813 .....G.....C.....C.....A.....
d20519 .....C.....A.....
d21570 .....C.....C.....A.....
j19901 .....C.....A.....T.....A.....
d332 ..TT.....C.....A.....
d733 ..TT.....C.....A.....
o469 ..TC.....C.....A.....A.....
d310 ..TT...G.....C.....A.....
d203 ..TT...G.....C.....A.....
o578/95 ..TC.....C.....A.....
j504/96 ..TT...G.....C.....A.....
o214/98 ..TC-.T.....N.....C.....A.....
o774/95 ..TC.....C.....A.....
o414/96 ..TC.....C.....A.....
o377 ..CT.....C.....A.....C...
j101 ..CT.....C.....A.....
d57 ..TT.....C.....A.....
j378 ..TT.....C.....A.....
d56 ..TT.....C.....A.....
d8/96 ..TT.G.....A.....C.....A.....
d95/755 ..TT.....TA.....C.....A.....
306/98 ..TT...G.....C.....A.....
527/98 ..TT...G.....C.....A.....
d77 ..TT...G.....C.....A.....
j1627 ..TT...G.....C.....A.....

351      361      371      381      391      400
|         |         |         |         |         |
pv ATCAAGCAAG A-T---CATG -TAGATTCT- ----CA--- ---TAATAG-
o615/91 .....A....G.....T.....C.....-.....CG
o491/98 .....A....G.....T.....C.....-.....CA
c938 .....A....G.....T.....C.....-.....CG
j544 .....A....G.....T.....C.....-.....CG
j598 .....A....G.....C.....C.....-.....CG
j669 .....A....G.....T.....C.....-.....CG
o462 -----,-----,.....T.....C.....-.....CG
d20548 .....A....G.....T.....C.....-.....CG
d352 .....A....G.....T.....C.....-.....CG

```



j602	.....A....	G.....	.T.....	C.....	-.....	.....CG
d19366	.....A....	G.....	.T.....	C.....	-.....	.....CG
j19344	.....A..G.	-.....	.T.....	C.....	-.....	.....CG
j717	.....A....	G.....	.T.....	C.....	-.....	.....CG
j596	.....AA...	G.....	.T.....	C.....	-.....	.....CG
j631	.....A....	G.....	.T.....	C.....	-.....	.....CG
j673	.....A....	G.....	.T.....	C.....	-.....	.....CG
982/97	.....A....	G.....	.T.....	C.....	-.....	.....C.
wd800/97	.....A....	G.....	.T.....	C.....	-.....	.....C.
wd884/97	.....A....	G.....	.T.....	C.....	-.....	.....C.
d224/98	.....A....	G.....	.T.....	C.....	-.....	.....CG
j1403	.....A....	G.....	.T.....	C.....	-.....	.....CG
675/99	.....A....	G.....	.T.....	C.....	-.....	.....CG
d820	.....A....	G.....	.T.....	C.....	-.....	.....CG
j446	.....A....	G.....A.	.T.....	C.....	-.....	.....CG
j773	.....G.....	.....	.T.....	C.....	-.....	.....CG
j19273	.....A....	G.....	.T.....	C.....	-.....	.....C.
d19347	.....A....	G.....	.T.....	T.....	.....	.....C.
d19385	.....A....	G.....	.T.....	C.....	-.....	.....C.
d16234	.....-....	G.....	.T.....	C.....	-.....	.....C.
d14702	.....A....	G.....	.T.....	C.....	-.....	.....C.
j14917	.....A....	G.....	.T.....	C.....	-.....	.....C.
j24137	.....A....	G.....	.T.....	C.....	-.....	.....C.
j21533	.....A....	G.....	.T.....	C.....	-.....	.....C.
d16838	.....A....	G.....	.T.....	C.....	-.....	.....C.
j14937	.....A....	G.....	.T.....	C.....	-.....	.....C.
j17711	.....A....	G.....	.C.....	C.....	-.....	.....C.
j19319	.....A....	G.....	.T.....	C.....	-.....	.....GC.
j19301	.....A....	G.....	.T.....	C.....	-.....	.....C.
j19286	.....A....	G.....	.T.....	C.....	-.....	.....C.
j17722	.....A....	GG.....	.T.....	C.....	-.....	.....C.
d20034	.....A....	G.....	.T.....	C.....	-.....	.....C.
d24465	.....A....	G.....	.T.....	C.....	-.....	.....C.
j23667	.....A....	G.....	.T.....	C.....	-.....	.....C.
j23357	.....A....	G.....	.T.....	C.....	-.....	.....C.
j21819	.....A....	G.....	.T.....	C.....	-.....	.....C.
j21111	.....A....	G.....	.T.....	C.....	-.....	.....C.
j22642	.....A....	G.....	.T.....	C.....	-.....	.....C.
j21532	.....A....	G.....	.T.....	C.....	-.....	.....C.
j21147	.....A....	G.....	.T.....	C.....	-.....	.....C.
j23578	.....A....	G.....	.T.....	C.....	-.....	.....C.
j23895	.....A....	G.....	.T.....	C.....	-.....	.....C.
d24132	.....A....	G.....	.T.....	C.....	-.....	.....C.
d21428	.....A....	G.....	.T.....	C.....	-.....	.....C.
d24299	.....A....	G.....	.T.....	C.....	-.....	.....C.
d23652	.....A....	G.....	.T.....	C.....	-.....	.....CC
j23275	.....A....	G.....	.T.....	C.....	-.....	.....C.
j24307	.....A....	G.....	.T.....	C.....	-.....	.....C.
d21467	.T..A....	G.....	.T.....	C.....	-.....	.....C.
d16387	.....A....	G.....	.T.....	C.....	-.....	.....C.
d16254	.....A....	G.....	.T.....	C.....	-.....	.....C.
d24505	.....A....	G.....	.T.....	C.....	-.....	.....C.
j23374	.....A....	G.....	.T.....	C.....	-.....	.....C.
j21579	.....A....	G.....	.T.....	C.....	-.....	.....C.
d21869	.....A....	G.....	.T.....	C.....	-.....	.....CG
d22547	.....A....	G.....	.T.....	C.....	-.....	.....CG
d16347	.....A....	G.....	.T.....	C.....	-.....	.....CG
d21057	.....A....	G.....	.T.....	T.....	.T.....	.....CG
d20896	.....A....	G.....	.T.....	C.....	-.....	.....CG
d20813	.....A....	G.....	.T.....	T.....	.....	.....CA
d20519	.....A....	G.....	.T.....	C.....	-.....	.....CG
d21570	.....A....	G.....	.T.....	C.....	-.....	.....C.
j19901	T.G.TAAC.A	G.....	.T.....	C.....	-.....	.....C.
d332	.....A....	G.....	.T.....	C.....	-.....	.....CG
d733	.....A....	G.....	.T.....	C.....	-.....	.....CG



```

o469 .....A....G......T......CA
d310 .....A....G......T......CG
d203 .....A....G......T......CG
o578/95 .....A....G......T......CG
j504/96 .....A....G......T......CG
o214/98 .....A....G.-.....T......C.
o774/95 .....A....G......T......C.
o414/96 .....GA....G......T......C.
o377 .C...A....G......G......C.
j101 ....CA..C.G......C......C.
d57 .....A....G......T......C.
j378 .....A....G......T......
d56 .....A....G......T......C.
d8/96 .....A....-G......T......CG
d95/755 .....A....G......T......CG
306/98 .....A....G......T......CG
527/98 .....A....G......T......CG
d77 .....A....G......T......C.
j1627 .....A....-G......T......CG

401      411      421      431      441      450
|         |         |         |         |         |
pv GGG---AGAT CTTCT----- -AGCAGT--- --TT--CA-G TGACTAA---
o615/91 ..-...A.. ..-...T.....T......C...A
o491/98 ..-...A.. ..-...T.....T......CT...A
c938 AA-...A.. ..-...T.....T......CT...A
j544 ..-...A.. ..-...T.....T......A..C...A
j598 ..-...A.. ..-...T.....T......C...A
j669 ..-...A.. ..-...T.....T......C...A
o462 ..-...A.. ..-...T.....T......CT...A
d20548 ..-...A.. ..A....T.....T......C...A
d352 ..-...A.. ..-...T.....T......C...A
j602 ..-...A.. ..-...T.....T......C...A
d19366 ..-...A.. ..-...T.....T......C...A
j19344 ..-...A.. ..-...T.....T......C...A
j717 ..-...A.. ..-...T.....T......C...A
j596 ..-...A.. ..-...T.....T......C...A
j631 ..-...A.. ..-...T.....T......C...A
j673 ..-...A.. ..-...T.....T......C...A
j982/97 ..-...A.. ..-...T.....T......C--A.A
wd800/97 ..-...A.. ..-...T.....T......C...A
wd884/97 ..-...A.. ..-...T.....T......C...A
d224/98 ..-...A.. ..-...T.....T......C...A
j1403 ..-...A.. ..-...T...C...T.....T...C...A
675/99 ..-...A.. ..-...T.....T......C...A
d820 ..-...A.. ..-...TTC AG.-...-...C....
j446 ..-...A.. ..-...TTC AG.-...-...C....
j773 ..-...A.. ..-...TTC AG.-...-...C....
j19273 ..-...A.. ..-...TTC AG.-...-...C...A
d19347 ..-...A.. ..-...TTC AG.-...-...C....
d19385 ..-...A.. ..-...TTC AG.-...-...C....
d16234 ..-...A.. ..-...TTC AG.-...-...C..T..
d14702 ..-...A.. ..-...TTC AG.-...-...C..T..
j14917 ..-...A.. ..-...TTC AG.-...-...C..T..
j24137 ..-...A.. ..-...TTC AG.-...-...C..T..
j21533 ..-...A.. ..-...TTC AG.-...-...C..T..
d16838 ..-...A.. ..-...TTC AG.-...-...C..C..
j14937 ..-...A.. ..-...TTC AG.-...-...C..C..
j17711 ..-...A.. ..-...TTC AG.-...-...C..C..
j19319 ..-...A.. ..-...TTC AG.-...-...C..C..
j19301 ..-...A.. ..-...TTC AG.-...-...C..C..
j19286 ..-...A.. ..-...TTC AG.-...-...C..C..
j17722 ..-...A.. ..-...TTC AG.-...-...C..C..
d20034 ..-...A.. ..-...TTC AG.-...-...C..CC.
d24465 A.....A.. ..-...TTC AG.-...-...C...A

```



j23667	A.....A..					C.-.A
j23357	A.....A..					C.-.A
j21819	.....A..					C.-.A
j21111	.....A..					C.-.A
j22642	.....A..					C.-.A
j21532	.....A..					C.-.A
j21147	.....A..					C.-.A
j23578	.....A..					C.-.A
j23895	.....A..					C.-.A
d24132	.....A..					C.-.A
d21428	T.....A..		C.....			C.-.A
d24299	T.....A..					C.-.A
d23652	.....A..					C.-.A
j23275	.....A..	T.....		T.....		C..A.A
j24307	A.....A..	-.....				C.-.A
d21467	.....A..					C.-.A
d16387	.....A..	A.....	-.....	T.....		C.-.A
d16254	.....A..	A.....	-.....	T.....		C.-..
d24505	.....A..	A.....	GC.....	T.....		C.-.A
j23374	.....A..					C.-.A
j21579	.....A..	T.....	A.....			C..C.C
d21869	..A...A-				C.A..	C...C
d22547	..A...A-				C.A..	C...C
d16347	..A...A-				C.A..	C...C
d21057	..A...A..	TA...	GC.....	C.A..		C..C..C
d20896	..A...A-					C.....
d20813	..A...A-					C.....
d20519	..A...A-				C.A..	C.....
d21570	.....A..					C..C..
j19901	..-...A..	CT.....	-A.....	-.....	-.....	C.-...
d332	..-...A..		TTC AG.-.-.-	-.....		C.....
d733	..-...A..		TTC AG.-.-.-	-.....		C.-...
o469	..-...A..		TTC AG.-.-.-	-.....	CT....	
d310	..-...A..		TTC AG.-.-.-	-.....		C.....
d203	..-...A..		TTC AG.-.-.-	-A..	C.....	
o578/95	..-...A..	T.....	T.....			C--TA.
j504/96	..-...A..	T.....	T.....			C--GA.
o214/98	.....A..		T.....			CT-.A.
o774/95	.....A..		T.....			CT-.A.
o414/96	.....A..		T.....			CT-.A.
o377	.....A..					C.....
j101	.....A..	A.....	T.....			C.....
d57	.....A..					C.....
j378	.....A..					C.....
d56	.....A..					C.....
d8/96	..-...A..			T.....		C--AA.
d95/755	..-...A..			T.....		C.-.A.
306/98	..-...A..			T.....		CGG.A.
527/98	..-...A..			T.....		C.-.A.
d77	.....A..	A.....	T.....			C.....
j1627	..-...A..			T.....		C--AA.
	451	461	471	481	491	500
pv	CGG-TG-CTT	TCATTCTCC-	-A-GGAA--C	T--GACAC-C	AAC----AG-	
o615/91	.....CT..	C-.....	.G.....	.....G.TCA	..-...G..	
o491/98	.....CT..	C-.....	.G.....	.....G.TCA	..-...G..	
c938	.....CT..	C-.....	.....	.....G.TCA	..-...G..	
j544	.....CT..	C-.....T..	.G.....	.....G.TCA	..-...G..	
j598	.....CT..	C-.....	.....G...	.....T.TCA	..-...G..	
j669	.....CT..	C-.....	.....	.....G.TCA	C.-...G..	
o462	.....CT..	C-.....	.G.....	.....G.TCA	..-...G..	
d20548	.....CT..	C-.....	.....	.....T.TCA	..-...G..	
d352	.....CT..	C-.....T..	.....GG...	.....T.TCA	..-...G..	
j602	.....CT..	C-.....	.....	.....TGTC	..-...G..	



d19366CT.. C-..... T.TCA ..-...G..
 j19344CT.. C-..... T.TCA ..-...G..
 j717CT.. C-..... G.TCA C-...G..
 j596CT.. CG.....G..... T.TCA G-...G..
 j631CT.. C-..... G.TCA C-...G..
 j673CT.. C-..... G.TCA C-...G..
 j982/97G.A.-..... G.TCA C-...AG..
 wd800/97G.A.-..... G.TCA ..-...G..
 wd884/97G.A.-..... G.TCA ..-...G..
 d224/98G...-..... T.TCA G-...G..
 j1403CT.. C-..... C.T.TCA ..-...G..
 675/99CT.. C-.....A..... TGTCA ..-...G..
 d820A-..... G.T... --.CAG..
 j446G.T... --.CAG..
 j773C..... T... --.CAG..
 j19273 ..-G.....-CA-..... T.TCA ..-...G..
 d19347A .G.A.-..... T.TCA ..-...G..
 d19385A .G.A.-..... T.TCA ..A...G..
 d16234 -.....-C T.T... .A...G..
 d14702 -.....-NC T.T... .A...G..
 j14917 -.....-C T.T... .A...G..
 j24137 -.....-C T.T... .A...G..
 j21533 -.....-C-T.T.T... .A...G..
 d16838 -.....-C T.T... .A...G..
 j14937 -.....-C T.T... .A...G..
 j17711 -.....-C T.T... .A...G..
 j19319 -.....T.C T.T... .A...G..
 j19301 -.....-C T.T... .A...G..
 j19286 -.....-C T.T... .A...G..
 j17722 -.....-C T.T... .A...G.G
 d20034 -.....-C T.T... .A...G..
 d24465C..... T.T... ..-...AG..
 j23667C..... T.T... ..-...AG..
 j23357C..... T.T... ..-...AG..
 j21819C..... T.T... ..-...AG..
 j21111C..... T.T... ..-...AG..
 j22642C..... T.T... ..-...AG..
 j21532C..... T.T... ..-...AG..
 j21147C..... T.T... ..-...AG..
 j23578-.....C T.T... ..-...AG..
 j23895C..... T.T... ..-...AG..
 d24132C..... T.T... ..-...AG..
 d21428C..... T.T.T... ..-...AG..
 d24299C..... T.T... ..-...AG..
 d23652TC..... T.T... ..-...AG..
 j23275TC.....-..... T.T... ..-...AG..
 j24307C...T.C-..... T.T... ..-...AG..
 d21467C...T.C T.T... ..-...AG..
 d16387T.T... ..-...AG..
 d16254T.T... ..-...AG..
 d24505G..... T.TT... ..-...AG..
 j23374G.T... C-...AG..
 j21579 -.....-C C.T.G.T... .CA...G..
 d21869 -.....T.-T... ..-...GG..
 d22547 -.....T.-T... ..-...GG..
 d16347 -.....G..... T.-T... ..-...GG..
 d21057G... .A.....T... ..A...ACTT.AT... ..-...GG..
 d20896T.-T... ..-...AG..
 d20813 T.....T.-T... ..-...AG..
 d20519T.-T... ..-...GG..
 d21570 -.....T.T.T... .A...G..
 j19901T.T.CA-..... T.TCA ..-...G-
 d332G..... T...T.T... --.GAG..
 d733TGT... --.AAG..
 o469G..... G.T... --.AAG..



d310	.....	.....	.....	T...TGT..	...AAG..	
d203	.....T..	.....T..	.G.....	.....G.T..	...AAG..	
o578/95	.....	.....	.G.....	.....G.T..	...AAG..G	
j504/96	.....	.....	.....	.....G.T..	...AAG..G	
o214/98	.....	.....	.G.....	.....G.T..	...AAG..G..	
o774/95	.....	.....	.G.....	.....G.T..	...AAG..G..	
o414/96	.....	.....	.G.....	.....G.T..	...AAG..G..	
o377	.....	.....	-.G.A..	.....G.T..	...AAG..G..	
j101	.....	.....	.....G...	.....T.T..	...AAG..G..	
d57	.....	.....	.....G...	.....T.T..	...AAG..G..	
j378	.....	.....	.....G...	.....T.T..	...AAG..G..	
d56	.....	.....	.....G...	.....T.T..	...AAG..G..	
d8/96	.....	.....	.....	.....G.T..	...C...C...	
d95/755	.....	.....	.....G...	.....T.T..	...AAG..G..	
306/98	.....	.....	.....	.....GTGT..	...AAG..G..	
527/98	.....	.....	.....	.....TGT..	...AAG..G..	
d77	.....	.....	.....	.....T.T..	...AAG..G..	
j1627	.....	.....	.....	.....T.T..	...AAG..G..	
	501	511	521	531	541	550
pv	--TTGTAG-A	CAAATC---A	CGG--GGTGT	CT-CAG-GTG	ATTCT--GCG	
o615/91	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
o491/98	.....T..	.GGG-.C...	A.A....	T...G....	.C..C...T.	
c938	.....	.GGG-.C...	A.A....C.	T...G....	.C..C...T.	
j544	.....	.GGGG.C...	A.A....A.	T...G....	.C..C...T.	
j598	.....	.GGG-.C...	A.A....A.	...G....	.C..C...T.	
j669	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
o462	.....	.GGG-.C.T	A.A....A.	T...G....A	.C..C...T.	
d20548	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...-	
d352	.....	.GGG-.C...	A.A....A.	T...G..A..	.C..C...T.	
j602	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
d19366	.....	.GGG-.C...	A.A....A.	T...G..A.A	.C..C...T.	
j19344	.....	.GGG-.C...	A.A....A.	T...G..A.A	.C..C...T.	
j717	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j596	...C.....	.GGG-.C...	A.A....A.	T...G..A..	.C..C...T.	
j631	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j673	.....	.GGG-.C...	A.A....A.	T...G....	.CC.C...T.	
j982/97	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
wd800/97	.....C.	.GGGC....	A.A....A.	T.G.G....	.C..C...T.	
wd884/97	.....	.GGGC....	A.A....A.	T...G....	.C..C...T.	
d224/98	...C.....	.GGGC....	A.A....-A.	T...G..A..	.C..C...T.	
j1403	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
675/99	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
d820	.....-	.GGG.C...	A.A....A.	T...G.G-	.C..C...T.	
j446	.....	.GGG.C...	A.A....A.	...G.A-	.C..C...T.	
j773	.....	.GGG.C...	A.A....A.	T...G.G-	.C..C...T.	
j19273	.....C	.GGGC-	A.A....-A.	T...G..A.A	-C..C...T.	
d19347	.....	.GGG-.C...	A.A....A.	T...G..A.A	-C..G...T.	
d19385	.....	.GGG-.C...	A.A....A.	T...G..A.A	.C..C...T.	
d16234	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
d14702	.....	.GGG-.C...	A.A....A.	T...G....	.C..CC..T.	
j14917	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j24137	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j21533	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
d16838	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j14937	.....	.GG--.C...	A.A....A.	T...G....	.C..C...T.	
j17711	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j19319	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j19301	.....	.GGG-.C...	A.A....A.	T...G....	.C..CC..T.	
j19286	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
j17722	.....	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
d20034	.....C.	.GGG-.C...	A.A....A.	T...G....	.C..C...T.	
d24465	.....	.GGG-.C...	A.A....A.	T...G..A.A	.C..CG.T-	
j23667	.....	.GGG-.C...	A.A....A.	T...G..A.A	.C..CG.T-	



