

https://dspace.org/

Molecular epidemiology and antigenic characteristics of measles virus in South Africa

Kreis, Stephanie

2014-04-30
http://hdl.handle.net10539/14627

Downloaded from a DSpace repository. https://dspace.org/

Immunoglobulin M Antibody Response to Measles Virus Following Primary and Secondary Vaccination and Natural Virus Infection. J.Med.Virol. 41, 44-48.

Esolen, L.M., Ward, B.J., & Moench, T.R. (1993) Infection of monocytes during measles. JID 168, 47.

Fantini, J., Cook, D.G., Nathanson, N., Spitalnik, S.L., & Gonzalez-Scarano, F. (1993) Infection of colonic epithelial cell lines by type I human immunodefiency virus is associated with cell surface expression of galactosylceramide, a potential alternativ gp120 receptor. Proc.Natl.Acad.Sci. USA 90, 2700-2704.

Felsenstein, J. (1985) Confidence Limits on Phylogenies: An Approach Using the Bootstrap. Evolution 39 (4), 783-791.

Felsenstein, J. (1989) PHYLIP: phylogony inference package, version 3.2, Cladistics 5, 164-166.

Fontaine, R. E., & Martin, A. S. (1978) Subacute Sclerosing Panencephalitis Surveillance-United States. Am.J.Epidemiol. 107, 36-45.

Forthal, D.N., Aarnaes, S., Blanding, J., de la Maza, L., & Tilles, J.G. (1992) Degree and Length of Viremia in Adults with Measles. JID 166, 421-424.

Forthal, D.N., Blanding, J., Aarnaes, S., Peterson, E.M., de la Maza, L., & Tilles, J.G. (1993) Comparison of Different Methods and Cell Lines for Isolating Measles Virus. J.Clin.Micro. 31, 695-697.

Frey, H.M., & Krugman, S. (1981) A typical measles syndrome: unusual hepatic , pulmonary, and immunologic aspects. Am.J.Med.Sci. 281, 51.

Frieden, T.R., Sowell, A.L., Henning, K.J., Huff, D.L., & Gunn, R.A. (1992) Vitamin A levels and severity of measles: New York City. Am.J.Dis.Child 146, 182-186.

Fugier, Vivier, I., Server-Delprat, C., Rivailler, P., Rissoan, M.-C., Liu, Y.-J., & Rabourdien-Ciombe, C. (1997) Measles virus suppresses cell-mediated immunity by interfering with the survival and functions of dendritic and T cells.

J.Exp.Med. 186, 813-823.

Galinski, M.S. (1991) Annotated nucleotide and protein sequences fro selected Paramyxoviridae. In: The Paramyxoviruses. Kingsbury, D.W. (ed.). Plenum Press, New York.

Gastel, B. (1973) Measles: a potentially finite history. J.Hist.Med. 28, 34.

Gellin, B.G., Katz, S.L. (1994a) Measles state of the art and future directions. JID (Suppl. 1), 170: S3.

Gellin, B.G., & Katz, S.L. (1994b) Putting a Stop to a Serial Killer: Measles. JID 170, (Suppl. 1): S1-2

Gerlier, D., Gayathri, V-K., & Devaux, P. (1995) CD46-mediated measles virus entry: a first key to host-range specificity. Trends Microbiol. 3, 338-345.

Gerlier, D., Loveland, B., Varior-Krrishhnan, G., Thorley, B., McKenzie, I.F.C., & Rabourdin-Combe, C. (1994) Measles virus receptor properties are shared by several CD46 isoforms differing in extracellular regions and cytoplasmic tails. J.Gen.Virol. 75, 2163-2171.

Giraudon, P., Jacquier, M.F., & Wild, T.F. (1988) Antigenic analysis of African measles virus field isolates: identification and localisation of one conserved and two variable epitope sites on the NP protein. Virus Research 18, 137-152.

Giraudon, P., Buckland, R., & Wild, T.F. (1991) The immune response to measles virus in mice. T-helper response to the nucleoprotein and mapping of the T-helper epitopes. Virus Research 22, 41-54.

Giraudon, P. & Wild T.F. (1985) Correlation between Epitopes on Hemagglutinin of Measles Virus and Biological Activities: Passive Protection by Monoclonal Antibodies Is Related to their Hemagglutination Inhibiting Activity. Virology 144, 46-58.

Goldberger, J., & Anderson, J.F. (1911) An experimental demonstration of the virus of measles in the mixed buccal and nasal secretions. JAMA 57, 476.

Gombart, A.F., Hirano, A., & Wong, T.C. (1995) Nucleoprotein phosphorylated on both serine and threonine is preferentially assembled into the nucleocapsids of measles virus. Virus Research 37, 63-73.

Gould, E.A., Cosby, S.L., & Shirodaria, P.V. (1976) Salt-dependent Haemagglutinating Measles Virus in SSPE. J.Gen.Virol. 33, 139-142.

Gould, E.A. & Linton, P.E. (1975) The production of a temperature-sensitive persistent measles virus infection. J.Gen.Virol. 28, 21-28.

Gresser, I.,& Katz, S.L. (1960) Isolation of Measles Virus From Urine. N.Eng.J.Med. (263), 452-454.

Griffin, D.E. (1995) Immune responses to measles virus infections. In: Measles Virus, ter Meulen, V. & and Billeter, M.A. (eds.), Springer Verlag, Berlin.

Griffin, D.E. & Bellini, W.J. (1996) Measles virus, Chapter 43, In: Fields Virology, 3rd ed., Fields, B.N., Knipe, D.M., & Howley, P.M. et al., (eds.), Lippincott Raven Publishers, Philadelphia.

Griffin, D.E., Ward, B.J., Jauregui, E., Johson, R.T. & Vaisberg, A. (1989) Immune activation during measles. N.Eng.J.Med. 320, 1667-1672.

Griffin, D.E., Ward, B.J., Jauregui, E., Johnson, R.T. & Vaisberg, A. (1990) Natural killer cell activity during measles. Clin.Exp.Immunol. 81, 218-224.

Griffin, D.E., & Ward, B.J., (1993) Differential CD 4 T Cell Activation in Measles. JID 168, 275-278.

Griffin, D.E., Ward, B.J., & Esolen, L.M. (1994) Pathogenesis of Measles Virus Infection: An Hypothesis for Altered Immune Responses. JID 170 (Suppl. 1): S24-31.

