

CURRICULUM VITAE

Name: **Eric Delwart**

Position: Associate Investigator
Blood Systems Research Institute

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EDUCATION:

1977-1980 **University of Newcastle upon Tyne, England.**
Bachelor of Sciences. Joint Honors in Biochemistry and Genetics.

1981-1982 **University of Geneva, Switzerland.**
Certificate of Specialization in Molecular Biology.

1984-1990 **University of Wisconsin-Madison.** McArdle Laboratory for Cancer Research.
Ph.D. in Oncology.

PRINCIPAL POSITIONS HELD:

1990-1994 **Stanford University School of Medicine.**
Post-doctoral fellow. Dept. of Microbiology and Immunology.

1994-1996 **New York University.**
Assistant Professor, School of Medicine. Dept. of Pathology.

1996-1999 **Rockefeller University.**
Assistant Professor.

1999-2005 **University of California, San Francisco.**
Associate Adjunct Professor. Dept. of Medicine.

OTHER PROFESSIONAL ACTIVITIES:

1982-1984 **Genentech Inc.**
Research Associate. Dept. of Molecular Biology.

1994-1999 **Aaron Diamond AIDS Research Center.**
Staff Investigator.

1999-2008 **Blood Systems Research Institute. San Francisco, CA.**
Director of Molecular Virology.

TEACHING (2004-07)

Training of 9 post-doctoral fellows in virology (Drs. F. Bernardin, B. Herring, M. Jones, A. Kapoor, C. Chabasse, J. Victoria, Linlin Li, Olga Blinkova).

Internal seminars and research group meetings at Blood Systems Research Institute.

UNIVERSITY AND PUBLIC SERVICE (2004-07)

HIV Basic Science Executive Steering Committee (Gladstone Institute of Virology and Immunology Institute).

Editorial board of AIDS.

Manuscript reviewer for: JAMA, Journal Infectious Diseases, Journal of Virology, AIDS Research and Human Retroviruses, Journal of AIDS, AIDS, Transfusion, American J of tropical medicine and hygiene.

Grant reviews for: NIH special review panel, UCSF AIDS Research Institute, SSI (Sustainable Sciences Institute), Wellcome PNG, CRDF (US civilian research and development foundation for the independent states of the former soviet union).

INVITED PRESENTATIONS (2004-2007)

Applied Biosystems. Foster City, CA. 11/07. Discovery of new human viruses using 454 pyrosequencing.

Center for HIV and AIDS Vaccine Immunology yearly meeting. Chapel Hill, North Carolina. 10/07. A search for abortive HIV infection

Lawrence Livermore Natl. Lab. Livermore, CA. 6/07. Viral discovery using shotgun sequencing and bioinformatics analyses.

Blood Systems Medical Directors Meeting. San Francisco, CA. 5/07. Viral discovery and blood safety.

Chiron Inc. Emeryville, CA. 4/07. HCV evolution and viral discovery.

Navigant/Gambro Inc. Denver, Colorado. 6/06. Shotgun sequencing for viral discovery.

UCSF Liver Center Symposium on Viral and Host Factors in Hepatitis B and C. Rohnert Park, CA. 5/06. HCV Mutation and Serosilence.

Northern California American Society of Microbiology. San Ramon, CA. 10/05. Virus discovery using shotgun sequencing.

Advisory Committee on Blood Safety and Availability, DHHS. Bethesda, MD. 5/05. Detection of New Pathogens through Surveillance of Bank Samples

The Institute for Genome Research (TIGR), Rockville, MD. 3/05. Human viral metagenomics.

UCSF Dept of Medicine. 12/04. HIV and HCV viral evolution.

Focus Diagnostics, Cypress, CA. 11/04. Discovery of novel human viruses-implications for diagnostics.

European Plasma Fractionation Association-PEI 11th NAT " Surveillance and Screening of Blood Borne Pathogens" 5/04, Paris, France. Novel approaches for discovery of new agents.

CDC Unexplained Deaths and Critical Illnesses Project (UNEX). Decatur, GA 5/04. Identification of new human viruses using shotgun sequencing of nucleic acids in plasma.