```

j23357 ..... GGG-.C... A.A.....A. T...G..A.A .C..CG.T-.
j21819 ..... GGG-.C... A.A.....A. T..TG..A.A .C..CG.T-.
j21111 ..... GGG-.C... A.A.....A. T...G..A.A .C..CG.T-.
j22642 ..... GGG-.C... A.A.....A. T...G..A.A .C..CG.T-.
j21532 ..... GGG-.C... A.A.....A. T...G..A.A .C..CG.T-.
j21147 ..... GGG-.C... A.A.....A. T...G..A.A .C..CG.T-.
j23578 ..... GGG-.C... A.A.....A. T...G..A.A .C..CG.T-.
j23895 ..... GGG-.C... A.A.....A. T...G..A.A .C..C...T.
d24132 ..... GGG-.C... A.A.....A. T...G..A.A .C..C...T.
d21428 ..... GGG-.C... -A.....A. T...G..A.A .C..CC...T.
d24299 ..... GGG-.C... A.A.....A. T...G..A.A .C..C...T.
d23652 ..... GGG-.C... A.A.....A. T...G..A.A .C..CC...T.
j23275 ..... GGGG.C... A.A.....A. T...G..A.A .C..CC...-.
j24307 ..... GGC-.....- A.A.....A. T...G..A.A -C..CT...-.
d21467 ..... GGG-.C... A.A.....A. T...G..A.A .C..CC...T.
d16387 ..... GGG-.CA.- A.A.....A. T...G..A.A .C..CG.T-.
d16254 ..... GGG-.CA.- A.A.....A. T.....A.A .C..CG.T-.
d24505 ..... GGG-.CA.- A.AA...A. T...G..A.A .C..CG.T-.
j23374 ..... GGGC..... A.A.....A. T...G..... .C..CG.T-.
j21579 ..... GGG-.C... A.A.....A. T...G..... .C..C...T.
d21869 ..... GGGC..A.. A.A.....A. T...G..A.. .C..C...T.
d22547 ..... GGGC..... A.A.....A. T...G..A.. .C..C...T.
d16347 ..... GGGC..... A.A.....A. T...G..A.. .C..CC...T.
d21057 ..... GGGC..C.. A.AA...A. T...G.GA.. .C..C...T.
d20896 ..... GGGC..... A.A.....A. T...G...G. .C..C...T.
d20813 ..... GGGC..... A.A.....A. ....G..... .C..C...T.
d20519 ..... GGGC..... A.A.....A. T...G..A.. .C..C...T.
d21570 ..... GGG-.C... A.A.....A. T...G..A.. .C..C...T.
j19901 ..... GGGC-.C... A.A.....A. T...G..A.A .C..C...G.
d332 ...C..... -GGG.C... A.A.....A. T...G.A-... .C..C...T.
d733 .....C .GGG-.C... A.A.....A. T...G.G-... .C..C...T.
o469 .....T.. .CGGG.C... A.A..... .T...G.G-... .C..C...T.
d310 ..... GGG-.C... A.A.....A. T...G.G-... .C..C...T.
d203 ..... GGG-.C... A.A.....A. T...G.G... .C..C...T.
o578/95 ..... GGGC..... A.A.....A. T...G..... .C..C...T.
j504/96 ..... GGGC..... .A.....A. T...G..... .C..C...T.
o214/98 ..... GGGC..... A.A.....A. T.CGG...-... .C..C...T.
o774/95 ..... GGGC..... A.A.....A. T.CGG...-... .C..C...T.
o414/96 ..... GGGC..... A.A.....A. T..NG..... .C..C...T.
o377 ..... GGGC..... A.A.....A. T...G..... .C..C...T.
j101 .....A.. .GGGC..... A.A.....A. T...G..A.. .C..C...T.
d57 ..... GGGC..... A.A.....A. T...G..A.. .C..C...T.
j378 ..... GGGC..... A.A.....A. T...G..A.. .C..C...T.
d56 ..... GGGC..... A.A.....A. T...G..A.. .C..C...T.
d8/96 ..... GGGC..... A.A.....A. ....G..... .C..C...T.
d95/755 .....C. .GGGC..... A.A.....A. T.G.G..A.. .C..C...T.
306/98 ..... GGGC..... A.A.....A. T...G..... .C..C...T.
527/98 .....C.... .GGGC..... A.A.....A. T...G..... .C..C...T.
d77 ..... GGGC..... A.A.....A. T...G..... .C..C...T.
j1627 ..... GGGC..... A.A.....A. T...G..... .C..C...T.

551      561      571      581      591      600
|         |         |         |         |         |
pv CTT-GGGCAC AGACAAAGGT CATGGTGTG- ---TTCCA-- --TGA-TAGC
o615/91 T.....G..... .A.AC.. .C..... .A.....
o491/98 .....G..... .A.AC.. .C..... .A.....
c938 .....C..... .A.AC.. .C..... .A.....
j544 .....G..... T.A.ACA. .C..... .A.....
j598 .....G..... .A.AC.. .C..C.. .A.....
j669 .....A..... .G..... .A.AC.. .C..... .A.....
o462 .....G..... .A.AC.. .C..... .A.....
d20548 .....T... .G..... .A.AC.. .C..C.. .A.....
d352 .....G..... .A.AC.. .C..... .A.....
j602 .....G..... .A.AC.. .C..C.. .A.....
d19366 .....G..... .A.AC.. .C..... .A.....

```



j19344G.....A..AC.. ..C.....A.....
 j717A.....G.....A..AC.. ..C.....A.....
 j596G.....A..AC.. ..C.....A.....
 j631A.....G.....A..AC.. ..C.....A.....
 j673A.....G.....A..AC.. ..C.....A.....
 j982/97A.....G.....A..AC.. ..C.....CA.....
 wd800/97G.....A..AC.. ..C.....A.....
 wd884/97G.....A..AC.. ..C.....A.....
 d224/98G.....G.A..AC.. ..C.....A.....
 j1403G.....A..AC.. ..C..C.. ..A.....
 675/99G.....A..AC.. ..C..C.. ..A.....
 d820A.....G.....A..AC.. ..C.....CA.....
 j446G.....A..AC.. ..C.....CA.....
 j773G.....A..A.. ..C.....A.....
 j19273G.....A..A.. ..C..-A.. ..A.....
 d19347 -.....G.....A..AC.. ..C..-A.. ..A.....
 d19385G.....A..AC.. ..C..-A.. ..A.....
 d16234G.....A..AC.. ..C..C.. ..A.....
 d14702G.....A..AC.. ..C..C.. ..A.....
 j14917G.....A..AC.. ..C..C.. ..A.....
 j24137G.....A..AC.. ..C..C.. ..A.....
 j21533G.....A..AC.. ..C.TC.. ..A.....
 d16838G.....A..AC.. ..C..C.. ..A.....
 j14937G.....A..AC.. ..C..C.. ..A.....
 j17711G.....A..AC.. ..C..C.. ..A.....
 j19319T.....G.....A..AC.. ..C..C.. ..A.....
 j19301G.....A..AC.. ..C..C.. ..A.....
 j19286G.....A..AC.. ..C..C.. ..A.....
 j17722G.....A..AC.. ..C..C.. ..A.....
 d20034G.....A..AC.. ..C..CC.. ..A.....
 d24465G.....A..AC.. ..C..-A.. ..A.....
 j23667G.....A..AC.. ..C..-A.. ..A.....
 j23357G.....A..AC.. ..C..-A.. ..A.....
 j21819G.....A..AC.. ..C..-A.. ..A.....
 j21111G.....A..AC.. ..C..-A.. ..A.....
 j22642G.....A..AC.. ..C..-A.. ..A.....
 j21532G.....A..AC.. ..C..-A.. ..A.....
 j21147G.....A..AC.. ..C..-A.. ..A.....
 j23578G.....A..AC.. ..C..-A.. ..A.....
 j23895A.....G.....A..AC.. ..C..-A.. ..A.....
 d24132G.....A..AC.. ..C..-A.. ..A.....
 d21428G.....A..AC.. ..C..-A.. ..A.....
 d24299G.....A..AC.. ..C..-A.. ..A.....
 d23652G.....A..AC.. ..C..CA.. ..A.....
 j23275G.....A..AC.. ..C..CA.. ..A.....
 j24307C..-.....A..AC.G ..C..CA.. ..A.....
 d21467G.....A..AC.. ..C..CA.. ..A.....
 d16387G.....A..AC.. ..C..-A.. ..A.....
 d16254G.....A..AC.. ..C..-A.. ..A.....
 d24505G.....A..AC.G ..C..-A.. ..A.....
 j23374A.....G.....A..AC.. ..C..-A.. ..A.....
 j21579A.....G.....A..AC.. ..C.....A..G..
 d21869 .G.....G.....A..AC.. ..C..-A.. ..A.....
 d22547 .G.....G.....A..AC.. ..C..-A.. ..A.....
 d16347 .G.....G.....A..AC.. ..C..-A.. ..A.....
 d21057 .G.....G.....A..AC.. ..C..-A.. ..A.....
 d20896G.....A..AC.. ..C..-..CA.....
 d20813G.....A..AC.. ..C..-..CA.....
 d20519 .G.....A..G.....A..AC.. ..C..-..A.A.....
 d21570G.....A..AC.. ..C..-A..CA..C..
 j19901G.....A..AC.. ..C..-A.. ..A.....
 d332 ..A.....G.....A..AC.. ..C.....A.....
 d733C.....G.....A..AC.. ..C..C.. ..A.....
 o469T.....G.....A..AC.. ..C.....A.....
 d310G.....A..AC.. ..C..C.. ..A.....



```

d203 .....G.... T..A..AC.. ....C..... A.....
o578/95 .....G.... ..A..AC.. ....C..... A.....
j504/96 .....G.... ..A..AC.. ....CC..... A.....
o214/98 .....G.... ..A..AC.. ....C..... A.....
o774/95 .....G.... ..A..CC.. ....C..... A.....
o414/96 .....G.... ..A..AC.. ....C..... A.....
o377 .....G.... ..A..AC.. ....C..... AC.....
j101 .....G.... ..A..AC.. ....C..... A.....
d57 .....G.... ..A..CAC.. ..G.C.-.. A.....
j378 .....G.... ..A..AC.. ....C..... A.....
d56 .....G.... ..A..AC.. ....C..... A.....
d8/96 ...A.....G.... ..A..AC.. ....C..... A.....
d95/755 .....G.... ..A..AC.. ....C..... A.....
306/98 .....G.... ..A..AC.. ....C..C.. A.....
527/98 .....G.... ..A..AC.. ....C..C.. A.....
d77 .....G.... ..A..AC.. ....C..C.. A.....
j1627 .....G.... ..A..AC.. ....C..C.. A.....

