

CURRICULUM VITAE

Name: Anthony Richard Hayward
3 Nisbet St, Providence, RI 02906
401 709 0017
anthonyhayward@outlook.com

EDUCATION

Undergraduate University College London, Physiology, Honors BSc 1964
Medical School University College Hospital Medical School, 1964-1967.
Other advanced degrees Ph.D. University of London 1974

POSTGRADUATE TRAINING

Residency House Physician at University College Hospital, 1968
House Surgeon, Royal Northern Hospital, London, England
Fellowship Research Fellow, Department of Immunology,
Institute of Child Health, London, England
January 1970 - December 1969 Registrar, Department of Clinical Pathology,
University College Hospital, London, England
Graham Scholar in Pathology at University College
Hospital Medical School, London, England

POSTGRADUATE HONORS AND AWARDS

Graham Scholar in Pathology 1969 (listed above)
Ciba Foundation Visiting Fellow, Paris, March-May 1974
Fellow, Royal College of Physicians, London, 1983
Outstanding Service Award, UCHSC Clinical Science
Program, 1999 and 2000.
Two NIH Director's Awards, 2007.
NCRR, NIH Achievement Award, 2009

MILITARY SERVICE

None

PROFESSIONAL LICENSES AND BOARD CERTIFICATION

MRCP (UK) 1970
Alabama State License # L184 1976
Colorado State License #22611 1979-2002
Rhode Island License #MD13884, 2012 to present

ACADEMIC APPOINTMENTS

Professor of Pediatrics (Research), Brown University
(2016)

Previous professional positions:

December 2011-April 2014 Senior Advisor for Translational Research to the NCATS
Director, National Center for Advancing Translational

November 2001- December 2011	Sciences, NIH. Director, Division for Clinical Research, National Center for Research Resources, NIH
June 1986 – November 2001	Professor, Departments of Pediatrics, Microbiology and Immunology, University of Colorado HSC, Denver Associate Director, Pediatric Clinical Research Center. Chief, Section of Allergy/Immunology, Dept. of Pediatrics, UCHSC & The Children’s Hospital, Denver.
January 1979 – June 1986	Associate Professor of Pediatrics, UCHSC
January 1979 – June 1986	Associate Professor of Microbiology and Immunology
January 1972 – December 1978	Registrar in Pediatrics & Senior Registrar in Pathology (Immunology) Hospital for Sick Children, Great Ormond Street, London, England
June 1977 – January 1979	Senior Lecturer in Immunology, Institute of Child Health
January 1976 – June 1977	Visiting Research Associate, Department of Pediatrics University of Alabama in Birmingham
January 1972 – June 1977	Lecturer in Immunology, Department of Immunology, Institute of Child Health, London, England

HOSPITAL APPOINTMENTS

Consulting physician in Pediatrics, Rhode Island Hospital Medical Staff (February 12, 2013).
 Attending Physician, The Children’s Hospital, Denver, 1980-2001
 Staff Physician, National Jewish Hospital, Denver, Colorado, 1979-2001
 Attending Physician, University Hospital, Denver, 1980-2001

OTHER APPOINTMENTS

Editorial boards

Clinical and Experimental Immunology (Editorial Board 1986-1991), J. Clin Immunol (Editorial board, 1993-1996) Immunology, American Scientist, Immunology Today, Archives of Diseases of Childhood, The Lancet

NIH Study Sections:

Committee member - GCRC 1987-1991 NIH
 Approximately two ad hoc Study Sections per year for NIH, 1979-2001:
 NCI
 NICHD
 NIAID
 NCRR

HOSPITAL & UNIVERSITY COMMITTEES

Pediatric Dept.:	Teaching Committee 1981-1984
	Research Committee 1982-1985
	Clinical Research Center Advisory Committee 1979-1993
	Promotions Committee 1985-1995

Cost recovery committee 1991-2001

Medical School: Curriculum Committee 1982-1985
Promotions Committee 1988-1991
Faculty Senate 1991-1993 (Secretary 1993-4)
Clinical Sciences PhD program Admissions committee 1998-2001
Clinical Sciences PhD program Curriculum committee 1998-2001

National: VZV Research Foundation Advisory Committee

MEMBERSHIP IN SOCIETIES

American Association of Immunologists	1980 to present
Society for Pediatric Research	1979 to 2001
American Pediatric Society	1979 to 2001
British Society of Immunology	1970 to 2001
Clinical Immunology Society	2016 to present
European Society for Immunodeficiency	2016 to present

PUBLICATIONS LIST

1. Hayward, A.R. (1972) Myoid cells in the human foetal thymus. *J. Path.* 106,45-48.
2. Hayward, A.R. (1974) Non-specific induction of cytotoxicity by human lymphocytes with human IgG. *Immunology* 26,61-65.
3. Ezer, G., Hayward, A.R. (1974) Inhibition of complement dependent rosette function, a possible test for activated complement products. *Eur. J. Immunol.* 4, 148-150.
4. Hayward, A.R. and Ezer, G. (1974) Development of lymphocyte population in the human foetal thymus and spleen. *Clin. Exp. Immunol.* 17, 169-178.
5. Hayward, A.R. and Greaves, M.F. (1975) Central failure of B lymphocyte induction in panhypogammaglobulinaemia. *Clin. Immunol. Immunopathol.* 3, 461-470.
6. Hayward, A.R. and Greaves, M.F. (1975) Identification of cells with monocyte markers in panhypogammaglobulinaemia. *Scand. J. Immunol.* 4, 563-570.
7. Smith, M.D., Barratt, T.M., Hayward, A.R. and Soothill, J.F. (1975) The inhibition of complement dependent rosette formation by the sera of children with steroid-sensitive nephrotic syndrome and other renal diseases. *Clin. Exp. Immunol.* 21, 236-243.
8. Hayward, A.R. and Graham, L. (1975) Increases E rosette formation by fetal liver or spleen cells incubated with theophylline. *Clin. Exp. Immunol.* 21, 236.
9. Seager, J., Jamison, D.L., Wilson, J., Hayward, A.R. and Soothill, J.F. (1975) IgA deficiency, epilepsy and phenytoin treatment. *Lancet* i, 632-635.