Grosjean, I., Caux, C., Bella, C., Berger, I., Wild, T.F., Banchereau, J., & Kaiserlian, D. (1997) Measles virus infects human dendritic cells and blocks their allostimulatory properties for CD4+ T cells. J.Exp.Med 186, 801-812.

Gustafson, T.L., Lievens, A.W., Brunelli, P.A., Moellenberg, R.G., Buttery, C.M.G.& Seehulster, L.M. (1987) Measles outbreak in a fully immunized secondary-

school population. N.Eng.J.Med. 316, 771-774.

Harty, R.N., & Palese, P. (1995) Measles virus phosphoprotein (P) requires the NH-2 and COOH- terminal domains for interactions with the nucleoprotein (N) but only the COOH terminus for interactions with itself. J.Gen.Virol. 76, 2863-2867.

Haspel, M.V. & Rapp, F. (1975) Measles virus: an unwanted variant causing hydrocephalus. Science 187, 450-451.

Hektoen, L. (1905) Experimental measles. JID 2, 238.

Helfand, R.F., Kebede, S., Alexander, J.P., Jr., Alemu, W., Heath, J.L., Gary, H.E., Jr., Anderson, L.J., Beyene, H., & Bellini, W.J. (1996) Comparative Detection of Measles-Specific IgM in Oral Fluid and Serum from Children by an Antibody-Capture IgM EIA. JID 173, 1470-1474.

Hickman, C. J., Khan, A. S., Rota, P. A., & Bellini, W. J. (1997) Use of Synthetic Peptides to Identify Measles Nucleoprotein T-Cell Epitopes in Vaccinated and Naturally Infected Humans. Virology 235, 386-397.

Hirano, A., Wang, A.H., Gombart, A.F., & Wong, T.C. (1992) The matrix proteins of neurovirulent SSPE virus and its acute progenitor are functionally different. Proc.Natl.Acad.Sci.USA 89, 8745-8749.

Hirano, A., Yant, S., Iwata, K., Korte-Sarfaty, J., Seya, T., Nagasawa, S., & Wong, T. (1996) Human Cell Receptor CD46 Is Down Regulated through Recognition of a Membrane-Proximal Region of the Cytoplasmic Domain in Persistent Measles Virus Infection. J.Virol. 70, 6929-6936

Horikami, S.M., & Moyer, S.A. (1995a) Structure, Transcription, and Replication of Measles Virus. In: Measles virus, ter Meulen, V. & Billeter, M.A. (eds.), Springer Verlag, Berlin.

Horikami, S.M., Smallwood, S., Bankamp, B., & Moyer, S.A. (1994) An Amino-Proximal Domain of the L Protein Binds to the P Protein in the Measles Virus RNA Polymerase Complex Virology 205, 540-545.

Horikami, S.M., & Moyer, S.A. (1995b) Double-stranded RNA adenosine deaminase

activity during measles virus infection. Virus Research 36, 87-96.

Hsieh, C-H., & Griffith, J.D. (1989) Deletions of bases in one strand of duplex DNA, in contrast to single-base mismatches, produce highly kinked molecules: Possible relevance to the folding of single-stranded nucleic acids. Proc .Natl. Acad Sci. USA 86, 4833-4837.

Hu, A., Cattaneo, R., Schwartz, S., & Norrby, E. (1994) Role of N-linked oligosaccharide chains in the processing and antigenicity of measles virus haemagglutinin protein. J.Gen.Virol. 75, 1043-1052.

Hu, A., Sheshberadaran, H., Norrby, E., & Kovamees, J. (1993) Molecular Characterization of Epitopes on the Measles Virus Hemagglutinin Protein. Virology 192, 351-354.

Hu, A., & Norrby, E. (1995) Role of individual cysteine residues in the processing and antigenicity of measles virus hemagglutinin protein. J.Gen.Virol 75, 2173-2181.

Hummel, K.B, & Bellini, W.J.(1995) Localization of Monoclonal Antibody Epitopes and Functional Domains in the Hemagglutinin Protein of Measles Virus. J.Virol. 69,1913-1916.

Hsu, E.C., Sarangi, F., Iorio, C., Sidhu, M.S., Udem, S.A., Dillehay, D.L., Xu, W., Rota, P.A., Bellini, W.J. & Richardson, C.D. (1998) A single amino acid change in the hemagglutinin protein of measles virus determines its ability to bind CD46 and reveals another receptor on marmoset cells. J.Virol. 72, 2905-2916.

Iwata, K., Seya, T., Ueda, S., Ariga, H., & Nagasawa, S. (1994) Modulation of complement regulatory function and measles virus receptor function by the serine-threonine domains of membrane cofactor protein (CD46). J.Biochem. 304, 169-175.

Jin, L., Brown, D.W.G., Ramsay, M.E.B., Rota, P.A., & Bellini, W.J. (1997) The diversity of measles virus in the United Kingdom, 1992-1995. J.Gen.Virol. 78, 1287-1294.

Kaplan, L.J., Daum, R.S., Smaron, M., & McCarthy, C.A. (1992) Severe Measles in

Immunocompromised Patients. JAMA 267 (9), 1237-1241.

Karp, C.L., Wysocka, M., Wahl, L.M., Ahearn, J.M., Cuomo, P.J., Sherry, B., Trinchieri, G., & Griffin, D.E. (1996) Mechanism of Suppression of Cell-Mediated Immunity by Measles Virus. Science 273, 228-231.

Katayama, Y.; Shibahara, K., Kohama, T., Homma, M., & Hotta, H. (1997) Molecular Epidemiology and Changing Distribution of Genotypes of Measles Virus Field Strains in Japan. J.Clin.Micro. 35, 2651-2653.

Katayama, Y., Kohso, K., Nishimura, A., Tatsuno, Y., Homma, M., & Hotta, H. (1998) Detection of Measles Virus mRNA from Autopsied Human Tissues. J.Clin.Micro. 36 (1), 299-301.

Katz, S.L., & Gellin, B.G. (1994) Measles Vaccine: Do We Need New Vaccines or New Programs? Science 265, 1391-1392.

Katz, S.L., & Enders, J.E. (1965) Measles virus. In: Horsfall, F.L.,Jr., & Tamm, I.,(eds.) Viral and Rickettsial infections of Man. 4th. ed., J.B., Lippincott, Philadelphia.

Kempe, C.H., & Fulginiti, V.A. (1965) The pathogenesis of measles virus infection. Arch. Ges. Virusforschung 16, 103.

Kew, O., & Nathanson, N. (1995) Introduction: Molecular epidemiology of viruses. Virology 6, 357-358.