        601          611          621          631          641          650
        |           |           |           |           |           |
pv      GGA CTCAG-G ATGACTTAAT TGA----- --GAGAGGCA A-TCTTCCTC
o615/91 A.....A.C .....CG.. ...G..... --A..... G.....
o491/98 A.....A.C .....CG.. ...G..... --A..... G.....
c938    A.....A.C .....CG.. ...G..... --A..... G.....
j544    A.....A.C .....CG.. ...G..... --A..... G.....
j598    A.....A.C .....CG.. ...GTCGATT GA..A..... G.....
j669    A.....A.C .....CG.. ...G..... --A..... G.....
o462    A.....A.C .....CG.. ...G..... --A..... G.....
d20548 A.....A.C .....CG.. ...G..... --A..... G.....
d352    A.....A.. .....CG.. ...G..... --A..... G.....
j602    A.....A.C .....CG.. ...G..... --A..... G.....
d19366 A.....A.C .....CG.. ...G..... --A..... G.....
j19344 A.....A.C .....CG.. ...G..... --A..... G.....
j717    A.....A.C .....CG.. ...G..... --A..... G.....
j596    A.....A.. .....CG.. ...G..... --A..... T..... G.....
j631    A.....A.C .....CG.. ...G..... --A..... G.....
j673    A.....A.C .....CG.. ...G..... --A..... G.....
j982/97 A.....A.C .....CG.. ...G..... --A..... G.....
wd800/97 A.....A.C .....CG.. .....A..... G.....
wd884/97 A.....A.C .....CG.. .....A..... G.....
d224/98 A.....A.. .....CG.. .....A..... G.....
j1403   A.....A.. .....CG.. ...G..... --A..... G.....
675/99  A.....A.C .....CG.. ...G..... --A..... G.....
d820    A.....A.C .....CG.. .....A..... G.....
j446    A.....A.C .....CG.. ...C..... ..C..... G.....
j773    A.....A.C G.....CG.. .....C..... G.....
j19273 A.....A.C .....CG.. .....A..... G.....
d19347 A.....A.C .....CG.. .....A..... G.....
d19385 A.....A.C .....G..... .....A..... G.....
d16234 A.....A.C .....CG.. .....A..... GT...
d14702 A.....A.C .....CG.. .....A..... GT...
j14917 A.....A.C .....CG.. .....GA..... GT...
j24137 A.....A.C .....CG.. .....A..... GT...
j21533 A.....A.C .....CG.. .....A.A..... GT...
d16838 A.....A.C .....CG.. .....A..... G.....
j14937 A.....A.C .....CG.. .....A..... G.....
j17711 A.....A.C .....CG.. .....A..... G.....
j19319 A.....A.C .....CG.. .....A..... G.....
j19301 A.....A.C .....CG.. .....A..... G.....
j19286 A.....A.C .....CG.. .....A..... G.....
j17722 A.....A.C .....CG.. .....A..... G.....
d20034 A.....A.C .....CG.. .....A..... T..... G.....
d24465 A.....A.C .....CG.. .....A..... G.....
j23667 A.....A.C .....CG.. .....A..... G.....
j23357 A.....A.C .....CG.. .....A..... G.....

```



j21819	A.....A.C	.....CG..	.....A.....	.....G.....
j21111	A.....A.C	.....CG..	.....A.....	.....G.....
j22642	A.....A.C	.....CG..	.....A.....	.....G.....
j21532	A.....A.C	.....CG..	.....A.....	.....G.....
j21147	A.....A.C	.....CG..	.....A.....	.....G.....
j23578	A.....A.C	.....CG..	.....A.....	.....G.....
j23895	A.....A.C	.....CG..	.....A.....	.....G.....
d24132	A.....A.C	.....CG..	.....A.....	.....G.....
d21428	A.....T.A.C	.....CG..	.....A.....	.....G.....
d24299	A.....T.A.C	.....CG..	.....A.....	.....G.....
d23652	A.....A.C	.....CG..	.....A.....	.....G.....
j23275	A.....A.C	.....CG..	.....A.....	.....G.....
j24307	A.....A.C	.....CG..	.....A.....	.....G.....
d21467	A.....A.C	.....CG..	.....A.....	.....G.....
d16387	A.....A.C	.....CG..	.....A.....	.....G.....
d16254	A.....A.C	.....CG..	.....A.....	.....G.....
d24505	A.....A.C	.....CG..	.....A.....	.....G.....
j23374	A.....A.C	.....CG..	.....A.....	.....G.....
j21579	A.....A.C	.....CG..	.....A.....	.....G.....
d21869	A.....A.C	.....CG..	.....A.....	.....G.....
d22547	A.....A.C	.....CG..	.....A.....	.....G.....
d16347	A.....A.C	.....CG..	.....A.....	.....G.....
d21057	A.....A.C	.....CG..	.....A.....	.....G.....
d20896	AA.....A.C	.....CG..	.....A.....	.....G.....
d20813	A..T...A.C	.....CG..	C.....A.....	.....GT...
d20519	A.....A.C	.....CG..	.....A.....	.....G.....
d21570	A.....A.C	.....CG..	.....A.....	.....G.....
j19901	A.....AAC	.....CG..	.....A.....	.....G.....
d332	A.....A..	.....CG..	.....A.....	.....G.....
d733	A.....A.C	.....CG..	.....A.....	.....G.....
o469	A.....A.C	.....CG..	.....A.....	.....G.....
d310	A.....A.C	.....CG..	.....A.....	.....G.....
d203	A.....A.C	.....CG..	.....A-A.....	.....G.....
o578/95	A.....A.C	.....G.....	.....A.....	.....G.....
j504/96	A.....A.C	..T..CG..	.....A.....	.....G.....
o214/98	A.....A.C	.....CG..	.....A.....	.....G.....
o774/95	A.....A.C	.....CG..	.....A.....	.....G.....
o414/96	A.....A.C	.....CG..	.....A.....	.....G.....
o377	A.....A.C	.....CG..	.....A.....	.....G.....
j101	A.....A..	.....CG..	.....A.....	.....G.....
d57	A.....A..	.....CG..	.....A.....	.....G.....
j378	.....A..	.....CG..	.....A.....	.....G.....
d56	A.....A..	.....CG..	.....A.....	.....G.....
d8/96	A.....A.C	.....CG..	.....A.....	.....G.....
d95/755	A.....A..	.....CG..	.....A.....	.....G.....
306/98	A.....A.C	.....CG..	.....A.....	.....G.....
527/98	A.....A.C	.....CG..	.....A.....	.....G.....
d77	A.....A.C	.....CG..	.....A.....	.....G.....
j1627	A.....AC-	.....CG..	.....C.....	.....G.....
	651	661	671	681	691	700
pv	CCGTGA-AGG	ACACAAGCAG	TAGCTCAC-A	AT-CATCTCG	TGTTTCA-GC	
o615/91	.AA.....	...T....CAG..CT..	C..C.....	
o491/98	.AA.....	...T....AG	...A.T.	CA.C.....	
c938	.AA.....	...T....AG	...A.T.	...C.....	
j544	.AA.....	...T....A	...T....GT.	CA.C.....	
j598	.AA.....	...T....AG	...T.	CA.C.....	
j669	.AA.....	...T....AG	...T.	CA.C.....	
o462	.AA.....	...T....AG	...A.T.	CA.C.....	
d20548	.AA.....	...T....AG	...T.	C..C.....	
d352	.AA.....	...T....AT.G	...T.	CA.C.....	
j602	.AA.....	...T....AG	...T.	CA.C.....	
d19366	.AA.....	...T....AG	...T.	CA.C.....	
j19344	.AA.....	...T....AG	...T.	CA.C.....	



j717	.AA.....	..T....A	.....G	.....T.	CA.C.....
j596	.AA.....	..T....A	.....G	.....T.	CA.C.....
j631	.AA.....	..T....A	.....G	.....T.	CA.C.....
j673	.AA.....	..T....A	.....G	.....T.	CA.C.....
j982/97	.AA.....	..T....A	.....G	.....T.	CA.C.....
wd800/97	.AA.....	..T....A	.....G	.....T.	CA.C.....
wd884/97	.AA.....	..T....A	.....G	.....T.	CA.C.....
d224/98	.AA.....	..T....A	.....G	.....T.	CA.C.....
j1403	.AA.....	..T....A	.....AC.G TC,--	.....T.	AC.C.....
675/99	.AA.....	..T....A	.....G	.....T.	CA.C.....
d820	.AA.....	..T....A	.....G	.....T.	CA.C.....
j446	.AA.....	..T....A	.....G	.....T.	CA.C.....
j773	.A.....	..T....A	.....G	.....T.	CA.C.....
j19273	.AA.....	..T....A	.....G	.....T.	CA.C.....
d19347	.AA.....	..T....A	.....G	.....T.	CA.C.....
d19385	.AA.....	..T....A	.....G	.....T.	CA.C.....
d16234	.AA.....	..T.T....A	.....G	.....T.	CA.C.....
d14702	.AA.....	..T.T....A	.....G	.....T.	CA.C.....
j14917	.AA.....	..T.T....A	.....G	.....T.	CA.C.....
j24137	.AA.....	..T.T....A	.....G	.....T.	CA.C.....
j21533	.AAC.....	..T.T....A	.....G	.....T.	CA.C.....
d16838	.AA.....	..T....A	.....G	.....T.	CA.C.....
j14937	.AA.....	..T....A	.....G	.....T.	CA.C.....
j17711	.AA.....	..T....A	.....G	.....T.	CA.C.....
j19319	.AA.....	..T....A	.....G	.....T.	C..C.....
j19301	.AA.....	..T....A	.....G	.....T.	C..C.....
j19286	.AA.....	..T....A	.....G	.....T.	CA.C.....
j17722	.AA.....	..T....A	.....G	.....T.	CA.C.....
d20034	.AA.....	..T....A	.....G	.....T.	CA.C.....
d24465	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j23667	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j23357	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j21819	.AAC.....	..T....A	.....G	.....T.T.	CA.C.....
j21111	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j22642	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j21532	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j21147	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j23578	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j23895	.AA.....	..TG....A	.....G	.....T.	CA.C.....
d24132	.AA.....	..T....A	.....G	.....T.	CA.C.....
d21428	.AA.....	..T....A	.....G	.....T.	CA.C.....
d24299	.AA.....	..T....A	.....G	.....T.	CA.C.....
d23652	.AA.....	..T....A	.....G	.....T.	CA.C.....
j23275	.AAC.....	..T....A	.....G	.....T.	CA.C.....
j24307	.A.C.....	..T....A	.....G	.....T.	CA.C.....
d21467	.AAC.....	..T....A	.....G	.....T.	CA.C.....
d16387	.AA.....	..T....A	.....G	.....T.	CA.C.....
d16254	.AA.....	..T....A	.....G	.....T.	CA.C.....
d24505	.AA.....	..T....A	.....G	.....T.	CA.C.....
j23374	.AA.....	..T....A	.....G	.....T.	CA.C.....
j21579	.AA.....	..T....A	.....G	.....T.	CA.C.....
d21869	.AA.....	..T....A	..T..G..G	.....T.	CA.C.....
d22547	.AA.....	..T....A	..T....G	.....T.	CA.C.....
d16347	.AA.A.....	..T....A	..T....G	.....T.	CA.C.....
d21057	.AA.....	..T....A	..T....G	.....T.	CA.C.....
d20896	.AA.....	..T....A	.....G	.....T.	C..C.....
d20813	.AA.....	..T.T....A	.....G	.....T.	CA.C.....
d20519	.AA.....	..T....A	..T....G	.....T.	CA.C.....
d21570	.AA.....A.	..T....A	.....G	.....T.	CA.C.....
j19901	.AA.....-	..T....A	.....G	.....T.	CA.C.....
d332	.AA.....	..T....A	.....G	.....T.	CA.C.....
d733	.AA.....	..T....A	.....G	.....T.	CA.C.....
o469	.AA.....	..T....A	.....G	.....A.T.	CA.C.....
d310	.AA.....	..T....A	.....G	.....T.	CA.C.....
d203	.AA.....	..T....A	.....G	.....T.	CA.C.....



```

o578/95 .AA.....T....A.....G. T-....A.T. CA.C.....
j504/96 .AA.....T....A.....G. T-....T. CA.C.....
o214/98 .AA.....T....A.....G.....A.T. CA.C.....
o774/95 .AA.....T....A.....G.....A.T. CA.C.....
o414/96 .AA.....T....A.....G.....A.T. CA.C.....
o377 .AA.....T....A.....G.....T. CA.C.....
j101 .AA.....T....A.....T.G.....T. CA.C.....
d57 .AA.....T....A.....G.....T. CA.C.....
j378 .AA.....T....A.....G.....T. CA.C.....
d56 .AA.....T....A.....G.....T. CA.C.....
d8/96 .AA.....T....A.....G.....T. CA.C.....
d95/755 .AA.....T....A.....T.G.....T. CA.C.....
306/98 .AA.....T....A.....G.....T. CA.C.....
527/98 .AA.....T....A.....G.....T. CA.C.....
d77 .AA.....T....A.....G.....T. CA.C.....
j1627 .AA.....T....A.....G.....T. CA.C.....