PEER REVIEWED PUBLICATIONS:

Reviews, book chapters, editorials, letters to editor

1. M.-E. Mirault, **E. L. Delwart**, and R. Southgate. 1982. Heat-shock from bacteria to man. pp35-42. Eds. M. J. Schlesinger, M. Ashburner and A. Tissieres. Cold Spring Harbor Laboratory Press, Plainview, NY.
2. **Delwart EL**, Mosialos G, Gilmore T. Retroviral envelope glycoproteins contain a "leucine zipper"-like repeat. AIDS research and human retroviruses 1990;6(6):703-6.
3. **Delwart, EL**, E. G. Shpaer and J. I. Mullins. 1995. Heteroduplex mobility assays for phylogenetic analysis. PCR Strategies. Eds M. A. Innis, D. H. Gelfand and J. J. Sninsky. Chapter 12. Academic Press, San Diego, CA.
4. **Delwart, EL**, B. Herring, A. G. Rodrigo, and J. I. Mullins. 1995. Genetic subtyping of human immunodeficiency virus using a heteroduplex assay. PCR Primer: A Laboratory Manual. Eds. C. W. Dieffenbach and G. Dveksler. Cold Spring Harbor Laboratory Press, Plainview, NY.
5. **Delwart E**. A new HIV-1 group: abstract and commentary. JAMA 1998;280(22):1960.
6. Doukhan L, **Delwart EL**. Use of tissue culture-amplified human immunodeficiency virus type 1 to study evolutionary changes in vivo. The Journal of infectious diseases 2001;183(1):173-5.
7. **Delwart EL**. Viral metagenomics. Reviews in Medical Virology 2007;17(2):115-31.

Peer reviewed research articles

1. Mirault ME, Southgate R, **Delwart E**. Regulation of heat-shock genes: a DNA sequence upstream of *Drosophila hsp70* genes is essential for their induction in monkey cells. The EMBO journal 1982;1(10):1279-85.
2. Wood WI, Capon DJ, Simenson CC, Eaton DL, Gitschier J, Keyt B, Seeburg PH, Smith DH, Hollingshead P, Wion KL, **Delwart E**, Tuddenham E, Vehar GA, and Lawn RM. Expression of active human factor VIII from recombinant DNA clones. Nature 1984;312 (5992):330-337.
3. Lowe DG, Capon DJ, **Delwart E**, Sakaguchi AY, Naylor SL, Goeddel DV. Structure of the human and murine R-ras genes, novel genes closely related to ras proto-oncogenes. Cell 1987;48(1):137-46.
4. **Delwart EL**, Panganiban AT. Role of reticuloendotheliosis virus envelope glycoprotein in superinfection interference. Journal of virology 1989;63(1):273-80.
5. **Delwart EL**, Panganiban AT. N-linked glycosylation and reticuloendotheliosis retrovirus envelope glycoprotein function. Virology 1990;179(2):648-57.
6. Freed EO, **Delwart EL**, Buchsacher GL, Jr., Panganiban AT. A mutation in the human immunodeficiency virus type 1 transmembrane glycoprotein gp41 dominantly interferes with fusion