Kingsbury, D.W. (1991) (ed.). Paramyxoviruses., Plenum, New York.

Kobune, F., Sakata, H., & Sugiura, A. (1990) Marmoset Lymphoblastoid Cells as a Sensitive Host for Isolation of Measles Virus. J.Virol. 64, 700-705.

Krantic, S., Gimenez,C., & Rabourdin-Combe, C. (1995) Cell-to-cell contact via measles virus haemagglutinin-CD46 interaction triggers CD46 downregulation. J.Gen.Virol. 76, 2793-2800.

Krais, S., & Whistler, T. (1997) Rapid identification of measles virus strains by the heteroduplex mobility assay. Virus Research 47, 197-203.

Kreis, S., Vardas, E., & Whistler, T. (1997) Sequence analysis of the nucleocapsid gene of measles virus isolates from South Africa identifies a new genotype. J.Gen.Virol. 78, 1581-1587.

Kreis, S., Schoub, B.D. (1998) Partial amplification of the measles virus nucleocapsid gene from stored sera and cerebrospinal fluids for molecular epidemiological studies. J.Med.Virol. In press.

Krugman, S. (1983) Further-attenuated measles vaccine: characteristics and use. Rev. Infect. Dis. 5, 477.

Krugman, S., Katz, S.L., & Gershon, A.A. (1985) Measles. In: Infectious Diseases of Children. 8th ed. Mosby, C.V. (ed.), St. Louis.

Lecouturier, V., Fayolle, J., Caballero, M.,Carabana, J., Celma, M.L., Fernandez-Munoz, R., Wild, T.F., & Buckland, R. (1996) Identification of Two Amino Acids in the Hemagglutinin Glycoprotein of Measles Virus (MV) That Govern Hemadsorption, HeLa Cell Fusion, and CD46 Downregulation: Phenotypic Markers That Differentiate Vaccine and Wild-Type MV Strains. J.Virol. 70, 2400-2404.

Liebert, U.G., Flanagan, S.G., Löffler, S., Baczko, K., ter Meulen, V., & Rima, B.K. (1994) Antigenic Determinants of Measles Virus Hemagglutinin Associated with Neurovirulence. J.Virol. 68, 1486-1493.

Lilley, D.M.J. (1995) Kinking of DNA and RNA by base bulges. Proc. Natl. Acad. Sci. USA. 92, 7140-7142.

Linnemann, C.C., Hegg, M.E., Rotte, T.C., Phair, J.P., & Schiff, G.M. (1973) Measles IgM response during reinfection of previously vaccinated children. J.Pediatrics 82 (5), 798-801.

Liston, P., Batal, R., DiFlumeri, C., & Briedis, D.J. (1997) Protein interaction domains of the measles virus nucleocapsid protein (NP). Arch.Virol. 142, 305-321.

Liston, P., DiFlumeri, C., & Briedis, D.J. (1995) Protein interactions entered into by the measles virus P, V, and C proteins. Virus Research 38, 2421-259.

Liston, P., & Briedis, D.J. (1995) Ribosomal Frameshifting during Translation of Measles Virus P Protein mRNA Is Capable of Directing Synthesis of a Unique Protein. J.Virol. 69, 6742-6750.

Liszewski, M.K., & Atkinson, J.P. (1992) Membrane cofactor protein. Microbiol.Immunol. 178, 7-60.

Louwagi, J., Delwart, E.J., Mullins, J.I., McCutchan, F.E., Eddy, G. & Burke, D.S. (1994) Genetic analysis of HIV-1 isolates from Brazil reveals presence of two distinct genetic groups. AIDS Research and Human Retroviruses 10, 561-567

Mäkelä, M.J., Salmi, A.A., Norrby, E. & Wild, T.F. (1989) Monoclonal antibodies against measles virus hemagglutinin react with synthetic peptides. Scand.J.Immunol. 30, 225-231.

Malvoisin, E. & Wild, F. (1990) Contribution of Measles Virus Fusion Protein in Immunity: Anti-F Monoclonal Antibodies Neutralize Virus Infectivity and Protect Mice against Challenge. J.Virol. 64, 5160-5162.

Malvoison, E. & Wild, F. (1993) Measles virus glycoproteins: studies on the structure and interaction of the haemagglutinin and fusion proteins. J.Gen.Virol. 74, 2365-2372.

Manchester, M., Valsamakis, A., Kaufman, R., Liszewski, M.K., Alvarez, J., Atkinson, J.P., Lublin, D.M., & Oldstone, M.B.A. (1995) Measles virus and C3 binding sites are distinct on membrane cofactor protein (CD46). Proc. Natl. Acad. Sci. USA 92, 2303-2307.

Manchester, M., Gairin, J.E., Patterson, J.B., Alvarez, J., Liszewski, M.K., Eto, D.S., Atkinson, J.P., & Oldstone (1997) Measles Virus Recognized Its Receptor, CD46, via Two Distinct Binding Domains within SCR1-2. Virology 233, 174-184.

Markowitz, L.E., & Katz, S.L. (1994) Measles vaccine. In: Plotkin, S.A., Mortimer, E.A., Jr. (eds.): Vaccines . 2nd Ed. W.B. Saunders.

Markowitz, L.E., Sepulveda, J., Diaz-Ortega, J.L., Valdespino, J.L., Albrecht, P., Zell, E.R., Stewart, J., Zarate, M.L., & Bernier, R.H. (1990) Immunization of

Six-month-old Infants with Different Doses of Edmonston-Zagreb and Schwarz Measles Vaccines. N.Eng.J.Med. 322 (9), 580-587.

Mathias, R.C., Meeksion, W.G., Arcand, T.A. & Schlechter, M.T. (1989) The role of secondary vaccine failures in measles outbreaks. Am.J.Public Health 79, 475-478.

Matsuzono, Y., Narita, M., Ishiguro, N., & Togashi, T. (1994) Detection of Measles Virus From Clinical Samples Using the Polymerase Chain Reaction. Arch. Pediatr. Adolesc. Med. 148. 289-293.

McNeill, W. H. (1976) Plagues and peoples. Garden City, N.J.: Anchor Press/ Doubleday; 329.

Minnich, L.L., Goodenough, F., & Ray, C.G. (1991) Use of Immunofluorescence To Identify Measles Virus Infections. J.Clin.Micro. 29, 11488-11500.