701      711      721      731      741      750
|         |         |         |         |         |
pv AAAG-T--GT GCATAATTAT AAAGTGCTGG GTC-----A TCTAAGCTTT
o615/91 ...T.....C... ..G.....--...TC.
o491/98 ..CT..... ..G.....--...TC.
c938 ...T..... ..G.....--...TC.
j544 ...T..... ..G-----TC.
j598 ...T..... ..G.....--...TC.
j669 ...T..... ..G.....--...TC.
o462 ...T..... ..G.....--...TC.
d20548 ...T.....C... ..G.....--...TC.
d352 ...T..... ..G.....--...TC.
j602 ...T..... ..G.....--...TC.
d19366 ...T.....T.T... ..G.....--...TC.
j19344 ...T.....T..... ..G.....--...TC.
j717 ...T..... ..G.....--...TC.
j596 ...T..... ..G.....--...TC.
j631 ...T..... ..G.....--...TC.
j673 ...T..... ..G.....--...TC.
j982/97 ...T..... ..G.....--...TC.
wd800/97 ...T..... ..G.....--...TC.
wd884/97 ...T..... ..G.....--...TC.
d224/98 ...T..... ..G.....--...TC.
j1403 ...T..... ..G.....--...TC.
675/99 ...T..... ..G.....T--...TC.
d820 ...T..... ..G.....--...TC.
j446 ...T..... ..G.....--...TC.
j773 ...T..... ..G.....--...TC.
j19273 ...T-.T. .T.T... ..G.....
d19347 ...T-.T. .T.T... ..G.....
d19385 ...T-.T. .T.T... ..G.....
d16234 ...T..... ..G.....
d14702 ...T..... ..G.....
j14917 ...T..... ..G.G...
j24137 ...T..... ..G.....
j21533 ...T..... ..G.....
d16838 ...T..... ..G.....
j14937 ...T..... ..G.....
j17711 ...T..... ..G.....
j19319 ...T.....C... ..G.....
j19301 ...T.....C... ..G.....
j19286 ...T..... ..G.....
j17722 ...T..... ..G.....
d20034 ...T..... ..G.....
d24465 ...T.....T..... ..G.....
j23667 ...T.....T..... ..G.....
j23357 ...T.....T..... ..G.....
j21819 ...T.....T..... ..G.G...

```




j21111	. . . T . . . . .	. T . . . . .	. . . G . G . . .	. . . . .	. T
j22642	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j21532	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j21147	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j23578	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j23895	. . . T . . . . .	. T . C . . . . .	. . . G . . . . .	. . . . .	. . . . .
d24132	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
d21428	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
d24299	. . . T . . . . .	. T C	. . . G . . . . .	. . . . .	. . . . .
d23652	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j23275	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j24307	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
d21467	. . . T . . . . .	. T . . . . .	. . . G . . . . .	. . . . .	. . . . .
d16387	. . . T . . . . .	. T . T . . . . .	. . . G . . . . .	. . . . .	. . . . .
d16254	. . . T . . . . .	. T . T . . . . .	. . . G . . . . .	. . . . .	. . . . .
d24505	. . . T . . . . .	. T T . T . . . . .	. . . G . . . . .	. . . . .	. . . . .
j23374	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
j21579	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d21869	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d22547	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d16347	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d21057	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d20896	. . . T . . . . .	. . . C . . . . .	. . . G . . . . .	. . . . .	. . . . .
d20813	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d20519	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
d21570	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . . .	. . . . .
j19901	. . . T . - . T . . .	. T . T . . . . .	. . . G . T . . . . .	. . . . .	. T
d332	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d733	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . T -- . . .	. T C
o469	. . . C T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d310	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d203	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
o578/95	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
j504/96	. . . T . - . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
o214/98	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
o774/95	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
o414/96	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
o377	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
j101	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d57	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
j378	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d56	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d8/96	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d95/755	. . . T . . . . .	. . . C . . . . .	. . . G . . . . .	. . . -- . . .	. T C
306/98	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
527/98	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
d77	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
j1627	. . . T . . . . .	. . . . .	. . . G . . . . .	. . . -- . . .	. T C
		751	761	771	
pv	TCAG-TCGAG	AAAAAAA	---	-----	
o615/91	. . . . .	. . . . .	. . . . .	. . . . .
o491/98	. . . . .	. . . . .	. . . . .	. . . . .
c938	. . . . .	. . . . .	. . . . .	. . . . .
j544	. . . . .	. . . . .	. . . A . . . . .	. . . . .
j598	. . . A . C . . . . .	. . . . .	. . . . .	. . . . .
j669	. . . . .	. . . . .	. . . . .	. . . . .
o462	. . . . .	. . . . .	. . . . .	. . . . .
d20548	. . . . .	. . . . .	. . . . .	. . . . .
d352	. . . . .	. . . . .	. . . . .	. . . . .
j602	. . . . .	. . . . .	. . . . .	. . . . .
d19366	. . . . .	. . . . .	. . . . .	. . . . .
j19344	. . . . .	. . . . .	. . . . .	. . . . .
j717	. . . . .	. . . . .	. . . . .	. . . . .



j596
j631
j673
j982/97
wd800/97
wd884/97
d224/98
j1403 .AC.....
675/99G.....TCG
d820
j446
j773
j19273
d19347
d19385
d16234
d14702
j14917
j24137
j21533A.....
d16838
j14937
j17711
j19319
j19301
j19286
j17722
d20034
d24465
j23667
j23357
j21819A.....
j21111A.....
j22642
j21532
j21147
j23578
j23895
d24132
d21428
d24299
d23652
j23275
j24307
d21467
d16387
d16254
d24505
j23374
j21579
d21869
d22547
d16347
d21057
d20896
d20813
d20519
d21570
j19901
d332
d733 ..G.....
o469
d310
d203G.....
o578/95



j504/96
o214/98
o774/95
o414/96
o377
j101
d57
j378
d56
d8/96
d95/755
306/98
527/98
d77
j1627

Appendix 2a : A distance matrix of the canid virus isolates in group A1. The genetic distances were generated as described elsewhere (Felsenstein, 1993).

1	0.0																	
2	1.4	0.0																
3	0.5	1.1	0.0															
4	4.7	1.8	1.6	0.0														
5	2.4	3.0	1.9	2.6	0.0													
6	1.9	2.5	1.4	2.1	5.7	0.0												
7	1.0	1.8	0.5	1.4	1.7	1.2	0.0											
8	4.4	3.4	3.7	4.2	4.8	4.4	3.7	0.0										
9	2.4	2.5	1.9	2.5	3.1	2.6	1.9	4.0	0.0									
10	3.7	4.6	3.0	3.6	4.2	3.7	3.0	5.9	1.7	0.0								
11	2.8	3.2	2.2	2.8	3.5	3.0	2.2	4.2	0.7	2.1	0.0							
12	6.1	3.2	2.2	2.8	3.5	3.0	2.2	4.4	0.7	2.1	1.0	0.0						
13	3.3	3.6	2.8	3.3	4.0	3.5	2.8	5.0	1.4	2.8	1.7	1.7	0.0					
14	2.4	2.8	1.9	2.5	3.1	2.6	1.9	4.2	0.5	1.9	0.9	0.9	1.6	0.0				
15	3.2	3.6	2.7	3.2	4.0	3.4	2.7	4.6	2.1	3.8	2.5	2.1	2.7	2.3	0.0			
Pv	17.2	17.0	16.4	16.8	17.9	17.3	16.5	19.4	16.3	17.2	16.7	16.9	17.7	16.7	17.3	0.0		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	pv		

Appendix 3: Complete nucleotide sequence alignment of the 592nt cytoplasmic domain of the glycoprotein gene of southern African viverrid virus isolates generated using ClustalW as described in the methods. The dots identical nucleotides. Only bases different from the PV are shown.

	1	11	21	31	41	50
pv	TCAATCGATC	GGAACCTACA	CAACACAAT-	CTCAGAGGGA	CAGGGAGGGA	
211/98	..CG....C.	AA.GT.C..G	.....G..	...G.....	....A.T.A.	
19571	..CG....C.	AA....CG..	.G.....	..G...A.	....T...A.	
ci19671	..CG....C.	AA....CG..	.....G..	...G...A.	....T...A.	
30	..CG....C.	A.....C.A.	.....CGC.	.....G..	....A..A.A.	
ci21179	..CG....C.	AA....CG..	.....G..	...G...A.	....T...A.	
hb20948	..CG....C.	AA..T.C...	.....G..	...G...A.	....T...A.	
g22107	..CG....C.	AA....CG..	.....G..	...G...A.	....T...A.	
s476/96	..C....C.	A.....C.AG	.....CGGG	.....G..	....A...A.	
fe410/96	..C....C.	A.....C.AG	.....CTC.	.....G..	....A...A.	
m28/96	..C....C.	A.....C.AG	.....CGC.	.....G..	....A...A.	
b85/98	..CG....C.	AA..T.C..G	.....G..	...G.....	....A.T.A.	
fe650/96	..CG....C.	AA.GT.C..G	.....G..	...G.....	....AGT.A.	
b89/98	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
gal19518	..CG....C.	AA....CG..	.G.....	...G...A.	....T...A.	
ci22574	..CG....C.	AA....CG..	.....G..	...G...A.	....T...A.	
o1020/94	..G....C.	A..GT.C...	.....G..	...G.....	....T...A.	
d23/98	..C....C.	A.....C.AG	.....CG..	.....G..	....A...A.	
m257/98	..C....C.	A.....C.AG	.....CGC.	.....G..	....A...A.	
fe401/98	..C....C.	A.....C.A.	.....CGC.	.....G..	....A...A.	
b328/98	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
fe138/98	..C....C.	A.....C.A.	.....CGC.	.....G..	....A...A.	
ge718/98	..CG....C.	AA.GT.C..G	.....G..	...G.....	....A.T.A.	
gal167/9	..C....C.	A..G..C.AG	.....CTC.	.....G..	....A...A.	
he197/97	..C....C.	A.....C.AG	.....CTC.	.....G..	....A...A.	
fe516/97	..C....C.	A.....C.AG	.....CTC.	.....G..	....A...A.	
s221/98	..C...A.C.	A.....C.A.	.....CGC.	.....A.G	....A...A.	
ge446/92	..CG....C.	AA.GT.C..G	.....G..	...G.....	....A.T.A.	
gel236/8	..CG....C.	A...T.C.AG	.....G..	...G.....	....A...A.	
s485/94	..C....CG	A...T.C.G.	.....G..	.....G..	....A...A.	
gal636/9	..C....C.	A.....C.AG	.....CGC.	.....G..	....A...A.	
s19/92	..C....C.	A.....C.AG	.....CGC.	.....G..	....A...A.	
d421/92	..C....C.	A.....C.AG	.....CGC.	.....G..	....A...A.	
gs637/90	..C....C.	A...TC.AG	.....CG..	.....G..	....A...A.	
j701/92	..C....C.	A...TC.AG	.....CGC.	TC.....	....A...A.	
fe298/90	..C....C.	A.....C.A.	.....CGC.	.....G..	....A...AG	
m710/90	..C....C.	A.....C.A.	.....GGC.	.....G..	....A...A.	
m732/90	..C....C.	A.....C.A.	.....C..	C.....	....A...A.	
j5/91	..C...A.C.	A.....C.A.	.....CGC.	.....A..	....A...A.	
ati668/9	..C....C.	A.....AG	.....CGC.	C.....	....A...A.	
m420/90	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
m466/90	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
m480/90	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
gal878/9	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
s970/93	..C....CG	A...T.C.A.	.....G..	.....G..	....A...A.	
j158/91	..C....CG	A...T.C..G	.....G..	T.T.....	....A...A.	
b256/90	..C....CG	A...T.C.A.	.....G..	.....G..	....AA...A.	
m669/90	..G....C.	A..GT.C...	.....G..	...G..A.	....T...A.	
s926/93	.....C.	A...T.C...	.....G..	...G..A.	....T...A.	



```

fe475/95 ..CG....C. AA.GT.C..G .....G.. ...G.---- ----.T.A.
ati113/9 ..C....C. AA..T.C... .....G.. ...G..... ..A...A.
ge611/92 ..CG....C. AA....C..G .....G.. ...G..... ..A.T.A.
ge1049/9 ..CG....C. AA..T.C..G .....G.. ...G..... ..A.T.A.
fe380/94 ..C....C. AA..T.C... .G....G.. ...G..... ..A.T.A.
b127/91 ..C..... A...T.C... .....GG.. ...G..... ..A...A.

```

	51	61	71	81	91	100
pv	GGTGTCAATC	ACTCCCCAAA	GCGGGAAGAT	CATATCTT-C	ATGGGAATCA	
211/98	.....G...	.....T.....	.....A..AG.	.....G.....	C.....G...	
19571	.....G...	.....T.....	.....A..G.	.....G.....	.....G...	
ci19671	.....G...	.....T.....	.....A..G.	.....G.....	.....G...	
30	.....G.G...	.....C.....	.....A..AGC	.....C.....	C.....G...	
ci21179	.....G...	.....T.....	.....A..G.	.....G.....	.....G...	
hb20948	.....G...	.....T.....	.....T..A...	.....G.....	.....G...	
g22107	.....G...	.....T.....	.....A..G.	.....G.....	.....G...	
s476/96	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
fe410/96	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
m28/96	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
b85/98	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
fe650/96	.....A.....	.....A.....	.....A..AG.	.....C.....	C.....G...	
b89/98	.....C.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
gal19518	.....G...	.....T.T.G.	.....A..G.	.....G.....	.....G...	
ci22574	.....G...	.....T.....	.....A..G.	.....G.....	.....G...	
o1020/94	.....A.....	.....CT.T...	.....T..A..GC	.....C.....	.....G...	
d23/98	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
m257/98	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
fe401/98	.....G.G...	.....C.....	.....A..AGC	.....C.....	.....G...	
b328/98	.....C.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
fe138/98	.....G.G...	.....C.....	.....A..AGC	.....C.....	.....G...	
ge718/98	.....G.G...	.....C.....	.....A..AG.	.....C.....	C.....G...	
gal167/9	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
he197/97	.....G.G.C.	.....CT.....	.....A..AGC	.....C.....	.....G...	
fe516/97	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
s221/98	.....G.G...	.....CT...G.	.....A..AGC	.....C.....	.....G...	
ge446/92	.....A.....	.....A.....	.....A..AG.	.....C.....	C.....G...	
ge1236/8	.....TG...	.....CT.....	.....A..GC	.....C.....	G.....G...	
s485/94	.....G...	.....CTT...	.....A..A..GC	.....C.....	.....G...	
gal636/9	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
s19/92	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
d421/92	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
gs637/90	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
j701/92	.....G.G...	.....CT.....	.....A..AGC	.....C.T.	.....G...	
fe298/90	.....G.....	.....CT.....	.....T..A..AGC	.....C.....	.....G...	
m710/90	.....G.G...	.....C.....G.	.....A..AGC	.....C.....	C.....G...	
m732/90	.....G.G...	.....C.....	.....A..AGC	.....C.....	.....G...	
j5/91	.....AG.G...	.....CT...G.	.....A..AGC	.....C.....	.....G...	
ati668/9	.....G.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
m420/90	.....G.....	.....AT.....	.....A..AGC	.....C.....	.....G...	
m466/90	.....G.....	.....AT.....	.....A..AGC	.....C.....	.....G...	
m480/90	.....G.....	.....AT.....	.....A..AGC	.....C.....	.....G...	
gal878/9	.....G.....	.....CT.....	CG.AA.AGC	.....C.....	.....G...	
s970/93	.....G.....	.....AT.....	.....A..AGC	.....C.....	.....G...	
j158/91	.....G.....	.....CT.....	.....A..A..AGC	.....C.....	.....G...	
b256/90	.....C.G...	.....CT.....	.....A..AGC	.....C.....	.....G...	
m669/90	.....A.....	.....CT.T...	.....T..A..GC	.....C.....	.....G...	
s926/93	.....A.....	.....CT.T...	.....T..A..GC	.....C.....	.....G...	
fe475/95	.....A.....	.....A.....	.....A..AG.	.....C.....	C.....G...	
ati113/9	.....G.....	.....A.....	.....A..G.	.....C.....	.....G...	
ge611/92	.....G.....	.....A.....	.....A..AG.	.....C.....	.....G...	
ge1049/9	.....G.....	.....A.....	.....A..AG.	.....C.....	.....G...	
fe380/94	.....G.....	.....A.....	.....A..G.	.....C.....	.....G...	
b127/91	.....G.....	.....T.....	.....A..G.	.....C.....	.....G...	



	101	111	121	131	141	150
pv	TACAAGAGCG	GGGGTGAGAC	CGGACTGTGA	GAG-CTGGCC	GTCCTTTCAA	
211/98	..T....AA.	.A.....	.C.....	.G...CT.T.	..T.....GG	
19571	..T....A..	.A.....	.A.....	AG.G.C..T.	A.....G.	
ci19671	..T....A..	.A.....	.A.....	AG...C..T.	A.....G.	
30	.....A..	..A.....	.A.A.....	.G...C..T.	CT.....G.	
ci21179	..T....AT.	.A.....	.A.....	AG...C..T.	A.....G.	
hb20948	..T....A..	.A.....	.A.....	AG...C..TG	A...CC.G.	
g22107	..T....A..	.A.....	.A.....	AG...C..T.	A.T....G.	
s476/96	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
fe410/96	.....A..	.....T..	.A.A.....	.G...C.AT.	..T....G.	
m28/96	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
b85/98	..T....AA.	.A.....	.C.....	.GA..CT.T.	..T....GG	
fe650/96	..T....AA.	.A.....	.C.....	.G...CT.T.	..T....GG	
b89/98	..T....A..	..A...A..	.A.A.....	.G...C...	ACT..C..G.	
gal19518	..T....A..	.A.....	.A...A..	AG...C..T.	A.....G.	
ci22574	..T....A..	.A.....	.A.....	AG...C..T.	A.....G.	
o1020/94	..T....A	AAAA.....	.AA.A.....	.GA..CA.T.	C.T....T.	
d23/98	.....A..	.....	.A.A.....	.G...C.AT.	A.T....G.	
m257/98	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
fe401/98	.....A..	.....	.A.A.....	.G...C..T.	..T....GG	
b328/98	..T....A..	..A...A..	.A.A.....	.G...C...	A.T..C..G.	
fe138/98	.....A..	.....	.A.A.....	.G...C..T.	..T....G.	
ge718/98	..T....AA.	.A.....	.C.....	.G...CT.T.	..T....GG	
gal167/9	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
he197/97	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
fe516/97	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
s221/98	.....A..	.....A..	.A.A.....	.G...CA.TT	..T....G.	
ge446/92	..T....C..	.C.....	.C.....	.G.....T.	..T....GG	
ge1236/8	..T....A..	.....	.A.A.....	.G.....T.	..T....G.	
s485/94	..T....A..	..A...C..	.A.A.....	.G...C..T.	A.T....G.	
gal636/9	.....A..	.....	.A.A.....	.G...C.AT.	A.T....G.	
s19/92	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
d421/92	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
gs637/90	.....A..	.....	.A.A.....	.G...CA-T.	..T....G.	
j701/92	.....A..	..-.....	.A.A.....	.G...GA-T.	..T....G.	
fe298/90	.....A..	.....	.A.A.....	.G...C..T.	..T....G.	
m710/90	.....A..	.....	.A.A.....	.G...C..T.	..T....G.	
m732/90	.....AT.	.....	.A.A.....	.G...C..T.	..T....G.	
j5/91	.....A..	.....	.A.A.....	.G...CA.TT	..T....G.	
ati668/9	.....A..	.....	.A.A.....	.G...C.AT.	..T....G.	
m420/90	..T....A..	..A...A..	.A.A.....	.G...C..T.	A.T....G.	
m466/90	..T....A..	..A...A..	.A.A.....	.G...C..T.	A.T....G.	
m480/90	..T....A..	..A...A..	.A.A.....	.G...C..T.	A.T....G.	
gal878/9	..T....A	..A...C..	.A.A.....	AG...C..T.	A.T....G.	
s970/93	..T....A..	..A.....	.A.A...A.	.G...C..T.	A.T....-G.	
j158/91	..T....-.	.....	.A.A.....	AG...C..T.	A.T....G.	
b256/90	..T....A..	..A.....	.A.A.....	.G...C...	A.T..C..G.	
m669/90	..T....A	AAA.....	.AA.A.....	.GA..CA.T.	C.....T.	
s926/93	..T....A	AA.....	.AA.A.....	.GA..CAAT.	C...C..G.	
fe475/95	..T....AA.	.A.....	.....	.G...CT.T.	..T....GG	
ati113/9	..T....AG.	AA.T.....	.C.....	.G...CT.T.	..T....G.	
ge611/92	..T....AA.	.A.....	.C.....	.GA..CT.T.	..T....GG	
ge1049/9	..T....A..	.A.....	.C.....	.GA..CT.T.	..T....GG	
fe380/94	..T....AA.	.C.....	.C.....	.G...CT.T.	..TTC.C.G.	
b127/91	..T....CA.	AA.....	.C.....	.G...CTAT.	..T....G.	
	151	161	171	181	191	200
pv	CGATCCAAGT	CCTGAAGATC	ACCT-CCCCT	TGGGGGGTTC	TTTTGAAAA	
211/98	...TT..A.	ATC.....C.	G.....AA	...A-----	--CA..TGG	
19571	..C..T..A.	.....	G.....ATA	C...A-----	--..A..GGG	
ci19671	..C..T..A.	.....	G.....ATA	C...A-----	--..A..GGG	
30	..C.TT....	.T.AG..G.T	.T....A..C	...A-----	--..AAGGGG	