- and infectivity. Proceedings of the National Academy of Sciences of the United States of America 1992;89(1):70-4.
7. **Delwart EL**, Buchschacher GL, Jr., Freed EO, Panganiban AT. Analysis of HIV-1 envelope mutants and pseudotyping of replication-defective HIV-1 vectors by genetic complementation. AIDS research and human retroviruses 1992;8(9):1669-77.
 8. **Delwart EL**, Shpaer EG, Louwagie J, et al. Genetic relationships determined by a DNA heteroduplex mobility assay: analysis of HIV-1 env genes. Science (New York, NY 1993;262(5137):1257-61.
 9. **Delwart EL**, Sheppard HW, Walker BD, Goudsmit J, Mullins JI. Human immunodeficiency virus type 1 evolution in vivo tracked by DNA heteroduplex mobility assays. Journal of virology 1994;68(10):6672-83.
 10. Sabino EC, **Delwart E**, Lee TH, Mayer A, Mullins JI, Busch MP. Identification of low-level contamination of blood as basis for detection of human immunodeficiency virus (HIV) DNA in anti-HIV-negative specimens. Journal of acquired immune deficiency syndromes 1994;7(8):853-9.
 11. Louwagie J, **Delwart EL**, Mullins JI, McCutchan FE, Eddy G, Burke DS. Genetic analysis of HIV-1 isolates from Brazil reveals presence of two distinct genetic subtypes. AIDS research and human retroviruses 1994;10(5):561-7.
 12. Grez, M., U. Dietrich, P. Balfe, H. von Briesen, G. Mahambre, J. K. Maniar, G. Mahambre, **E. Delwart**, J. I. Mullins, and H. Rubsamen-Waigmann Genetic analysis of human immunodeficiency virus type 1 and 2 (HIV-1 and HIV-2) mixed infections in India reveals a recent spread of HIV-1 and HIV-2 from a single ancestor for each of these viruses. Journal of virology 1994;68(4):2161-8.
 13. Bachmann MH, **Delwart EL**, Shpaer EG, Lingenfelter P, Singal R, Mullins JI. Rapid genetic characterization of HIV type 1 strains from four World Health Organization-sponsored vaccine evaluation sites using a heteroduplex mobility assay. WHO Network for HIV Isolation and Characterization. AIDS research and human retroviruses 1994;10(11):1345-53.
 14. Shpaer EG, **Delwart EL**, Kuiken CL, Goudsmit J, Bachmann MH, Mullins JI. Conserved V3 loop sequences and transmission of human immunodeficiency virus type 1. AIDS research and human retroviruses 1994;10(12):1679-84.
 15. Wasi C, Herring B, Raktham S, Vanichseni S, Mastro TD, Young NL, Rübnsamen-Waigmann H, von Briesen H, Kalish ML, Luo CC, Chou-Pong P, Baldwin A, Mullins JI, **Delwart EL**, Esparza J, Heyward WL, Osmanov S 1995. Determination of HIV-1 subtypes in injecting drug users in Bangkok, Thailand, using peptide-binding enzyme immunoassay and heteroduplex mobility assay: evidence of increasing infection with HIV-1 subtype E. 1995 AIDS;9(8):843-849.
 16. **Delwart EL**, Herring B, Rodrigo AG, Mullins JI. Genetic subtyping of human immunodeficiency virus using a heteroduplex mobility assay. PCR methods and applications 1995;4(5):S202-16.
 17. **Delwart EL**, Busch MP, Kalish ML, Mosley JW, Mullins JI. Rapid molecular epidemiology of human immunodeficiency virus transmission. AIDS research and human retroviruses 1995;11(9):1081-93.
 18. **Delwart EL**, Gordon CJ. Tracking changes in HIV-1 envelope quasispecies using DNA heteroduplex analysis. Methods (San Diego, Calif) 1997;12(4):348-54.
 19. **Delwart EL**, Pan H, Sheppard HW, Wolpert D, Neumann AU, Korber B, Mullins JI. Slower evolution of human immunodeficiency virus type 1 quasispecies during progression to AIDS. Journal of virology 1997;71(10):7498-508.
 20. **Delwart EL**, Mullins JI, Gupta P, Learn Jr. GH, Holodniy M, Katzenstein D, Walker BD, Singh MK. Human immunodeficiency virus type 1 populations in blood and semen. Journal of virology 1998;72(1):617-23.
 21. **Delwart EL**, Pan H, Neumann A, Markowitz M. Rapid, transient changes at the env locus of plasma human immunodeficiency virus type 1 populations during the emergence of protease inhibitor resistance. Journal of virology 1998;72(3):2416-21.