Moench, T.R., Griffin, D.E., Obriecht, C.R., Vaisberg, A.J., & Johson, A.T. (1988) Acute measles in patients with and without neurological involvement: distribution of measles virus antigens and RNA. JID 158, 433-442.

Morton, R., & Mee, J. (1986) Measles pneumonia: lung puncture findings in 56 cases related to chest X-ray changes and clinical features. Am.Trop.Pediatr. 6, 41-45.

Muller, C.P., Huiss, S. & Schneider, F. (1996) Secondary immune responses in parents of children with recent measles. Lancet 348, 1379-1380.

Murakami, Y., Seya, T., Kurita, M., Ueda, S. & Nagasawa, S. (1998) Molecular cloning of membrane cofactor protein (MCP; CD46) on B95a cell, an Epstein-Barr virus-transformed B cell line: B95a-MCP is susceptible to infection with CAM, but not the Nagahata strain of the measles virus. Biochem.J. 330, 1351-1359.

Murray, K., Selleck, P., Hooper, P., Hyatt, A., Gould, A., Gleeson, L., Westbury, H., Hiley, L., Selvey, L., Rodwell, B., & Ketterer, P. (1995) A Morbillivirus that Caused Fatal Disease in Horses and Humans. Science 268, 94-97.

Myers, R.M., Larin, Z. & Maniatis, T. (1985) Detection of single base substitutions

by ribonuclease cleavage at mismatches in RNA:DNA duplexes. Science 230, 1242-1246.

Naidoo, S., & Meyers, K., (1994) Measles Epidemic, SAMJ 84,125.

Nakayama, T., Mori, T., Yamaguchi, S., Sonoda, S., Asamura, S., Yamashita, R., Takeuchi, Y., & Urano, T. (1995) Detection of measles virus genome directly from clinical samples by reverse transcriptase-polymerase chain reaction and genetic variability. Virus Research 35, 1-16.

Naniche, D., Varior-Krishnan, G., Cervoni, F., Wild, T.F., Rossi, B., Rabourdin-Combe, C., & Gerlier, D. (1993) Human Membrane Cofactor Protein (CD46). Acts as a Cellular Receptor for Measles Virus. J.Virol. 67, 6025-6032.

Naniche, D., Wild, T.F., Rabourdin-Combe, C. & Gerlier, D. (1993b) Measles virus haemagglutinin induces down-regulation of gp57/67, a molecule involved in virus binding. J.Gen.Virol. 74, 1073-1079.

Narita, M., Yamada, S., Matsuzono, Y., Itakura, O., Togashi, T. & Kikuta, H. (1996) Immunoglobulin G avidity testing in serum testing in serum and cerebrospinal fluid for analysis of measles virus infection. Clon.Diag.Lab.Immunol. 3, 211-215.

Norrby, E., & Oxmman, M.N. (1990) Measles Virus. In : Fields B. N., Knipe, D.M. (eds.) Virology 2nd ed., 1013-1044, Raven Press, New York.

Norrby, E., & Golmar, Y. (1972) Appearance and persistence of antibodies against different virus components after regular measles infection. Infect.Immunol. 6, 240-247.

Norrby, E. (1995) The paradigms of measles vaccinology. In: ter Meulen, V. & Billeter, M., A. (eds.) Springer Verlag, Berlin.

Novitsky, V., Arnold, C., & Clewley, J.P. (1996) Heteroduplex mobility assay for subtyping HIV-1: Improved methodology and comparison with phylogenetic analysis of sequence data. J.Virol.Methods 59, 61-72.

Nussbaum, O., Broder, C.C., Moss, B., Stern, L.B-L. Rozenblatt, S., & Berger E.A. (1995) Functional and Structural Interactions between Measles Virus

Hemagglutinin and CD46. J.Virol. 69, 3341-3349.

Obeid, O.E., Partidos, C.D., & Steward, M.W. (1993) Identification of helper T cell antigenic sites in mice from the haemagglutinin glycoprotein of measles virus. J.Gen. Virol 74, 2549-2557.

Ogura, H., Sato, H., Kamiya, S., & Nakamura, S. (1991) Glycosylation of measles virus hemagglutinin protein in infected cells. J.Gen.Virol. 72, 2679-2684.

O'Neill, H.J., Russell, J.D., Wyatt, D.E., McCaughey, C., & Coyle, P.V. (1996) Isolation of viruses from clinical specimens in microtitre plates with cells inoculated in suspension. J.Virol.Methods 62, 169-178.

Orita, M., Iwahana, H., Kanazawa, H., Hayashi, K., & Sekiya, T. (1989) Detection of polymorphisms of human DNA by gel electrophoresis as single-strand conformation polymorphisms. Proc. Natl. Acad. Sci. USA. 86, 2766-2770.

Örvell C. (1994) In: Encyclopedia of Virology. Webster, R.G., & Granoff, A. (eds.). Academic Press, London.

Osterhaus, A. D. M. E., de Swart, R. L., Vos. H. W., Ross, P. S., Kenter, M. J. H.,& Barrett, T. (1995) Morbillivirus infections of aquatic mammals: newly identified members of the genus. Veterinary Micro. 44, 219-227.

Osterhaus, A.D.M.E. (1994) Measles vaccines: novel generations and new strategies. JID 170, S42-S55.

Outlaw, M.C., & Pringle, C.R. (1995) Sequence variation within an outbreak of measles virus in the Coventry area during spring /summer 1993. Virus Research 39, 3-11.

Outlaw, M. C., Jaye, A., Whittle, H. C., & Pringle, C. R. (1997) Clustering of haemagglutinin gene sequences of measles viruses isolated in the Gambia. Virus Research 48, 125-131.

Oxman, M.N. (1997) In: Clinical Virology, Richman, D.D., Whitley, R.J., & Hayden, F.G. (eds.), Churchill Livingstone, New York.

Padayachee, N., Schoub, B., Hurwitz, H.S., Evans, A., De Beer, M., Wagstaff, L.,

Ijsselmuiden, C., Martin, D., Johnson, S., Gruntner, I., & Naidoo, S. (1990) A descriptive study of measles in Johannesburg and Benoni. S. Afirc. J. Epid. Inf. 5 (2), 24-267.

Panum, P.L. (1939) Observation made during the epidemic of measles on the faroe Island in the year 1846. Med. Classics 3, 829.

Pedersen, I.R., Mordhost, C.H., Ewald, T., & von Magnus, H. (1986) Long-term antibody response after measles vaccination in an isolated arctic society in Greenland. Vaccine 4, 173-178.