```

ci21179 ..C..T..A. ....G.....ATA C...A----- ..A..GGG
hb20948 ..C..T..A. ....G.....ATA .....----- ..A..GGG
g22107 ..C..T..A. ....G.T...-ATA C...A----- ..A..GGG
s476/96 ..C.TTG... ..AG..G.T .T.....TC .....----- ..AAGGGG
fe410/96 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
m28/96 ..C.TTG... ..AG..G.T .T.....TC .....----- ..AAGGGG
b85/98 ....TT..A. ATC.....G.....GA ...A----- ..CA..TGG
fe650/96 ....TT..AC ATC.....G.....AA ...A----- ..CA..TGG
b89/98 T.C.TTT... ..T..G..G.. .T.....C ..A----- ..AAGGGG
gal19518 ..C..T..A. ....G.....ATA C...A----- ..A..GGG
ci22574 ..C..T..A. ....G.....ATA C...A----- ..A..GGG
o1020/94 ..C.TT.... ..G..... ..C...A. ....T----- ..AA.GGGG
d23/98 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
m257/98 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
fe401/98 .TC.TT.... ..T.AG..G.T GT....A..C ...A----- ..A.GGGG
b328/98 T.C.TTT... ..T..G..G.. .T..... ..A----- ..AAGGGG
fe138/98 .TC.TT.... ..T.AG..G.T GT....A..C ...A----- ..A.GGGG
ge718/98 ....TT..A. ATC.....C. G.....AA ...A----- ..CA..CGG
gal167/9 ..C..TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
he197/97 ..C.TTG... ..AG..G.T .T...T...C .....----- ..AAGGGG
fe516/97 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
s221/98 ..C.TT.... ..T.AT..G.T .T.....C .....----- ..GAGGGG
ge446/92 .....AG.....G.....AA ...A----- ..CA..TGG
ge1236/8 ..C.T.... ..G..G.. ..C...C G..A----- ..AAGGGG
s485/94 T.C.TTT.T. .TC.G..G.. .T.....C .....----- ..AAGGG.
gal636/9 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
s19/92 ..C.TTG... ..AG..G.T .T...T..C .....----- ..AAGGGG
d421/92 ..C.TTG... ..AG..G.T .T.....C .....----- ..GAG.GG
gs637/90 ..C.TT.... ..AG..G.T .T.....C .....----- ..AAGGGG
j701/92 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
fe298/90 .AC.TT.... ..AG..G.T .T.....C .....----- ..AAGGG.
m710/90 ..C.TT.... ..T.AG..G.T .T...A..C ...A----- ..AAGGGG
m732/90 ..C.TT.... ..T.AG..G.T .T.....C A..A----- ..GAGGGG
j5/91 ..C..T.... ..T.AG...T .T.....C .....----- ..GAGGGG
ati668/9 ..C.TTG... ..AG..G.T .T.....C .....----- ..AAGGGG
m420/90 T.T.TTT... ..T..G..G.. .T.....C .....----- ..AAGGGG
m466/90 T.T.TTT... ..T..G..G.. .T.....GAA. ....----- ..AAGGGG
m480/90 T.C.TTT... ..T..G..G.. .T.....C .....----- ..AAGGGG
gal878/9 T.C.TT.... T...G..G.. .T.....C .....----- ..A..GGG
s970/93 T.C.TTT... ..T..G..G.. .T.....C .....----- ..AAGGGG
j158/91 T.C.TTT.T. ....G..G.. .T.....C .....----- ..AAGGGG
b256/90 T.C.TT.... ..T..G..G.. .T..T...C C.A. ....----- ..A.GGGG
m669/90 ..C.TT.... ..G..... ..C...A. ....T----- ..AA.GGGG
s926/93 ..C.TT.... ..G..... ..C..TA. ....T----- ..AAGGGG
fe475/95 ....TT..AC A.....G.....G.....AA ...AA----- ..CA..TGG
ati113/9 ....TT.... A.....G.. GA.....AA ...T----- ..ACA..TGG
ge611/92 ....TT..A. ATC.....G.....AA ...T----- ..ACA..TGG
ge1049/9 ....TT..A. ATC.....G.....AA ...T----- ..ACA..TGG
fe380/94 ....TTG.AG A.....G.....G.....AA ...T----- ..ACA..TGG
b127/91 ....TT..TA AT.....G.. G.....A. .AA. ....----- ..G.GACTGG

```

```

201      211      221      231      241      250
|         |         |         |         |         |
pv AAAAA----- ---CCTGGGT TCAATAGTCC TCCTTGAAC CCATGCAAC-
211/98 G..TC..... ..C.A.. ..ATT ..CA... T.G..TG...
19571 ..TC..... ..C.A.. ..A. ...CA... TAG.AT...
ci19671 ..TC..... ..C.A.. ..A. ...CA... TAG.AT...
30 .GTC..... ..T.A.A.. ..A. .T.CA... T.G..TC...
ci21179 ..TC..... ..C.A.. ..A. ...CA... TAG.AT...
hb20948 ..TC..... ..C.AA. ....A. ...CAG... TA..AT...
g22107 ..TC..... ..C.A.. ..A. ...CA... A-----GA.
s476/96 ..TC..... ..T.A.A.C ..AG.A. ...CA... T.G.-T...
fe410/96 ..TC..... ..T.A.A.C ..AG.A. ...CA... T.G..T...
m28/96 ..TC..... ..T.A.A.C ..AG.A. ...CA... T.G.AT...
b85/98 G..TC..... ..C.A.. ..ATT ..CA... T.G..TG...

```



```

fe650/96 G..TC.....C.A..ATT C...CA...T.G..TG...
b89/98 G..TC.....T.A.A.C...C.AA..C...CA...T.G..T...
gall19518 ...T.....C.A..A...CA...TAG.AT...
ci22574 ...TC.....C.A..A...CA...TAG.AT...
o1020/94 .TCT.....-AA.A..A..GT..CA..TC T.G..T...G
d23/98 .TC.....T.A.A..A..A...CA.G..T.G..T...
m257/98 .TC.....T.A.A.C...AG.A..CA...T.G..T...
fe401/98 .GTC.....T.G.A..A...T.CA...T.G..T...
b328/98 G..TC.....T.A.A..AA...CA...T.G..T...
fe138/98 .GTC.....T.G.A..A...T.CA...T.G..T...
ge718/98 G..TC.....C.A..ATT ...CA...C T.G..TG...
gall167/9 ...TC.....T.A.A.C...AG.A..CA...T.T..T...
hel197/97 .TC.....T.A.A.C...AG.-..T.CA...T.G..T...
fe516/97 .TC.....T.A.A.C...AG.A..CA...T.G..T...
s221/98 .GT.....TTA.A..A...CA...TTG..T...
ge446/92 G..TC.....C.A..ATT C...CA...T.G..TG...
ge1236/8 .TC.....T.A.A..T...A..A.CA...T.G..T...
s485/94 GG..ATC...T.A.A..AA...CA...T.G..TG...
gal636/9 .TC.....T.A.A..A..A...CA.G..T.G..T...
s19/92 .TC.....T.A.A..A..A...CA.G..T.G..T...
d421/92 .TC.....T.A.A..A..A...CA...T.G..T...
gs637/90 .TC.....T.A.A.C...AG.A..CA...T.G..T...
j701/92 .T-.....T.A.A.C...AG.A..CA...T.G..T...
fe298/90 .TC-.....T.A.A..A..A...CC...C T.G..T...
m710/90 .GTC.....T.A.A..A...T.CA...T.G..T...
m732/90 .GTC.....T.A.A..A...CA...T.G..T...
j5/91 .GTC.....TTA.A..A...C...TTG..T...
ati668/9 .T-.....TTA.A.C.TC.AG.A..CA...C TTG..T...
m420/90 ....AATC...T.A.A..G...AA...CA...TTG..T...
m466/90 ....ATC...T.A.A..G...AA...CA...TTG..T...
m480/90 ....GTC...T.A.A..G...AA...CA...TTG..T...
gal878/9 G--.....TC.A..AA...CA...TTG..T...
s970/93 ....A.....T.A.A..GG..AA...CA...TTG..T...
j158/91 .C-.....T.A.A..AA...CA...TTG.AT...
b256/90 GG--.....T.A.A..AA...CA...T.G..T...
m669/90 .TC.....TAA.A..A..G...CA..TC T.G..T...A
s926/93 .TC.....T.A.A..A...CA..TC T.G..T...
fe475/95 G..TC.....C.A..ATT C...CA...T.G..TG...
ati113/9 G..TC.....C.A..ATT ...CA...T.T..G...
ge611/92 GTC-.....A.A..ATT ...A...T.G..TG...
ge1049/9 G--.....C.A..ATT ...CA...T.G..TG...
fe380/94 GG--.....C.A..ATT C...CA...T.G..TG...
b127/91 TCGCTC....C.A..C..ATT ...CA...T.G...G...