22. Shen DF, Doukhan L, Kalams S, **Delwart E**. High-resolution analysis of T-cell receptor beta-chain repertoires using DNA heteroduplex tracking: generally stable, clonal CD8+ expansions in all healthy young adults. Journal of immunological methods 1998;215(1-2):113-21.
23. Rodrigo AG, Shpaer EG, **Delwart EL**, Iversen AK, Gallo MV, Brojatsch J, Hirsch MS, Walker BD, Mullins JI. Coalescent estimates of HIV-1 generation time in vivo. Proceedings of the National Academy of Sciences of the United States of America 1999;96(5):2187-91.
24. Tien PC, Chiu T, Latif A, Ray S, Batra M, Contag CH, Zejena L, Mbizvo M, **Delwart EL**, Mullins JI, Katzenstein DA. Primary subtype C HIV-1 infection in Harare, Zimbabwe. J Acquir Immune Defic Syndr Hum Retrovirol 1999;20(2):147-53.
25. Gordon CJ, **Delwart EL**. Genetic diversity of primary HIV-1 isolates and their sensitivity to antibody-mediated neutralization. Virology 2000;272(2):326-30.
26. Foley B, Pan H, Buchbinder S, **Delwart EL**. Apparent founder effect during the early years of the San Francisco HIV type 1 epidemic (1978-1979). AIDS research and human retroviruses 2000;16(15):1463-9.
27. Doukhan L, **Delwart E**. Population genetic analysis of the protease locus of human immunodeficiency virus type 1 quasispecies undergoing drug selection, using a denaturing gradient-heteroduplex tracking assay. Journal of virology 2001;75(14):6729-36.
28. Foley B, Donegan E, Silitonga N, Wignall FS, Busch MP, **Delwart EL**. Importation of multiple HIV type 1 strains into West Papua, Indonesia (Irian Jaya). AIDS research and human retroviruses 2001;17(17):1655-9.
29. Machado DM, **Delwart EL**, Diaz RS, de Oliveira CF, Alves K, Rawal BD, Sullivan M, Gwinn M, Clark KA, Busch MP. Use of the sensitive/less-sensitive (detuned) EIA strategy for targeting genetic analysis of HIV-1 to recently infected blood donors. AIDS (London, England) 2002;16(1):113-9.
30. Alves K, Canzian M, **Delwart EL**. HIV type 1 envelope quasispecies in the thymus and lymph Nodes of AIDS patients. AIDS research and human retroviruses 2002;18(2):161-5.
31. **Delwart E**, Magierowska M, Royz M, et al. Homogeneous quasispecies in 16 out of 17 individuals during very early HIV-1 primary infection. AIDS (London, England) 2002;16(2):189-95.
32. Bernardin F, Doukhan L, Longone-Miller A, Champagne P, Sekaly R, **Delwart E**. Estimate of the total number of CD8+ clonal expansions in healthy adults using a new DNA heteroduplex-tracking assay for CDR3 repertoire analysis. Journal of immunological methods 2003;274(1-2):159-75.
33. Gonzales MJ, **Delwart E**, Rhee SY, Tsui R, Zolopa AR, Taylor J, Shafer RW. Lack of detectable human immunodeficiency virus type 1 superinfection during 1072 person-years of observation. The Journal of infectious diseases 2003;188(3):397-405.
34. **Delwart EL**, Orton S, Parekh B, Dobbs T, Clark K, Busch MP. Two percent of HIV-positive U.S. blood donors are infected with non-subtype B strains. AIDS research and human retroviruses 2003;19(12):1065-70.
35. Bernardin F, Herring BL, Peddada L, **Delwart EL**. Primary infection of a male plasma donor with divergent HIV variants from the same source followed by rapid fluctuations in their relative frequency and viral recombination. AIDS research and human retroviruses 2003;19(11):1009-15.
36. Tsui R, Herring BL, Barbour JD, Grant RM, Bacchetti P, Kral A, Edlin BR, **Delwart EL**. Human immunodeficiency virus type 1 superinfection was not detected following 215 years of injection drug user exposure. Journal of virology 2004;78(1):94-103.
37. Magierowska M, Bernardin F, Garg S, Staprans S, Miller MD, Van Rompay KK, **Delwart EL**. Highly uneven distribution of tenofovir-selected simian immunodeficiency virus in different anatomical sites of rhesus macaques. Journal of virology 2004;78(5):2434-44.
38. Angel JB, Hu YW, Kravcik S, Tsui R, Lee KH, Barbour J, Balaskas E, Branson BM, **Delwart EL**, Grant RM. Virological evaluation of the 'Ottawa case' indicates no evidence for HIV-1 superinfection. AIDS (London, England) 2004;18(2):331-4.