Pedersen, I.R., Bog-Hansen, T.C., Dalsgaard, K., & Heegaard, P.M.H. (1992) Iscom immunization with synthetic peptides representing measles virus hemagglutinin. Virus Research 24, 145-159.

Pedersen, I.R., Mordhorst, C.A., Glikmann, G. & von Magnus, H. (1989) Subclinical measles infection in vaccinated seropositive individuals in arctic Greenland. Vaccine 7, 345-348.

Pena, S.D.J., Barreto, G., Vago, A.R., De Marco, L., Reinach, F.C., Dias Neto, E. & Simpson, A.J.G. (1994) Sequence-specific "gene signatures" can be obtained by PCR with single specific primers at low stringency. Proc.Natl.Acad.Sci. USA 91, 1946-1949.

Prior, T.W., Papp, A.C., Snyder, P.J., Burghes, A.H.M., Bartolo, C., sedra, M.S. & Western, L.M. (1993) A missense mutation in the dystrophin gene in a Duchenne muscular dystrophy patient. Nature Genetics 4, 357-366.

Rager-Zisman, B., Egan, J.E., Kress, Y., & Bloom, B.R. (1984) Isolation of cold-sensitive mutants of measles virus from persistently infected murine neuroblastoma cells. J. Virol.51, 845-855.

Rapp, F. (1964) Plaque differentiation and replication of virulent and attenuated strains of measles virus. J.Bacteriol. 88, 1448-1458.

Ray, J., & Fujinami, R.S. (1987) Characterization of in vitro transcription and transcriptional products of measles virus. J. Virol. 61, 3381-3387.

Reddy, V., Bhaskaram, P., Raghnuramulu, N., et al. (1986) Relationship between

measles, malnutrition, and blindness : a prospective study in Indian children. Am. J. Clin. Nutr. 44, 924-930.

Richardson, C.D., Hull, D., Greer, P., et al. (1986) The nucleotide sequence of the mRNA encoding the fusion protein of measles virus (Edmonston strain): a comparison of fusion protein from several different paramyxoviruses. Virology 155, 508-523.

Richardson, C.D., Berkovich, A., Rozenblatt, S., & Bellini, W.J. (1985) Use of antibodies directed against synthetic peptides for identifying cDNA cones, establishing reading frames and deducing the gene order of measles virus. J. Virol. 54, 186-193.

Rima, B.K., Earle, J.A.P., Yeo, R.P., Herlihy, L., Baczko, K., ter Meulen, V., Carabana, J., Caballero, M., Celma, M.L., & Fernandez-Munoz, R. (1995a) Temporal and geographical distribution of measles virus genotypes. J.Gen.Virol. 76, 1173-1180.

Rima, B.K., Earle, J.A., Baczko, K. (1995b) In: Measles virus, ter Meulen, V., & Billeter, M.A. (eds.), Springer-Verlag, Berlin.

Rima, B.K., Earle, J.A.P., Baczko, K., ter Meulen, V., Liebert, U.G.,Carstens, C., Carabana, J., Caballero, M., Celma, M.L., & Fernandez-Munoz, R. (1997) Sequence divergence of measles virus haemagglutinin during natural evolution and adaptation to cell culture. J.Gen.Virol. 78, 97-106.

Robbins, S.J., Pope.J.H., & Sculley, T.B. (1991) Western Blot Analysis of Antibody Specificities in Subacute Sclerosing Panencephalitis: Reactivity to Measles Virus Proteins Produced in Persistently Infected Cells. Intervirology 32, 52-58.

Rota, P.A., Bloom, A.E., Vanchiere, J.A., & Bellini, W.J. (1994) Evolution of the nucleoprotein and matrix genes of wild-type strains of measles virus isolated from recent epidemics. Virology 198, 724-730.

Rota, P.A., Rota, J.S., & Bellini, W.J. (1995a) Molecular epidemiology of measles virus. Virology 6, 379-386.

Rota, P. A., Khan, A. S., Durigon, E., Yuran, T., Villamarzo, Y. S., & Bellini, W. J.

(1995b) Detection of Measles Virus RNA in Urine Specimens from Vaccine Recipients. J. Clin. Micro. 33, 2485-2488.

Rota, J.S., Wang, Z.D., & Rota, P.A. (1994) Comparison of sequences of the H, F, and N Coding genes of measles virus vaccine strains. Virus Res. 31, 317.

Rota, J.S., Heath, J.L., Rota, P.A., King, G.E., Celma, M.L., Carabana, J., Fernandez-Munoz, R., Brown D., Jin, L., & Bellini, W.J. (1996) Molecular Epidemiology of Measles Virus: Identification of Pathways of Transmission and Implications for Measles Elimination. JID 173, 32-37.

Rota, J.S., Rota, P.A., Redd, S.B., Redd, S. C., Pattamadilok, S., & Bellini, W. J. (1998) Genetic Analysis of measles Viruses in the United States, JID 177, 1995-1996.

Rota, J .S., Hummel, K. B., Rota, P. A., & Bellini, W. J., (1992) Genetic Variability of the Glycoprotein Genes of Current Wild-Type measles isolates. Virology 188, 135-142.

Rozenblatt, S., Eizenberg, O., Ben-Levy, R., Lavie, V., & Bellini, W. J. (1985) Sequence Homology Within the Morbilliviruses. J. Virol. 53 (2), 684-690.

Ruano, G., & Kidd, K.K. (1992) Modeling of Heteroduplex Formation during PCR from Mixtures of DNA Templates. PCR Meth.Appl. 2, 112-116

Saiffudin, M., Hedayati, T., Atkinson, J.P., Holguin, M.H., Parker, C.J. & Spear, G.T. (1997) Human immunodeficiency virus type 1 incorporates both glycosyl phosphatidylinositol-anchored CD55 and CD59 and integral membrane CD46 at levels that protect from complement-mediated lysis. J.Gen.Virol. 78, 1907-1911.

Saito, H., Nakagomi, O., & Morita, M. (1995) Molecular identification of two distinct hemagglutinin types of measles virus by polymerase chain reaction and restriction fragment length polymorphism (PCR-RFLP). Mol.Cell.Probes 9, 1-8.

Saito, H., Sato, H., Abe, M., Harata, S., Amano, K.-I., Suto, T., & Morita, M. (1994) Cloning and Characterization of the cDNA Encoding the HA Protein of a Hemagglutination-Defective Measles Virus Strain. Virus Genes 8 (2), 107-

113.