251 261 271 281 291 300
| | | | | |
pv ---TGGGTAG ATTC AAGAGT CATGAGA-TT TTCATTA--- -ATCCTCTCA
211/98 ...A.AA.G. ...C... ..C...G... ..T.C... ..A...
19571 ...GA.AGGA ...C...A. .C... ..T.C-... CG..A...
ci19671 ...GA.AGGA ...C...A. .C...G... ..T.C-... CG..A...
30 ...A.....C... ..C...G... ..T.C... ..A...
ci21179 ...GA.AGGA ...C...A. .C...G... ..T.C-... CG..A...
hb20948 ...GA.AGGA .C.C...A. .C...G... ..T.C-... CG..A...
g22107 .T.AC.AA.. .A.C...TC --..G... -.TCC-... .G.A.-...
s476/96 ...A.....T ...C... ..C... ..T.C... ..A...
fe410/96 ...A.....C... ..C... ..T.C... ..A...
m28/96 ...A.....T ...C... ..C... ..T.C... ..A...
b85/98 ...A.AA.G. ...C... ..C...GG.. ..T.C... ..A...
fe650/96 ...A.AA.G. ...C... ..C...G... ..T.C... ..A.T...
b89/98 ..AA.....-.....ACGA.AG... ..C.C... ..A...
gall19518 ...GA.AGGA ...C...A. .C...G... ..T.C-... CTG.A...
ci22574 ...GA.AGGA ...C...A. .C...G... ..T.C-... CG..A...
o1020/94 ...G..A..G...C... ..CA..G... ..T.C... ..A...
d23/98 ...A.....-.....C... ..A... ..T.C... ..A...
m257/98 ...C.....C... ..T.C... ..A...

```



fe401/98 ...A.....C.....C...G...T.C.....A.....
 b328/98 ...A.....C.....C...AG...TC.C.....A.....
 fe138/98 ...A.....C.....C...G...T.C.....A.....
 ge718/98 ...A.AA.G...C.....C...G...T.C.....A.....
 gall167/9 ...A.....-.....C.....T.C.....A.....
 he197/97 ...A.....C.....C.....T.C.....A.....
 fe516/97 ...A.....C.....C.....T.C.....A.....
 s221/98 ...A.....C.....C...G...C.T.C.....A.TC..
 ge446/92 ...A.AA.G...C.....C...G...T.C.....A.T...
 ge1236/8 ...A.....CG...C...G...TGC.....A.....
 s485/94 ...A.....C.....C...AG...T.C.....A.....
 gal636/9 ...A.....C.....C...A...T.C.....A.....
 s19/92 ...A.....C.....C...A...T.C.....A.....
 d421/92 ...A...AT...C.....C.....A.....
 gs637/90 ...A.....C.....C.....T.C.....A.....
 j701/92 ...A.....C.....C.....T.C.....A.....
 fe298/90 ...A.....C.....CA.G.C...T.C.....A.....
 m710/90 ...A.....C.....C...G.A...T.C.....A.....
 m732/90 ...G.....C.....C...G...T.C.....A.....
 j5/91 ...A.....C.....C...G...G.GT.C.....A.C..
 ati668/9 ...A.....C.....C.....T.C.....A.....
 m420/90 ...A.....C.A.A...C...AG...T.C.....A.....
 m466/90 ...A.....A...C...G...T.C.....A.....
 m480/90 ...A.....A.TG...C...G...T.C.....A.....
 gal878/9 ...AA.....C.....C...G...T.C.....A.....
 s970/93 ...A.....C.A.A...C...G...T.C.....A.....
 j158/91 ...A.....C.....T.C...G...T.C.....A.....
 b256/90 ...A.....C.....C...AG...T.C.....A.....
 m669/90 ...G.A...G.-C.....CA.G...AG...C.....A.....
 s926/93 ...G.A...G...C.....C...G...C...T.C.....A.....
 fe475/95 ...A.AA.G...C.....C...G...T.C.....A.T...
 atil13/9 ...A.A.G...C.....C...G...T.C.....A.....
 ge611/92 ...A.AA.G...C.....C...G...T.C.....A.....
 ge1049/9 ...A.AT.G...C.....C.....T.C.....A.....
 fe380/94 ...A.AA.G...C.....C...G...T.C.....A.....
 b127/91 ...A.A.G...C.....C...G...T.C.....A.....

	301	311	321	331	341	350
pv	GTT-----	GATC--AAGC	AAGATCATGT	AGATTCTCAT	AATAGGGGAG	
211/98	.....	.....GA	TT.G.....	.T...G..	...CAA..A	
19571	A.....	.....A	TT.G.AG...	.A.C...T..	.C.CAA...	
ci19671	A.....	.....A	TT.G.G.C	.A.C...T..	.C.CAA...	
30	...G.....	-.....GA	...G.....	.....T..	...CAA..A	
ci21179	A.....	.....A	TT-GG.G...	.A.C...T..	.C.CAA...	
hb20948	AC.....	.....GA	TT.G.G.C	.A.C.T.T..	.C.CAA..A	
g22107	A.....	-.....A	TT-G.G...	.A-C...T..	-C.CAA..-	
s476/96	.....	A...GGA	...G.G...	-...T.T..	...CCAA..A	
fe410/96	.....	...GGA	...G.G...	...T-...	...CAA..A	
m28/96	.....	A...GGA	...G.G...	...T.T..	...CAA..A	
b85/98	.....	...GA	TT.G.....	...G.T.G..	...CAA..A	
fe650/96	.....	...GA	TT.G.....	...T.T.G..	...CAA..A	
b89/98	A.....	.....GCA	.G.TC.G...	...T-T..	.G..C.A..A	
gall19518	A.....	.....-	...G.G...	.A.C...T..	...C...C	
ci22574	A.....	.....A	TT.G.G...	.A.C...T..	.C.CAA...	
o1020/94	.....	...GA	.T.G.G...	...T..	...CAA..A	
d23/98	.....	...GGA	...G.TG...	...T.T..	G...CAA..A	
m257/98	.....	...GA	...G.G...	...T.TG.	...CAA..A	
fe401/98	...G.....	-.....GA	...G.....	...T..	...CAA..A	
b328/98	.....	...GA	...G.G...	...TCT..	.G..C.A..A	
fe138/98	...G.....	-.....GA	...G.....	...T..	...CAA..A	
ge718/98	.....	...GA	TT.G.....	...T...G..	G...CAA..A	
gall167/9	A.....	...GGA	...GC.G...	...T.T..	...CAA..A	
he197/97	...T.....	...GGA	...G.G...	...T.T..	...CAA..A	
fe516/97	.C.....	...GGA	...G.G...	...T.T..	...CAA..A	



s221/98 ...G..... ..GA. ...G..... ..T..CAA..A
ge446/92GA. TT.G..... ..T.A.. ..G.CAA..A
ge1236/8T...GA. ...G..G... ..T.T... ..CAA..A
s485/94GA. ...G..G... ..T.. ..G.C.A..A
gal636/9G.A. ...G..G... ..T... ..CAA..A
s19/92GGA. ...G..G... ..T.A..CAA..A
d421/92GGA. ...G..G... ..T.T... ..CAA..A
gs637/90GGA. ...G..G... ..T.T... ..CAA..A
j701/92GGA. ...G..G... ..T.T... ..CAA..A
fe298/90 ...G..... -.....GA. ...G..T... ..T... ..CAA...
m710/90 ...G..... -.....GA. ...G..... ..T... ..C.A..A
m732/90 ...G..... -.....GA. ...G..... ..T... ..CAA..A
j5/91 ...G..... -.....GA. ...G..... ..T... ..C.A..A
ati668/9GG.. ..G..G... ..T.T... ..CAA..A
m420/90GA. ...G..G... ..T.T... ..G.C.A..A
m466/90GA. ...G..G... ..T.T... ..G.C.A..A
m480/90GA. ...G..... ..T... ..A..A
gal878/9GA. ...G..G... ..T... ..G.C.A..A
s970/93G..G... ..T.T... ..G.CAA..A
j158/91GA. ...G..G... ..T... ..G.C.A..A
b256/90G..G... ..G.C.A..A
m669/90GA. ...G..... ..T... ..AA...
s926/93TGA. .T.G..G... ..T... ..G.CAA..A
fe475/95GA. TT.G..... ..T.T.G... ..CAA..A
ati113/9GA. TT.G..G... ..T... ..A..A
ge611/92GA. TT.G..... ..T.T... ..CAA..A
ge1049/9GGA. ...G..G... ..T.T... ..CAA..A
fe380/94GA. TT.G..... ..T.A..CAA..A
b127/91CT..GA. TT.G..G... T.....G... ..CAA...

	351	361	371	381	391	400
pv	ATCTT-CTAG	CA-GTTTCAG	TGA--CTAAC	GG-TGCTTTC	ATTCT-CCAG	
211/98	GC.....G.	..AC.G..T	...T-...	.....	..C.....-A	
19571	.....G.	..A..G...	...T-...	.....	GCCT.....	
ci19671	.....G.	.....G...	...T-...	.....T	GCCT.....	
30	GC.....G.	.....G...	..-ATC...	.....N	..C...T..	
ci21179	..T.C.T.G-	.....-G...	...T-...	.....T	GCCT...-..	
hb20948	.....G.	.....G...	...T-...	.....	GCCT..TT..	
g22107	.....G.	.....-G...	...T-...	.....CT..-	GCCT.....	
s476/96	GC-.....GC	.....G...	..G.C--G.	.....	G.C...T..	
fe410/96	GC.....G.	.....-G...	..G.T-...	.....	G.C...T..	
m28/96	GC.....G.	.....G...	..G.T.A.G.	.....	G.C...T..	
b85/98	GC.....G.	..-C.G-.T	...T-...	.....-	..C.....--	
fe650/96	GC.....G.	..AC.G..T	...T-...	.....	.....--A	
b89/98	.....-CG.	..A..CG.C	...T-...	C.G.....T	G.....T.A	
gal19518	.....	.....	...C-..T	.....	.....
ci22574	.....G.	.....G...	...T-...	.....T	GCCT.....	
ol020/94	..T...T.GA	.....G...	...T.-C..	.....	..C...G..	
d23/98	GC-...G.	.....G...	..G.T-...	.....	G...T..	
m257/98	GC.....G.	.....G...	..G.T-...	.....	G.C...T..	
fe401/98	GC.....GC	.....G...	..-ATC...	.....	..C...T..	
b328/98	.....CG.	.....CG.C	...T-...	-G.....T	G.....T.A	
fe138/98	GC.....GC	.....G...	..G.ATC...	..G.....	..C...T..	
ge718/98	GC.....G.	..AC.G..T	...T-...	.....G.	..C.....A	
gal167/9	----GC	.T.T..G...	..G.T-...	.....T...	G.C...T..	
he197/97	GC.....G.	.....G...	..G.T-...	.....	G.C...T..	
fe516/97	GC.....G.	.....G...	..G.TT-	.....	G.C...T..	
s221/98	GC.....G.	.....G...	..-ATC...	.....	..C...T..	
ge446/92	GC.....G.	..AC.G..T	...T-...	.....	..C.....-A	
ge1236/8	G.....G.	.....G...	...T-...	.....	.....T..	
s485/94	.....G.	.....G.C.	...T-...	-G.....	.....T..	
gal636/9	GC.....G.	.....G...	..G.T-...	.....	G.C...T..	
s19/92	GC.....G.	.....G...	..G.T-...	.....	G.C...T..	
d421/92	GC.....G.	.....G...	...T-...	.....	.....T..	



gs637/90 GC.....G.G... ..G.T-... ..G.C...T..
j701/92 G-.....G.G... ..G.T-... ..C. G.C...T..
fe298/90 GC.....G.G... ..-ATC... ..G.C...T..
m710/90 GC.....G.G... ..-ATC... ..C...T..
m732/90 GC.....G.G... ..-ATC... ..C...T..
j5/91 GC.....G.G... ..-ATC... ..T..
ati668/9 .G.....G.G... ..G.T-.T.G.C...T.TA
m420/90G.G.C.T-... -G.....
m466/90G.G.C.T-... -G.....
m480/90G.G.C.T-... -G.....
gal878/9G.G.C.T-... -G.....T.A
s970/93 C.....G.G.C.T-... -G.....
j158/91G.G.C.T-... -G.....T.A
b256/90CG.CG.C.T-... -G.....G.G.CTC.TT..
m669/90GAG...T-... ..G...G..
s926/93GA .G...G...T-... ..C...G..
fe475/95 GC.....G. ...AC.G..TT-... ..C...-A
atill3/9 .C.....G. ...A..G... ..T-.CAC...-A
ge611/92 GC.....G. ...AC.G... ..TT-... ..G.C...-A
gel049/9 GC.....G.G... ..G.T-... ..G.C...T..
fe380/94 .C.....G.G..TT-... ..C...-A
bl27/91 .C.....G. ...A..G.CTT-... ..C...-A

	401	411	421	431	441	450
pv	GA	CC	TAG	A--CG	TCT	
211/98	ACT-GACA	CAACAGTTG	ACAAATC	GGGGTG	CAGGTGA	
19571	AG.G.GA.GG	T...AG..C.	.G....GGC.	...G.....A	.TG...A...	
ci19671	...GAA.GG	T...GG..CA	CG.....GC.	...G.....	..G...A...	
30	...A...GGG	T...AC.CC.	.G..A..GCT	...G....CA	..GAG.A...	
ci21179	A-.G.A.GG	T...GG-.CA	C.-...GCA	-.-.....	..G..AA...	
hb20948	...G.A.GG	T...AG..CA	CGA...GC.	...G.....	..G...A...	
g22107	..-G.A.GG	T...GG..CA	C.-...GC.	-.A.....	..G...A...	
s476/96	.....G-	T...AC..C.	.G.-A..GC.	...G...-CA	..G.G.A...	
fe410/96	.....GG	T...AC..C.	.G.GA..GC.	...G....CA	..GAG.A...	
m28/96	.....GG	T...AC..C.	.G.GA..GC.	...G....CA	..G.G.A...	
b85/98	A..A.TA.AG	T...AG..C.	.G-...GC.	C..A....A	.TG...A.T.	
fe650/96	AG.G.GA.GG	-...AG..C.	.G....GGC.	...G.....A	.TG...A...	
b89/98	...TA.GG	...AG..C.	.G....GC.	G..G...-A	..G.G.A...	
gal19518	.....T.	T.G.AG...	...GGGC.	..A.A...A	T..G.....	
ci22574	...G.A.GG	T...GG..CA	C.....GC.	..G.....	..G...A...	
o1020/94	.G...A.GG	T...AG..C.	CG....GC.	..G.....A	.TG.G.....	
d23/98	.....GG	T...AC....	.G..A..GC.	G..G...CA	..AAG.A...	
m257/98	.....GG	T...AC..C.	.G.GA..GC.	...G....CA	..GAG.A...	
fe401/98	.....GG	T...AT..CA	.G..A..GCT	..G.....A	..GAG.A...	
b328/98	.....A.GG	...AG..C.	.G....GC.	G..G...A	..G.G.A...	
fe138/98	.....GG	T...AT..CA	.G..A..GCT	..G.....A	..GAG.A...	
ge718/98	AG.G.GA.GG	T...AG..C.	.G....GGC.	..G.....A	.TG...A...	
gal167/9	..-.....G-	T...G..C.	.G.-A..GC.	...G...-CA	..GAG.A...	
he197/97	.....GG	T...AC..C.	.G.GA..GC.	...G....CA	..GAG.A...	
fe516/97	.....GG	T...AC..C.	.G.GA..GC.	...G....CA	..GAG.A...	
s221/98	.....GG	T...AC..C.	.G..AG.GC.	...G....CA	..GAG.A...	
ge446/92	AG.G.GA.GG	T...AG..C.	.GA...GGC.	..G.....A	.....A...	
ge1236/8	...C.A.GG	TT..AG..C.	.G....G.	T..A....A	..G.G.A...	
s485/94	.....A.GG	...AG....	.G....GG.	C..A....A	..G.G.A...	
gal636/9	.....GG	T...GT.C.	.G..A..G.	C..G....CA	..AAG.A...	
s19/92	.....GG	T...AC..C.	.G..A..GC.	G..G....CA	..AAG.A...	
d421/92	.....A.GG	T...AG..C.	.G..A..GC.	C..G....CA	..AAG.A...	
gs637/90	.....GG	T...AC..C.	.G.GA..G.	C..A....CA	..GAG.A...	
j701/92	..T...A.GG	T...GTG..	G..A.TGC.	C..A....CA	..GAG.A...	
fe298/90	.....A.GG	T...AC..C.	.G.GA..GC.	..G..A..CA	..GAG.A...	
m710/90	.....GG	T...AG..C.	.G..A..GCT	..G....CA	..GAG.A...	



```

m732/90 .....GG T...AG..C. .G..A..GC. ...G....CA ..GAG.A...
j5/91 .G.....GG T...AG..C. .G..A.G.GT C..A....CA ..GAG.A...
ati668/9 .....GG T...AC..C. .G..A..G- C..A....CA ..GAG.A...
m420/90 .G...A.GG ...AGA.C. .G....GC. ...A....A ..G.G.A...
m466/90 .G...A.GG ...AGA.C. .G....GC. ...A....A ..G.G.A...
m480/90 .G...A.GG ...AGA.C. .G....GC. ...A....A ..G.G.A...
gal878/9 .....A.GG ...AGA.C. .G....GC. ...G....A ..G.G.A...
s970/93 .G...A.GG ..C.A..AC. .G....GC. ...A....A ..G.A...
j158/91 .....A.GG TT..AG.C.. .G....GC. ...G....A ..G.G.A...
b256/90 .G...A.GG ...AG..C. .G....GC. G..G....A ..G.G.A...
m669/90 .G...A.GG T...AG..C. CG....GG. C..A....A .TG.G....
s926/93 .....A.TG T...AG..C. CG....GC. ...GT....A .TG.G....
fe475/95 AG.G.GA.GG T...AG..C. .G....GGC. ...G....A .TG...A...
ati113/9 AG.G.GA.GG ...AG.... .GA...GGC. T..TTA...A .TG...A...
ge611/92 AG.GCT...G .....T.C. .A..GGGC. ...GT....A .GCAG.A.T.
ge1049/9 .....GG T...AC..C. .G.GAC.GC. ...G....CA ..GAG.A...
fe380/94 AG.GCGA.GG T...AG..C. .G....GGC. ...G....A .TG...A...
b127/91 .GGAGTA.GG T...AG..C. .G...GGGG. ...GA....A .TG...A...