39. **Delwart EL**, Kalmin ND, Jones TS, Ladd DJ, Foley B, Tobler LH, Tsui RC, Busch MP. First report of human immunodeficiency virus transmission via an RNA-screened blood donation. *Vox sanguinis* 2004;86(3):171-7.
40. Bernardin F, Magierowska M, Dandekar S, Van Rompay KK, **Delwart EL**. Number of CD4+ and CD8+ T-cell CDR3 clonotypes expanding during acute infection of macaques with simian immunodeficiency virus. *Virology* 2004;322(1):105-17.
41. Herring BL, Page-Shafer K, Tobler LH, **Delwart EL**. Frequent hepatitis C virus superinfection in injection drug users. *The Journal of infectious diseases* 2004;190(8):1396-403.
42. Kapoor A, Jones M, Shafer RW, Rhee SY, Kazanjian P, **Delwart EL**. Sequencing-based detection of low-frequency human immunodeficiency virus type 1 drug-resistant mutants by an RNA/DNA heteroduplex generator-tracking assay. *Journal of virology* 2004;78(13):7112-23.
43. Herring BL, Tsui R, Peddada L, Busch M, **Delwart EL**. Wide range of quasispecies diversity during primary hepatitis C virus infection. *Journal of virology* 2005;79(7):4340-6.
44. Fiebig EW, Heldebrandt CM, Smith RI, Conrad AJ, **Delwart EL**, Busch MP. Intermittent low-level viremia in very early primary HIV-1 infection. *Journal of acquired immune deficiency syndromes* 2005;39(2):133-7.
45. Jones MS, Kapoor A, Lukashov VV, Simmonds P, Hecht F, **Delwart E**. New DNA viruses identified in patients with acute viral infection syndrome. *Journal of virology* 2005;79(13):8230-6.
46. Bernardin F, Kong D, Peddada L, Baxter-Lowe LA, **Delwart E**. Human immunodeficiency virus mutations during the first month of infection are preferentially found in known cytotoxic T-lymphocyte epitopes. *Journal of virology* 2005;79(17):11523-8.
47. Fryer JF, Kapoor A, Minor PD, **Delwart E**, Baylis SA. Novel parvovirus and related variant in human plasma. *Emerging infectious diseases* 2006;12(1):151-4.
48. **Delwart E**, Kuhns MC, Busch MP. Surveillance of the genetic variation in incident HIV, HCV, and HBV infections in blood and plasma donors: implications for blood safety, diagnostics, treatment, and molecular epidemiology. *Journal of medical virology* 2006;78 Suppl 1:S30-5.
49. Bernardin F, Herring B, Page-Shafer K, Kuiken C, **Delwart E**. Absence of HCV viral recombination following superinfection. *Journal of viral hepatitis* 2006;13(8):532-7.
50. Trautmann L, Janbazian L, Chomont N, Said EA, Gimmig S, Bessette B, Boulassel MR, Delwart E, Sepulveda H, Balderas RS, Routy JP, Haddad EK, Sekaly RP. Upregulation of PD-1 expression on HIV-specific CD8+ T cells leads to reversible immune dysfunction. *Nature medicine* 2006;12(10):1198-202.
51. Johnson JA, Rompay KK, Delwart E, Heneine W. A rapid and sensitive real-time PCR assay for the K65R drug resistance mutation in SIV reverse transcriptase. *AIDS research and human retroviruses* 2006;22(9):912-6.
52. Herring BL, Bernardin F, Caglioti S, Stramer S, Tobler L, Andrews W, Cheng L, Rampersad S, Cameron C, Saldanha J, Busch MP, **Delwart E**. Phylogenetic analysis of WNV in North American blood donors during the 2003-2004 epidemic seasons. *Virology* 2007;363(1):220-8.
53. Jones MS 2nd, Harrach B, Ganac RD, Gozum MM, Dela Cruz WP, Riedel B, Pan C, **Delwart EL**, Schnurr DP. New adenovirus species found in a patient presenting with gastroenteritis. *Journal of virology* 2007;81(11):5978-84.
54. Bernardin F, Stramer SL, Reherrmann B, Page-Shafer K, Cooper S, Bangsberg DR, Hahn J, Tobler L, Busch M, **Delwart E**. High levels of subgenomic HCV plasma RNA in immunosilent infections. *Virology* 2007;365(2):446-56.
55. Fryer JF, **Delwart E**, Hecht FM, Bernardin F, Jones MS, Shah N, Baylis SA. Frequent detection of the parvoviruses, PARV4 and PARV5, in plasma from blood donors and symptomatic individuals. *Transfusion* 2007;47(6):1054-61.
56. Fryer JF, Delwart E, Bernardin F, Tuke PW, Lukashov VV, Baylis SA. Analysis of two human parvovirus PARV4 genotypes identified in human plasma for fractionation. *The Journal of general*

virology 2007;88(Pt 8):2162-7.

57. Kapoor A., Victoria J., Simmonds P., Wang C., Shafer R.W., Nims R., Nielsen O., E. **Delwart**. A highly divergent picornavirus in a marine mammal. Journal of Virology 2008. 82:311-320.
58. D Vallerini, P Barozzi, C Quadrelli, R Bosco, L Potenza, G Riva, G Gregorini, S Sandrini, A Tironi, G Montagnani, M-D Palma, G Torelli, **E Delwart**, and M Luppi. Parvoviruses in blood donors and transplant patients, Italy. Emerging infection diseases. 2008. 14(1):185-186
59. F Bernardin, L Tobler, I Walsh, J Dunn Williams, MP Busch, and **E Delwart**. Clearance of Hepatitis C Virus RNA from the peripheral blood mononuclear cells of blood donors who spontaneously or therapeutically control their plasma viremia. Hepatology. 2007 ;47:1446-1452
60. A Kapoor, B Shapiro, RW Shafer, N Shulman, S-Y Rhee and **E Delwart**. Multiple independent origins of a protease inhibitor resistance mutation in salvage therapy patients. Retrovirology. 2008. 5:7.