Saito, H., Sato, H., Abe, M., Harata, S., Amano, K., Suto, T., & Morita, M.(1992) Isolation and Characterization of the Measles Virus Strains with Low Hemagglutination Activity. Intervirology 33, 57-60.

Sakaguchi, M., Yoshikava, Y., Yamanouchi, K., Takeda, K. & Sato, T. (1986) Characteristics of fresh isolates of wild type measles virus. Japanese Journal of Experimental Medicine 56, 61-67.

Sakata, H., Kobune, F., Sato, T.A., Tanabayashi, K., Yamada, A., & Sugiura, A. (1993) Variation in Field Isolates of Measles Virus during an 8-Year Period in Japan. Microbiol. Immunol. 37 (3), 233-237.

Salmi, A.A. (1995) Measles virus. In: Murray, P.R., Baron, E.J., Pfaller, M.A. (eds): Manual of Clinical Microbiology. 6th ed. ASM Press, Washington, DC.

Sato, T.A., Kohama, T. & Sugiura, A. (1988) Intracelluiar processing of measles virus fusion protein. Arch.Virol. 98, 39-50.

Schneider-Schaulies, J., Schnorr, J-J., Brinckmann, U., Dunster, L.M., Baczko, K., Liebert, U.G., Schneider-Schaulies, S., & ter Meulen, V. (1995). Receptor, usage and differential downregulation of CD46 by measles virus wild-type and vaccine strains. Proc. Natl. Acad. Sci. USA Vol. 92, 3943-3947.

Schneider-Schaulies, J.,Dunster, L.M., Kobune, F., Rima, B., & ter Meulen, V. (1995a). Differential Downregulation of CD46 Measles Virus Strains. J.Virol. 69, 7257-7259.

Schneider-Schaulies, J., Dunster, L.M., Schwartz-Albiez, R., Krohne, G., & ter Meulen V. (1995b) Physical Association of Moesin and CD46 as a Receptor Complex for Measles Virus . J.Virol. 69, 2248-2256.

Schlender, J., Schnorr, J-J., Spielhofer, P., Cathomen, T., Cattaneo, R., Billeter, M. A., ter Meulen, V., & Schneider-Schaulies, S. (1996) Interaction of measles virus glycoproteins with the surface of uninfected peripheral blood lymphocytes induces immunosuppression in vitro. Proc. Natl. Acad. Sci. USA 93, 13194-13199.

Schnorr, J-J., Dunster, L.M., Nanan, R., Schneider-Schaulies, J., Schneider-Schaulies, S. & ter Meulen, V. (1995) Measles virus-induced down-regulation of CD46 is associated with enhanced sensitivity to complement-mediated lysis of infected cells. Eur. J. Immunol. 25, 976-984.

Schnorr, J-J., Seufert, M., Schlender, J., Borst, J., Johnston, I. C. D., ter Meulen, V., & Schneider-Schaulies, S. (1997) Cell cycle arrest rather than apoptosis is associated with measles virus contact-mediated immunosuppression in vitro. J. Gen. Virol. 78, 3217-3226.

Schoub, B.D., Johnson, S., McAnerney, J.M., Wagstaff, L.A., Matsie, W., Reinach, S.G., Vandevoorde, D., Andre, F.E., & Teuwen, D.E. (1990) Measles, mumps and rubella immunization at nine months in a developing country. J.Pediatr Infect.Dis. 9, 263-267.

Schoub, B.D. (1994a) Measles, Mumps and Rubella Vaccines-Dispelling the Myths. Virus SA 3, (4), 1-7.

Schoub, B., Johnson, S., & McAnerney, J.M. (1992) Observation of subacute sclerosing panencephalitis in South Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene 86, 550-551.

Schoub, B.D. (1994b) The Resurgence of Measles. The Leech 63, (2) 24-28.

Schoub, B.D., & Martin,D.J (1993) Lessons from the measles epidemic in South Africa. SAMJ, 83, 82-83.

Sheshberadaran, H., Chen, S.-N., & Norrby, E. (1983) Monoclonal Antibodies against Five Structural Components of Measles Virus. Virology 128, 341-353.

Sheshberadaran, H., & Norrby, E. (1986) Characterization of Epitopes on the Measles Virus Hemagglutinin. Virology 152, 58-65.

Shibahara, K., Hotta, H., Katayama, Y., & Homma, M. (1994) Increased binding activity of measles virus to monkey red blood cells after long-term passage in Vero cell cultures. J.Gen.Virol. 75, 3511-3516.

Shimizu, H., McCarthy, C.A., Smaron, M.F., & Burns, J.C. (1993) Polymerase Chain Reaction for Detection of Measles Virus in Clinical Samples. J.Clin. Micro.

31, 1034-1039.

Shirodaria, P.V., Dermott, E. & Gould, E.A. (1976) Some characteristics of salt-dependent hemagglutinating measles virus. J.Gen.Virol. 33, 107-115.

Soto, D., & Sukumar, S. (1992) Improved Detection of Mutations in the p53 Gene in Human Tumors as Single-stranded Conformation Polymorphs and Double-stranded Heteroduplex DNA. PCR Meth.Appl. 2, 96-98.

Spehner, D., Drillien, R., & Howley, P.M. (1997) The Assembly of the Measles Virus Nucleoprotein into Nucleocapsid-like Particles Is Modulated by the Phosphoprotein. Virology 232, 260-268.

Spinarda, L., Mazars, R. & Theillet, C. (1991) Protocols for an improved detection of point mutations by SSCP. Nuc.Ac.Res. 19, 4409.

Stern, L. B-L., Greenberg, M., Gershoni, J. M., & Rozenblatt, S. (1995) The Hemagglutinin Envelope Protein of Canine Distemper Virus (CDV) Confers Cell Tropism as Illustrated by CDV and Measles Virus Complementation Analysis. J. Virol. 69, 1661-1668.

Strunnikova, N.,Ray, S.C., Livingston, R.A., Rubalcaba, E., & Viscidi, R.P. (1995) Convergent Evolution within the V3 Loop Domain of Human Immunodeficiency Virus Type 1 in Association with Disease Progression. J.Virol. 69, 7548-7558.

Surveillance Bulletin (1996) South African Virus Laboratories, July 1996.

Suryanarayana , K., Baczko, K., ter Meulen, V., & Wagner, R.R. (1994) Transcription inhibition and other properties of matrix proteins expressed by M genes cloned from measles viruses and diseased human brain tissue. J.Virol. 68, 1532-1543.