451      461      471      481      491      500
|         |         |         |         |         |
pv        TTCTG-CGCT TGGGCACAGA CAAAGGTCAT GGTGTGTTC A-TGATAGCG
211/98    ....CACTC C...-...AG .G..A.TG. A...CA.C.. C.....G..A
19571    ...TG..T. CA..... .G...T.. A.CACACC.. C.....A
ci19671   ...-G..T. CA..... .G...T.. A.CACACC.. C.....A
30        ...A...CT. ....G... .G...TGC A...CACC.. C.....
ci21179   ..-...T. CA.....AG AC.GA.GT.. A.CACACC.. T.....A
hb20948   ...C...T. CA....C.. ...T..TG. C.C.CACC.. C.....A
g22107   .....T. CA.....- -...T.. A.CACACC.. C.....A
s476/96   ...A...CT. ....TG.- .G...TGC A...CACC.. C.....A.A
fe410/96  ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A.A
m28/96    ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A.A
b85/98    ....CATTC C.....AG .G..A.TG. A...CA.C.. C.....G..A
fe650/96  ...-...CACTC C...-...A- .G..A.TGN A...CA.C.. C.....G..A
b89/98    ..G.G.AT. .... .G.A..T.. A...CACC.. CC.....A
gal19518  C..C..T... .. .G..... A.CACACC.. C.....A
ci22574   .....T. CA..... .G...T.. A.CACACC.. C.....A
o1020/94  ...A...AT. .A..... .G..... AA.CACC.. C.....G..A
d23/98    ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A
m257/98  ...A...CT. ....TG.G .G...TGC A...CACC.. CC.....A.A
fe401/98  ...A...CT. .A..G.TG.. .G...TGC A...CACC.. C.....A.A
b328/98  ...G...AT. .... .G.A..T.. A...CACC.. C.....A
fe138/98  ...A...CT. .A..G.TG.. .G...TGC A...CACC.. C.....A
ge718/98  ....CACTC C...-...AG .G..A.TG. A...CA.C.. C.....G..A
gal167/9  ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A.A
hel97/97  ...A...CT. ....TG.G .G...TGC ...CACC.. C.....A.A
fe516/97  ...A...CTC ....TG.G .G...TGC A...CACC.. C.....A.A
s221/98  ...A...CT. ....G... .GGA..TGC A...CACC.. C.....A
ge446/92  ....CACT. G..-...TA. .G..A.TG. A...CA.C.. C.....G..A
ge1236/8  ...A...AT. .... .G...T.C A.C.CACC.. C.....A
s485/94   ...A...AT. ....G... .G.A..T.. A...CACC.. C.....A
gal636/9  ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A
s19/92    ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A
d421/92   ...A...CT. ....TG.. .G...TGC A...CACC.. C...A...A
gs637/90  ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A.A
j701/92   ...A...CT. ....TG.G .G...TGC A...CACC.. C.....A.A
fe298/90  ...A...CT. ....TG.. .G...TGC A..ACACC.. C.....A
m710/90   ...A...CT. ....TG.. .G...TGC A...CACC.. C.....A
m732/90   ...A...CT. ....TG.. .G...TGC A...CACC.. C.....A
j5/91     ...A...CT. ....T.G .G.A..TGC A...CACC.. C.....A
ati668/9  ...A...CT. ....-T.G .G...TGC A...CACC.. C.....A.A
m420/90   ...A...ATG .....GA. .G..T..G. A...CACC.. C.....A
m466/90   C..A...ATG .....TGA. .GGA..TG. A...CACC.. C.....A
m480/90   C..A...ATG .....GA. .GGA..TG. A...CACC.. C.....A
gal878/9  ...A...AT. C.....G... .G.A..T.. A...CACC.. C...A.C...A

```



```

s970/93 C..A...ATG .....GA. ..GGA..TG. A...CACC.. C.....A
j158/91 ...A...T. C.....G.. ..G.A..T.. A...CACC.. C.C.....A
b256/90 ...G...AT. ....G.A..T.. A...CACC.. C.....A
m669/90 ...A...AT. ..A..... ..G..... AA..CACC.. C.....G..A
s926/93 ...A...AT. ..A..... ..G..... AA..CACC.. C.....G..A
fe475/95 .....CACTC C..-...AG ..G..A.TG. A...CA.C.. C.....G..A
ati113/9 .....CACTC C..-...TG.G ..G..A.TGG A...CA.C.. C.....G..A
ge611/92 .....C.TT. C..-...AG ..G..A.TG. A.....C.. C.....G..A
ge1049/9 ...A...CT. ....TG.G ..G...TGC A...CACC.. C.....A.A
fe380/94 .....CACTC G..-...G ..G..A.TG. A...CA.C.. C.....G..A
b127/91 .C...CACTC C..-...TG.G ..G..A.TG. A...CA.C.. C.....G..A

501      511      521      531      541      550
|         |         |         |         |         |
pv GAC-TCAGGA TGA-GTTAAT TGAGAGAGGC AATCTTCCTC CC-GTGAAGG
211/98 A.-C...AT. C....C.G. ....AG... .CCT.G..G. ...A.....
19571 .....AT. C-GA..C.TC .A...G... .CCT.G..G. .T.A...G..
ci19671 .....AT. CCGA..C.TC .A...G..T .CCT.G..GA ...A...G..
30 A...TGAC. C....C.T. ....G... .TC..G... .T.A.....
ci21179 .....AT. C...-G..TC .A...G..T .CCT.C..GA ...A...G..
hb20948 .....AT. A....C.TC .A...AG... .CCT.G..G. ...A.....
g22107 .....AT. C....C.TC .A...G..T .CCT.G..GA ...A...G..
s476/96 A...T.AC. CA...C.T. ....AG... .TC..G..C. ...A.....
fe410/96 A...T.AC. CAG...C.T. ....AG... .TC..G..C. ...A.....
m28/96 A...T.AC. CA...C.T. ....AG... .TC..G..C. ...A.....
b85/98 A..T..CAT. C....C.G. ....AGA... .CCT.G..G. ...A.....
fe650/96 A--C...CATT C..GTCC.G. .A...AG... .CCT.G..GG ...A.....
b89/98 A..C..TGAC. CA....C.G. ....AT... .CC..G... ..A.....
gal19518 .....AT. C....C.TC .A...G... .CCT.GT... ..A...G..
ci22574 .....AT. C....C.TC .A...G..T .CCT.G..GA ...A...G..
o1020/94 AGA.A..AC. C....C.GA ....AG... .CC..G... ..A.....
d23/98 AG...T.AC. CA....C.T. ....G... .TC..G..C. ...A.....
m257/98 A...T.AC. CA....C.T. ....AG... .T..G..C. .CA.....
fe401/98 A...TGAC. CA....C.T. ....AG... .TC..G... .T.A.....
b328/98 A...TGAC. CA....C.G. ....AT... .CC..G... ..A.....
fe138/98 A...TGAC. CA....C.T. ....AG... .TC..G... .T.A.....
ge718/98 A.-C...AT. C....C.G. ....AG... .CCT.G..G. ...A.....
gal1167/9 A...T.AC. CA....C.T. .C..AG... .TC..G..C. ...A.....-
hel197/97 A...T.AC. CA....C.T. ....AG... .TC..G..C. ...A.....
fe516/97 A...TGAC. CA....C.T. ....AG... .TC..G..C. ...A.....
s221/98 A...T.AC. CA....C.C. ....AG... .TC..G... .T.A.....
ge446/92 A.-C...AT. C....C.G. ....AG... .CCT.G..G. ...A.....
gel236/8 A....AC. CA....C.GG ....AG... .C..G... ..A.....
s485/94 A...T.AC. CA....C.G. ....AG... .CC..G... ..A.....
gal636/9 AG...T.AC. CA....C.T. ....G... .TC..G..C. ...A.....
s19/92 AG...T.AC. CA....C.T. ....G... .TC..G..C. ...A.....
d421/92 .....T.AC. CA....C.T. ....AG... T.C..G..C. ...A.....
gs637/90 A...T.AC. CA....C.T. .A...AG... .TC..G..C. ...A.....
j701/92 A...T.AC. CA.GT.C.T. .A...-G... .TC.CG..C. .A.A.....
fe298/90 .....T.AC. CAG...C.T. ....AG... .TC..G..C. T..A.....
m710/90 A...T.AC. CA....C.T. ....AG... .TC..G... .T.A.....
m732/90 A...T.AC. CA....C.T. ....AG... .TC..G... .T.....
j5/91 A...T.AC. CA....C.T. ....AG... .TC..G... .T.A.....
ati668/9 A...T.AC. CA....C.T. .A...-... .TC..G..C. ...A.....
m420/90 A...T..C. CAG...C... ..AG... .C..G... .A.....
m466/90 A...CT.AC. CAG...C.G. ....AG... .C..G... .A.....
m480/90 A...CT.AC. CAG...C.G. ....AG... .C..G... .A.....
gal878/9 A...T.AC. CA....C.G. ....AG... .C..G... ..A.....
s970/93 A...CT.AC. CAG...C... ..AG... .C..G... .A.....
j158/91 A...TGAC. CA....C.G. ....AG... .CC..G... ..A.....
b256/90 A...TGAC. CA....C.G. ....AT... .CC..G... ..A.....
m669/90 AGA.A..AC. C....C.GA ....AG... .CC..G... ..A.....
s926/93 AGA.A..AC. C....C.G. ....AG... .CC..G... ..A.....
fe475/95 A.-C...AT. C....C.G. ....AG... .CCT.G..G. ...A.....
ati113/9 ..-C...AT. C....C.G. ....A.... .CC.C...G. ...A.....

```



```

ge611/92 A.-C.T.AT. C.....C.G. ....AGA.. .CC..G..G. ...A.....
ge1049/9 A....T.AC. CA....C.T. .A...AG... .TC..G..C. -.A.....
fe380/94 A.-C...AT. C.....C.G. ....AG... .C...G.... ...A.....
b127/91 A.-C...AT. C.G...C.G. ....AG... .CC.CG..G. TA.....