Sydenham, T. (1922) In: The works of Thomas Sydenham. Vol. 2. Sydenham Society, London.

Tamin, A., Rota, P.A., Wang, Z-D. , Heath, J.L., Anderson, L.J., & Bellini, W.J. (1994) Antigenic Analysis of Current Wild Type and Vaccine Strains of Measles Virus. JID 170, 795-801.

Tanaka, K., Xie, M. & Yanagi, Y. (1998) The hemagglutinin of recent measles virus isolates induces cell fusion in a marmoset cell line, but not in other CD46-positive human and monkey cell lines, when expressed together with the F protein. Arch.Virol. 143, 213-225.

Taylor, M.J., Godfrey, E., Baczko, K., ter Meulen, V., Wild, T.F., & Rima, B.K. (1991) Identification of several different lineages of measles virus. J.Gen.Virol. 72, 83-88.

Thompson, J.D., Higgins, D.G. & Gibson, T.J. (1994) Clustal W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. NAR 22, 4673-4680.

Trudgett, A., Gould, E.A., Armstrong, M., Mingioli, E.S., & McFarlin, D.E. (1981) Antigenic Differences In The Hemagglutinin of Measles and Related Viruses. Virology 109, 180-182.

Tyrrell, D.L., & Ehrnst, A. (1979) Transmembrane communication in cells chronically infected with measles virus. J.Cell Biol. 81, 396-402.

Van Belkum, A. (1995) Low-stringency single specific primer PCR, DNA sequencing and single-strand conformation polymorphism of PCR products for identification of genetic variants of human papillomavirus type 16. J.Virol.Methods 55, 435-443.

Vardas, E., Andre, M., Kreis, S., Zachariades, N., & Schoub, B.D. (1997) Measles virus transmission from infected to immune individuals- implications for measles control and elimination. SAMJ 87, 1709.

Von Pirquet, C. (1908) Verhalten der kutanen Tuberkulin-Reaktion während der Masern. Dt.Med.Wochenschr. 34, 1297-1300.

Vidal, S., Curran, J., & Kalakofsky, D. (1990a) A stuttering model for paramyxovirus P mRNA editing. EMBO J. 9, 2017-2022.

Vidal, S., Curran, J., & Kalakofsky, D. (1990b) Editing of the Sebadi virus P/C mRNA by G insertion occurrs during mRNA synthesis via a virus encoded activity. J.Virol. 64, 239-246.

Wang, Y-H., Barker, P., & Griffith, J. (1992) Visualization of diagnostic heteroduplex DNAs from cystic fibrosis deletion heterozygotes provides an estimate of the kinking of DNA by bulged bases. J. Biol. Chem. 267, 4911-4915.

Wang, Y-H., & Griffith, J. (1991) Effects of Bulge Composition and Flanking Sequence on the Kinking of DNA by Bulged Bases. Biochemistry 30, 13558-1363.

Ward, B.J., Boulianne, N., Ratnam, S.,Guiot, M.-C., Couillard, M., & De Serres, G. (1995) Cellular Immunity in Measles Vaccine Failure: Demonstration of Measles Antigen-Specific Lymphoproliferative Responses despite Limited Serum Antibody Production after Revaccination. JID 172, 1591-1595.

Wardrop, E.A., & Briedis, D.J. (1991) Characterization of V protein in measles virus-infected cells. J.Virol. 65, 3421-3428.

Wechsler, S.L., Weiner, H.L., & Fields, B.N. (1979) Immune responses in SSPE reduced antibody responses to the matrix protein of measles virus. J.Immunol. 123, 884-889.

Weekly Epidemiological Record (1994) World Health Organization, Geneva, No.31, 229-236.

White, M.B., Carvalho, M., Derse, D., O'Brien, S.J., & Dean, M. (1992). Detecting Single Base Substitutions as Heteroduplex Polymorphisms. Genomics 12, 301-306.

Wild, T.F., Fayolle, J., Beauverger, P., & Buckland, R. (1994). Measles Virus Fusion: Role of the Cysteine-Rich Region of the Fusion Glycoprotein. J.Virol. 68 , 7546-7548.

Wild, T.F., Bernard, A., Spehner, D., & Drillien, R. (1992). Construction of vaccinia virus recombinants expressing several measles virus proteins and analysis of their efficacy in vaccination of mice. J.Gen.Virol. 73, 359-367.

Wild, T. F., & Buckland, R. (1995). Functional Aspects of Envelope-Associated Measles Virus Proteins. In: Measles virus. Ter Meulen, V. & Billetter, M.A. (eds.), Springer Verlag, Berlin.

Wu, V.H., McFarland, H., & Mayo, K. (1993). Measles virus-specific cellular immunity in patients with vaccine failure. J.Clin.Micro. 31, 118.

Wong, T.C., Ayata, M., Ueda, S. & Hirano, A. (1991) Role of biased hypermutation in evolution of Subacute Sclerosing Panencephalitis virus from progenitor acute measles virus. J.Virol. 65, 2191-2199.

Yamaguchi, S. (1997). Identification of Three Lineages of Wild Measles Virus by Nucleotide Sequence Analysis of N, P, M, F, and L Genes in Japan. J.Med.Virol. 52, 113-120.

Yang, K., Mustafa, F., Valsamakis, A., Santoro, J.C., Griffin, D.E., & Robinson, H.L. (1997). Early studies on DNA-based immunization for measles virus. Vaccine 15, No.8, 888-892.

6. APPENDICES

LIST OF ABBREVIATIONS

α	anti
AMV	Avian Myeloblastosis Virus
AP	Alkaline Phosphatase
CPE	cytopathic effects
CSF	cerebrospinal fluid
dNTP	desoxyribonucleoside triphosphate
EBV	Epstein Barr virus
EtOH	Etahnol
EMEM	Eagle's minimum essential medium
BSA	Bovine serum albumin
F	fusion
FCS	foetal calf serum
GTG	glycerol tolerant gel buffer
h	hour
H	hemagglutinin
HMA	Heteroduplex Mobility Assay
IPTG	isopropyl B-D-thiogalactopyranoside
LB	Luria Broth
mAb	monoclonal antibody
min	minutes
MV	measles virus
N	nucleocapsid
NaN_3	Sodium azide
o/N	over night
PAGE	Polyacrylamide gel electrophoresis
PBS	Phosphate buffered saline
PCR	Polymerase chain reaction
pi	Post infection
PVDF	polyvinylidene difluoride
RFLP	Restriction Fragment Length Polymorphism
rpm	rounds per minute
RT	Reverse transcription
SDS	sodium dodecyl sulfate
SN	supernatant
TBE	Tris Boric acid EDTA buffer
TS	Throat swab
TC	Tissue culture
U	Unit
V	volt
X-Gal	5-bromo-4-chloro-3-indolyl-B-galactoside

MEASLES VIRUS STRAINS PREVIOUSLY DESCRIBED:

Strain	*Year*	*Location*	*Description*	*Acession No.*
Edm wt	1954	Bethesda, USA	Edm. wild-type	U01987
EZ			Edm.-Zagreb vaccine	U03658
Len16	1960	Russia	Leningrad 16 vaccine strain	U03661
Mor	1964	USA	Moraten vaccine	U01999
Schw			Schwarz vaccine	U03668
AIK-C			Edm. derived vaccine	K01711
Ph26	1957	Philadelphia, USA	Philadelphia 26 strain	U01991
Chg47	1957	China	Changchun 47 vaccine	U03653
Hln	1962	Turku, Finland	Halonen strain	U01996
CAM70	1968	Japan	Vaccine from Tanabe starin	U03650
Hu2	1971	Northern Ireland	Schw.vaccine related case	D01011
Hal	1971	USA	Halle SSPE isolate	X13480
Y22	1983	Cameroon	wt	D01010
Y14	1983	Cameroon	wt	U01998
NY94	1994	New York, USA	wt	L46753
R96	1984	Gabon	wt	U01994
R118	1984	Gabon	wt	D01009
R103	1984	Gabon	wt	U01992
R113	1984	Gabon	wt	U01993
SIP3A	early 1970s	USA	SSPE	X16566
MF	early 1970s	Europe	SSPE	X84882
S(A)	mid 1980s	Germany	SSPE	X16567
S(K)	1970/1981	Germany	SSPE	X84883
SMa81	1970/1981	Madrid, Spain	SSPE	X84866
JM77	1977	Bethesda, USA	wt	D01002
WTF	1990	Erlangen, Germany	wt, case Fleckenstein	X84872
Bil	1991	The Netherlands	wt	X84878
Neth91	1991	Bilthoven, Netherlands	wt	L46748
DL	1992	Germany	wt	X84873
Ma93F	1993	Madrid, Spain	wt, case FV	X84871
LB	1993	Germany	wt	X84880
Il94	1994	Chicago, USA	wt	L46740
TN94	1994	Tennesse, USA	wt	L46760
SBi	1992	Bonn, Germany	wt	X84874
MVO	1974	Bristol, UK	wt	D01004
MVP	1974	Bristol, UK	wt	D01005
S33	1983	Northern Ireland	SSPE	D01008
S81	1986	Northern Ireland	SSPE	D01007
SE	1988	Birmingham, UK	wt	
CL	1988	Birmingham, UK	wt	
TT	1991	London, UK	wt, Kawasaki case	
Chi1	1989	Chicago, USA	wt	U01977
Chi2	1989	Chicago, USA	wt	U01978
SD	1989	San Diego, USA	wt	U01995
JK	1990	Dallas, Texas, USA	MIBE	U01988
PA2-90	1990	Pennsylvannia, USA	wt	L46756
TX92	1992	Corpus Christi, Texas, USA	wt	L46764

Measles virus strains previously described, **continued:**

Guam94	1994	Guam Island, Pacific, USA	wt	L46735
Ma94a	1994	Madrid, Spain	wt	
NJ1-94	1994	New Jersey, USA	wt	L46750
Co94	1994	Colarado, USA	wt	L46728
WA94	1994	Seattle, Washington, USA	wt	L46767
NE94	1994	Omaha, Nebraska, USA	wt	L46746
Pal94	1994	Palau Islands, Pacific, USA	wt	L46758
WFK	early 1970s	Woodfolk, USA	wt	X84877
Brx	1971	Germany	encephalitis case	X84879
S(C)	1981	USA	MIBE	X16569
CM	1977	Bethesda, USA	wt	D01003
SMa79	1967/1979	Madrid, Spain	SSPE	X84864
SMa94	1968/1994	Madrid, Spain	SSPE	X84865
BE83	1983	Berkely, USA	wt	U01974
BO83	1983	Boston, USA	wt	U01990
Gam91	1991	Gambia	wt	L46733
Can	1989	Montreal, Canada	wt	U01976
PK89H-1	1989	Pakistan	wt	AB003182
PK89-H2	1989	Pakistan	wt	AB003179
Ca96	1996	unknown (USA)	wt	AF009596
TX96	1996	Italy (USA)	wt	AF009594
Ma96-1	1996	unknown (USA)	wt	AF009591
Co95	1995	unknown (USA)	wt	AF009587
Thai93	1993	Thailand	wt	AF009580
NM95	1995	unknown (USA)	wt	AF009574
NY96	1996	Germany (USA)	wt	AF009586
Thai94	1994	Thailand	wt	AF009575
Mad79	1979	Spain	wt	Z80831
CGL	1994	Spain	wt	Z80822
AGR	1993	Spain	wt	Z80818
WTFV	1992	Germany	wt	Z80309
CAM83H	1983	Cameroon	wt	L46726
TX89-H	1989	Texas, USA	wt	L46761
Pal93	1993	Palau	wt	L46757
Eng93	1993	England	wt	L46729
Ca90	1990	California, USA	wt	L46725
Davis87	1987	USA	wt	U97349
EBL85Jp	1985	Japan	wt	Z80803
AMH781				
ABS3Ger	1993	Germany	wt	Z80794
ABP94	1994	Spain	wt	Z80816
Zam92A11	1992	Zambia	wt	U72232
Zam92A43	1992	Zambia	wt	U72233
Gam94X914	1994	Gambia	wt	U72214
Gam94X920	1994	Gambia	wt	U72220
Gam95X1247	1995	Gambia	wt	U72231
Cov#041	1993	England	wt	U72213

ETHICS CLEARANCE

Ethics clearance for collection of throat swab and urine specimens has been obtained from the **COMMITTEE FOR RESEARCH ON HUMAN SUBJECTS** (MEDICAL), University of Witwatersrand, Johannesburg on 26/1/96 under reference number **R14/49 Kreis** and protocol number **M 960105.**

Author Kreis S
Name of thesis Molecular Epidemiology And Antigenic Characteristics Of Measles Virus In South Africa Kreis S 1998

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.