          551          561          571          581          591          600
          |           |           |           |           |           |
pv ACACAAGCAG TAGCTCACAA TCATCTCGTG TTCAGCAAA GTGTGCATAA
211/98 G..T...CA ...A..... .G..T.CA .C...T... .C.....
19571 G.....CA ...A..... .G..CA .C...T... ...A....
ci19671 G.....CA ...A...T.. .G..CA .C...T... ...A....
30 ...T...TCA ...A...G .TG..C..CA .CC..TT... .T...C..
ci21179 G.....CA ...A...T.. .G..CA .C...T... ...A....
hb20948 G.....CA ...G...T.. .A..CA .C...T... ...A....
g22107 G.....CA ...A...T.. .G..CA .C...T... ...A....
s476/96 ...T...CA ...A...G .G..CT.CA .C...TT... ..C...
fe410/96 ..T...CA ..A...G .G..CT.CA .C...TT... A.....CT.
m28/96 ...T...CA ...A...G .G..CT.CA .C...TT... ..C...
b85/98 G..T...CA ...A..... .AT.CA .C...T... .C.....
fe650/96 G..T...CA ...A..... .GT.CA .C...T... .C.....
b89/98 ...T...CA ...T..... .CT.CA .C...TT... ..C...
gal19518 G.....CA ...A..... .T.CA .C...T... ...A....
ci22574 G.....CA ...A...T.. .G..CA .C...T... ...A....G
ol020/94 ..GT...CA ...AC.... .G..CT.CA .C...T... ..C...
d23/98 ...T...CA ...A...G .G..T.CA .C...TT... ..C...
m257/98 ...T...CA ...A...G .G..CT.CA .C...TT... ..C...
fe401/98 ..T...CA ...A...G .TG..C..CA .CC..TT... ..C...
b328/98 ...T...CA ...T..... .CT.CA .C...TT... ..C...
fe138/98 ..T...CA ...A...G .TG..C..CA .CC..TT... ..C...
ge718/98 G..T...CA ...A..... .GT.CA .C...T... .C.....
gal167/9 ..T...CA ...A...G .G..CT.CA .C...TT... A.....C..
he197/97 ..T...CA ...A...G .G..CT.CA .C...TT... A.....CT.
fe516/97 ..T...CA ...A...G .G..CT.CA .C...TT... A.....C..
s221/98 ..T...CA ...A...T.G .TG-.C..CA .CC..TT... ..C...
ge446/92 T..T...CA ...A..... .GT.CA .C...T... TC.....
ge1236/8 ..T...CA ...A..... .CT.CA .C...TT... ..TC..
s485/94 ..T...CA ...A...T.. .CT.CA .C..GTT... ..C...
gal636/9 ..T...CA ...A...G .G..CT.CA .C...TT... ..C...
s19/92 ..T...CA ...A...G .G..CT.CA .C...TT... ..C...
d421/92 ..T...CA ...A...G .G..CT.CA .C...TT... ..C...
gs637/90 ..T...CA ...A...G .G..CT.CA .C...TT... A.....C..
j701/92 ..T...CA ...A...G .G..CT.CA .C...TT... A.....C..
fe298/90 ..T...CA ...A...G .G.TCT.CA .C...T... ..C...
m710/90 ..T...CA ...A...G .TG..C..CA .CC..TT... ..C...
m732/90 ..T...CA ...A...G .TG..C..CA .CC..TT... ..A..C..
j5/91 ..T...CA ...A...T.G .TG..C..CA .CC..TT... ..C...
ati668/9 ..T...CA ...A...G .G..CT.CA .C...TT... A.....C..
m420/90 CT.T...CA ...A..... .T.CA .C...TT... T.....C..
m466/90 CT.T...CA ...A..... .T.CA .C...TT... ..C...
m480/90 .T.T...CA ...A..... .CT.CA .C...TT... ..C...
gal878/9 ..T...CA ...A..... .CT.CA .C..GTT... ..C...
s970/93 .T.T...CA ...A..... .CT.CA .C..CTT... ..C...
j158/91 ..T...CA ...A..... .CT.CA .C..GTT... ..C...
b256/90 ..T...CA ...T..... .CT.CA .C...TT... ..C...
m669/90 ..GT...CA ..AC..T.. .G..CT.CA .C...T...-- ..C...
s926/93 ..GT...CA ...A..... .G..CT.CA .C...T... ..A...
fe475/95 G..T...CA ...A..... .GT.CA .C...T... .C.....
at113/9 T..T...CA .G.A..... .AGT.CA .C...T... .C.....
ge611/92 T..T...CA ...A..... .AT.CA .C...T... .C.....
ge1049/9 ..T...CA ...A...G .G..C..CA .C...TT... A.....C..
fe380/94 ..T...CA ...A..... .T.CA .C...T... TC.....
b127/91 G..T...A ...A..... .GT.GA .C...T... .C.....

```



	601	611	621	631	641
pv	TTATAAAGTG	CTGGGTCATC	TAAGCTTTTC	AGTCGAGAAA	AAAA-
211/98	C..C...G.	.....C.	..GA....C.	.AC.....	.....
19571	C..C...G.	.....G..	..GA.....	.AC.....	.....C
ci19671	CC.C...G.	.....G..	..GA.....	.AC.....	.....
30	C.....G.	..TT.....	.G.A..C...	.A..A.....	.....
ci21179	CC.C...G.	.....G..	..GA.....	.AC.....	.....
hb20948	A..C...G.	.....G..	..GA....C.	.AC.....	.....
g22107	CC.C...G.	.....G..	..GA.....	.AC.....-
s476/96	C..C...G.	....T.....	.G.A..C...	GA..A.....	....A
fe410/96	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
m28/96	C..C...G.	....T.....	.G.A..C...	GA..A.....	....A
b85/98	C..C...G.	.....C.	..GA....C.	.AC.....	.....
fe650/96	C..C...G.	.....C.	..GA....C.	.AC.....	.....
b89/98	C.....G.	..TTC....	..A.....	.A.....	.....
gal19518	C..C...G.	.....G..	..GA.....	.AC.....	.....
ci22574	CC.C...G.	.....G..	..GA.....	.AC.....	.....
o1020/94	CC.....G.	..AA.....	.G.A.....	.A..A.....	.....
d23/98	C.....G.	....T.....	.G.A..C...	G..A.....	.....
m257/98	C.....G.	....T.....	.GGA..C...	GA..A.....	.....
fe401/98	C.....G.	....T.....	.G.AT.C...	.A..A.....	.....
b328/98	C.....G.	..TTC....	..A.....	.A.....	.....
fe138/98	C.....G.	....T.....	.G.AT.C...	.A..A.....	.....
ge718/98	C..C...G.	.....C.	..GA....C.	.AC.....	.....
gal167/9	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
he197/97	C.....G.	....T.....	.G.A..C...	GA..A.A...	.....
fe516/97	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
s221/98	C.....G.	....T.....	.G.A..C...	.A..A.....	.....
ge446/92	C..C...G.	.....C.	..GA....C.	.AC.....	.....
ge1236/8	C.G....G.	....C.....	C..A..C...	.A.....	.....
s485/94	C.....G.	..TTC....	.G.A....C.	GA.....	.....
gal636/9	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
s19/92	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
d421/92	C.....G.	....T.....	.G.A..C...	..A.....	.....
gs637/90	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
j701/92	C.....G.	....T.....	.G.A..C..T	GA..A.....	.....
fe298/90	C.G....G.	....T.....	.G.A..C...	.A..A.....	.....
m710/90	C.....G.	....T.....	.G.AT.C...	.A..A.....	.....
m732/90	C.....G.	....T.....	.G.A..C...	..A.....	.....
j5/91	C.....G.	....T.....	.G.A..C...	.A..A.....	.....
ati668/9	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
m420/90	C.....G.	..TTC....	C..A..C...	.A.....	.....
m466/90	C.....G.	..TTC....	C..A..C...	.A.....	.....
m480/90	CC.....G.	..TTC....	C..A..C...	.A.....	.....
gal878/9	C.....G.	..TTC....	..A..C...	.A.....	.....
s970/93	C.....G.	..TTC....	C..A..A...	.A.....	.....
j158/91	C.....G.	..TTC....	..A..C...	.A.....	.....
b256/90	C.....G.	..TTC....	..A.....	.A.....	.....
m669/90	CC.....G.	..AA.....	.G.A.....	.A..A.....	.....
s926/93	CC.....G.	..AA.....	.G.A.....	.A..A.....	.....
fe475/95	C..C...G-	.....C.	..GA....C.	.AC.....	.....
ati113/9	C..C...G.	.....C.	..GA....C.	.AC.....	.....
ge611/92	C..C...G.	.....C.	..AC.....	.A.....	.....
ge1049/9	C.....G.	....T.....	.G.A..C...	GA..A.....	.....
fe380/94	C..C...G.	.....C.	..GA....C.	.AC.....	.....
bl27/91	C..C...G.	.....C.	AT.....C.	.AC.....	.....

Appendix 4a: Genetic distances of Zimbabwean viverrid viruses used in this study. The genetic distances were generated by DNADIST program in Phylip 3.5 package (Felsenstein, 1993).

20	0.0								
19	2.2	0.0							
21	5.1	3.3	0.0						
22	5.8	3.7	6.4	0.0					
23	10.0	1.0	13.2	13.9	0.0				
24	1.9	0.7	3.6	3.6	10.6	0.0			
25	7.8	7.6	7.8	6.4	15.5	7.6	0.0		
pv	31.3	31.4	33.2	35.6	27.6	32.1	34.3	0.0	
	20	19	21	22	23	24	25	pv	

Appendix 4b: Genetic distances of South African viverrid viruses used in group 2.

5	0.0										
9	0.7	0.0									
29	2.6	1.2	0.0								
13	3.2	2.4	2.3	0.0							
12	4.0	3.5	4.8	5.0	0.0						
30	6.2	5.5	4.6	6.1	8.1	0.0					
31	7.3	6.6	6.7	8.0	8.7	8.5	0.0				
32	9.7	8.9	10.4	10.6	8.7	12.1	11.6	0.0			
33	10.0	9.2	10.4	11.4	11.5	12.1	9.9	14.3	0.0		
34	14.0	13.1	14.6	15.5	15.5	17.4	22.1	18.3	14.1	0.0	
Pv	35.1	34.3	35.0	36.9	34.9	32.9	34.4	33.9	32.8	36.1	0.0
	5	9	29	13	12	30	31	32	33	34	pv

Appendix 5: An alignment of the 292bp nucleotide sequence of the nucleoprotein gene of the southern African Mokola virus isolates. The alignment was carried out as described in the methods against Lagos bat virus and viverrid viruses from South Africa.

Base substitutions are shown and identical nucleotides are marked by dots.

	1	11	21	31	41	50
32296	ACTTCAGATT	TTGGTTGGT	ACATACTACA	TGTTTTTTC	GGGAGTTGAG	
54395	.....	.....	.....G...	.....	AA.....	
11296	.....	.....	.....G...	.....	AA.....	
70070	..G.....	C.....G...	.....G.T.	.....	AA.....	
22997	.....	C.....G...	.....G.T.	.....	AA...C...	
25297	.....	C.....G...	.....G.T.	.....	AA.....	
07198	.....	C.....G...	.....G.T.	.....	AA.....	
ZIM82	.....	CC...G..C	....TG.T.	...C....	AA...C...	
15010zim	.....	CC...G..C	....TG.T.	...C....	AA...C...	
13270zim	.....	CC...G..C	....TG.T.	...C....	AA...C...	
12341zim	.....	CC...G..C	....TG.T.	...C....	AA...C...	
12574zim	.....	CC...G..C	....TG.T.	...C....	AA...C...	
21846zim	.....	C.....A..	....TG.T.	.....	AA.G..C..A	
lagosbat	.....	...CA..G	..T..G..	.....	AA.G....A	
256	.....	C...C...A	G.C..TG...	.....CT.	CC.GA.....	
810	.....	C...C...A	..C..TG...	.....CT.	CC.GA.....	
m420	..C.....	C...C...A	..C..TG...	.....CT.	CC.GA.....	
gel236	.....	C...C...A	..C..G...	.....CT.	CC.GA.....	
m710	.....	C...C...A	..C..TG...	.....CT.	CC.GA.....	
	51	61	71	81	91	100
32296	CATATATACT	CGGCTCTCAG	AGTAGGAACA	GTGGTCACAG	CATATGAGGA	
54395	.....	.....	..G.....	.....A....	.....
11296	.....	.....	.....	.....G....	.....
70070	.....	.....C.	.....	.....G....	.....
22997	.....T.	.....TC.	G.....	.....G....	..C.....	
25297	.....	.....TC.	G.....	.....G....	..C.....	
07198	.....	.....TC.	G.....	.....G....	.....
ZIM82	.....T.	.....	..C.....	..C..G....	..C..C....	
15010zim	.....T.	.....	..C.....	..C..G....	..C..C....	
13270zim	.....T.	.....	..C.....	..C..G....	..C..C....	
12341zim	.....T.	.....	..C.....	..C..G....	..C..C....	
12574zim	.....T.	.....	..C.....	..C..G....	..C..C....	
21846zim	.....T.	T.....	..T.....	.....G....	.....
lagosbat	..C.C...T	..T...T.	G..T..C...	..T..A..T.	..T..C....	
256	..C.C...T	..A..AA...	..G..C...	..T...T.	..T..C....	
810	..C.C...T	..A..AA...	..G..C..G	.....T.	..T..C....	
m420	..C.C...T	..A..AA...	.....C..G	.....T.	..T..C....	
gel236	..C.C...T	..A..AA...	..G..C...	.....T.	..T..C....	
m710	..C.C...T	..A..AA...	..G..C...	.....T.	..T..C....	
	101	111	121	131	141	150
32296	TTGTTCTGGG	TTGGTCTCCG	TCACAGGGTT	TATCAAACAG	ATCAATCTAT	
54395	.....	.....T	.....	.....	.....



```

11296 .....A.....T .....
70070 ...C.....G.....T ...C.....
22997 ...C..C... ..T.....T.....
25297 ...C..C... ..T.....T.....
07198 ...C..C... ..T.....T.....
ZIM82 ...C..A..C ..T.....T.....A.....
15010zim ...C..A..C ..T.....T.....A.....
13270zim ...C..A..C ..T.....T.....A.....
12341zim ...C..A..C ..T.....T.....A.....
12574zim ...C..A..C ..T.....T.....A.....
21846zim ...C..... ..T.....C.....
lagosbat ...C..C..A C...G..TT .T..... C..T.....C....
256 ...C..... C..A..A..AT .T..... C..A..G... ..A..T.CA
810 ...C..... C..A..A..GT .T..... C..A..G... ..A....GA
m420 ...C..... C..A..A..AT .T..... C..A..G... ..A..T.GA
gel236 ...C..... ..A..A..AT .T..G..... C..A..G... ..A..T.GA
m710 ...C..... CAT..A..AT .T..... C..A.....A .AG.T.T.GA

151      161      171      181      191      200
|         |         |         |         |         |
32296 CCCCTAGAGA CGCACTGCTA TATTCTTCC ACAAAAACCTT TGAGGGAGAG
54395 .....
11296 .....
70070 ..... T..... T.....
22997 ...C..... T..... T.....
25297 ...C..... T..... T.....
07198 .T..C..... T..... T.....
ZIM82 .T..... T..... T..... ..A..G...
15010zim .T..... T..... T..... ..A..G...
13270zim .T..... T..... T..... ..A..G...
12341zim .T..... T..... T..... ..A.....
12574zim .T..... T..... T..... ..A.....
21846zim .T..C..... T.....C ..C..... T..... ..A.....
lagosbat .TG.AC.... ..G..CT.. ..T..... ..G..G... ..A..A...
256 .TG.A.... A..GA.A..G ..... ..A..A...
810 .TG.A.... A..GA.A..G ..... ..A..A...
m420 .TG.A.... G..GA.A..G ..... ..A..A...
gel236 .TG..... A..GA.A..G ..... ..A..A...
m710 .TG.A.... A..GA.A..G ..... ..A..A...

201      211      221      231      241      250
|         |         |         |         |         |
32296 ATCAAGAGAA TGTTTGAGCC AGGGCAAGAA ACAGCAGTCC CCCACTCATA
54395 .....
11296 ..... ..G.....
70070 ..... C.....
22997 .....
25297 ..... ..C.....
07198 .....
ZIM82 .T..... ..G..... T.....
15010zim .T..... ..G..... T.....
13270zim .T..... ..G..... T.....
12341zim .T..... ..G..... T.....
12574zim .T..... ..G..... T.....
21846zim ..A.....G. ....C..... ..T.....T. ....T.....
lagosbat .T..A.... ..A.. T..T..... ..T..... T..TC...
256 ..A.GA..G. ....C..... G.....G..G ..G..T..T. .T.....T..
810 ..A.GA..G. ....C..... ..G..C ..G..T..T. .T.....T..
m420 ..A.GA..G. ....C..... ..G..G .....T..T. A.....T..
gel236 ..A.GA..G. ....C..... G.....G..G .....T..T. T.....T..
m710 ..A.GA..G. ....C..... ..G..G ..G..T..... TG.....T..

251      261      271      281      291

```



32296	CTTCATTCAT	TTCAG--GGC	ACTTGGATTG	AGTGGCAAAT	CT-
54395	.....	.....	.....	.....	...
11296	.....	.....	...C.....	.....	...
70070	.....	.....A..	.....T..	.....	...
22997	.....	.....A..	.....T..	.....C.	.C.
25297	.....	.....A..	.....T..	.....C.	.C.
07198	.....	.....	.....T..	.....	...
ZIM82	.....	..T...A..	.....CC..	.....G.	.C.
15010zim	.....	..T...A..	.....CC..	.....G.	.C.
13270Zim	.....	..T...A..	.....CC..	.....G.	.CC
12341Zim	.....	..T.AGAA..	.....CC..	.....G.	.CC
12574Zim	.....	..T...A..	.....CC..	.....G.	.CC
21846zim	.....	..T...A..	G.....C..	.....	.C.
lagosbat	T.....A...	..T.....	.T.G..GG..	.....A..G.	...
256	T..T....C	...C...TT.	...A..CC..	.....G..G.	.C.
810	T..T..C..C	...C...TT.	...G..C...	.....G..G.	...
m420	T..T....C	...C...TT.	...G..CC..	.....G..G.	.C.
ge1236	T.....C	...C...TT.	...G..CC..	...C..G..G.	.C.
m710	T.....C	...C...TT.	...G..CC..	.....G..G.	.C.

Appendix 6: Genetic distances of the Mokola viruses used in this investigation.

5	0.0																			
2	9.6	0.0																		
1	10.4	0.7	0.0																	
3	10.4	0.7	0.7	0.0																
4	10.4	0.7	0.7	0.0	0.0															
9	10.8	10.3	11.1	11.1	11.1	0.0														
6	10.4	0.7	0.7	0.0	0.0	11.1	0.0													
7	11.6	10.0	10.8	10.8	10.8	2.1	10.8	0.0												
10	10.0	10.0	10.8	10.8	10.8	3.5	10.8	4.3	0.0											
11	12.3	12.8	13.6	13.6	13.6	6.5	13.6	8.1	5.8	0.0										
13	13.3	13.4	14.5	14.5	14.5	7.3	14.5	8.9	6.6	2.8	0.0									
12	12.0	12.4	13.2	13.2	13.2	6.1	13.2	7.7	5.4	1.8	2.1	0.0								
8	10.4	8.8	9.6	9.6	9.6	2.5	9.6	1.0	4.6	8.4	9.2	8.0	0.0							
14	26.9	26.8	27.2	27.3	27.3	24.1	27.3	26.0	28.1	24.9	26.0	24.0	26.4	0.0						
15	31.5	30.7	31.2	31.2	31.2	34.9	31.2	35.5	35.2	33.2	32.7	32.7	34.9	29.1	0.0					
16	30.4	32.3	32.9	32.9	32.9	0.34	32.9	34.4	3.0	31.0	30.5	30.5	33.7	28.2	4.3	0.0				
17	30.4	31.8	32.3	32.3	32.3	32.7	32.3	33.3	32.4	31.0	30.5	30.5	32.7	30.2	4.3	4.3	0.0			
18	29.7	29.1	29.6	29.6	29.6	29.5	29.6	32.6	32.2	30.3	29.8	29.8	31.9	29.2	3.9	5.4	4.6	0.0		
19	32.3	31.7	32.2	32.2	32.2	32.2	32.2	34.8	34.4	32.4	31.9	31.9	34.1	30.1	5.8	6.5	6.5	6.1	0.0	
	5	2	1	3	4	9	6	7	10	11	13	12	8	14	15	16	17	18	19	

COMMUNICATIONS GENERATED DURING THE COURSE OF THIS STUDY

Presentation at conferences

1. Sabeta, C.T., Bingham, J. and Nel, L.H. 2000. Molecular epidemiology of rabies associated with canine and viverrid species in Zimbabwe and South Africa. Poster, South African Microbiology Society, BioY2K Millenium Congress, Rhodes University, January 2000.
2. Nel, L.H., Sabeta, C.T., Bingham, J. and Rupprecht, C.E. 2000. Molecular analysis of rabies and rabies-related viruses from southern Africa. 100th General meeting of the American Society for Microbiology, Los Angeles USA, May 2000.
3. Nel, L.H., Sabeta, C.T., Bingham, J., Niezgod, M. and Rupprecht, C.E. 2000. Molecular analysis of Mokola virus isolates from southern Africa. 19th Annual meeting of the American Society for Microbiology. Fort Collins, USA, July 2000.
4. Contribution to the ARC OVI report, 2000. Onderstepoort, Pretoria, South Africa.
5. Sabeta, C.T., Bingham, J. and Nel, L.H. 1999. Molecular epidemiology of rabies in Zimbabwe. Paper presented at an International Virology and Microbiology meeting in Yaounde, Cameroon, Nov 12-16, 1999.
6. Contribution to the ARC OVI report, 1998. Onderstepoort, Pretoria, South Africa.

Articles published from this thesis

1. Bingham, J., Javangwe, S., Sabeta, C., Wandeler, A.I. Report of isolations of unusual lyssaviruses (rabies and Mokola) identified retrospectively from Zimbabwe. 2001. *Journal of the South African Veterinary Association*. 72(2): 92-94.

Articles submitted for publication

1. Sabeta, C.T., Bingham, J. and Nel, L.H. Molecular epidemiology of canine rabies in Zimbabwe and South Africa (Chapter 2). Submitted to Virus Research.

Articles being prepared for publication

1. Sabeta, C.T., Bingham, J. and Nel, L.H. Molecular epidemiology of viverrid rabies in Zimbabwe and South Africa (Chapter 3).