10. Burge, P.S., Johnson, W.S. and Hayward, A.R. (1976) Neutrophil pyruvate kinase deficiency with recurrent staphylococcus infections: first reported case. *Brit. Med. J.* 1, 742-745.
11. Hayward, A.R. and Soothill, J.F. (1975) Progressive restriction of reaction to antigen by human fetal thymic cells. *Immunology* 30, 873-879.
12. Hayward, A.R. and Lawton, A.R. (1977). Induction of plasma cell differentiation of human fetal lymphocytes; evidence for functional immaturity of T and B cells. *J. Immunol.* 119, 1213-1217.
13. Lipson, A., Marshall, W.C. and Hayward, A.R. (1977) Treatment of pneumocystis carinii pneumonia in childhood. *Arch. Dis. Childh.* 52, 314-9.
14. Webster, A.D.B., Tripp, J.H., Hayward, A.R., Dayan, A.D., Doslilc, R., MacIntyre, E.H. and Tyrrell, D.A.J. (1978) Echovirus encephalitis and myositis in primary immuno-globulin deficiency. *Arch. Dis. Childh.* 53,33-7.
15. Candy, D.C.A., Hayward, A.R., Hughes, D.T., Layward, L. and Soothill, J.F. (1979) Four families with immunodeficiency and chromosome abnormalities. *Arch. Dis. Childh.* 54, 518-23
16. Hayward, A.R. (1978) Hypoimmunoglobulinaemia with deficiency of Pre-B cells. *Lancet* i, 1014-1015.
17. Hayward, A.R. and Lydyard, A.R. (1978) Suppression of B lymphocyte differentiation by newborn T lymphocytes with an Fc receptor for IgM. *Clin. Exp. Immunol.* 34, 374.
18. Trompeter, R.S., Layward, L. and Hayward, A.R. (1978) Primary and secondary abnormalities of T cell subpopulations. *Clin. Exp. Immunol.* 34, 388-392.
19. Hayward, A.R., Layward, L., Lydyard, P.M., Moretta, L., Dagg, M. and Lawton, A.R. (1978) Fc receptor heterogeneity of human suppressor T cells. *J. Immunol.* 121, 1-5.
20. Hayward, A.R., Simons, M.A., Lawton, A.R., Mage, R.G. and Cooper, M.D. (1978) Pre-B and B cells in rabbits. *J. Exp. Med.* 148, 1367-1377.
21. Hayward, A.R. (1978). Mixed lymphocyte culture primed T lymphocytes suppress pokeweed mitogen induced plasma cell differentiation. *I.R.C.S. Medical Science* 6, 75-77.
22. Greaves, M.F., Verbi, W., Festenstein, H., Papasteriadis, C., Jaraquemada, D. and Hayward, A.R. (1979) Ia-like antigens on human T cells. *Eur. J. Immunol.* 9, 356.
23. Paolucci, P., Hayward, A.R. and Rapson, N.T. (1979) Pre-B and B cells in children on leukaemia remission maintenance treatment. *Clin. Exp. Immunol.* 37, 259-266.
24. Hayward, A.R., Harvey, B.A.M., Leonard, J., Greenwood, M.C., Wood, C.B.S. and Soothill, J.F. (1979) Delayed separation of the umbilical cord, widespread infections and defective neutrophil mobility. *Lancet* i, 1099.
25. Simons, M.A., Hayward, A.R., Gathings, W.E., Lawton, A.R., Young-Cooper, G.O., Cooper, M.D. and Mage, R.G. (1979) Expression of b4 and b5 kappa light chain allotypes by B and pre-B cells in allotype-suppressed and neutralized rabbits. *Eur. J. Immunol.* 9, 887.

26. Lydyard, P.M. and Hayward, A.R. (1979) Induction of suppression through human T cell interactions. *Clin. Exp. Immunol.* 39, 496-502.
27. Hayward, A.R., Mowla, R. and Harvey, B.M. (1981) Defect of neutrophil mobility with dominant inheritance in a family with Waardenberg's Syndrome. *Arch. Dis. Childh.* 56, 279-82.
28. Hayward, A.R. (1980) Resistance of pokeweed mitogen stimulated B cells to inhibition by deoxyadenosine. *Clin. Exp. Immunol.* 41, 141.
29. Murphy, S., Hayward, A.R., Troup, G., Devor, E.J. and Coons, T. (1980) Gene enrichment in an American Indian population: an excess of severe combined immunodeficiency disease. *Lancet* ii, 502.
30. Hayward, A.R. and Kurnick, J.T. (1981) Newborn T cell suppression: early appearance, maintenance in culture and lack of growth factor suppression. *J. Immunol.* 126, 50.
31. Kurnick, J.T., Hayward, A.R. and Altevogt, P. (1981) Helper and suppressor inducer activity of human T cells and their cloned progeny maintained in long-term culture. *J. Immunol.* 126, 1307.
32. Paolucci, P., Rapson, N.T., Layward, L. and Hayward, A.R. (1981) Growth of pre-B cells in cultures of bone marrow from children with acute lymphoblastic leukemia and other diseases. *Clin. Exp. Immunol.* 43, 143.
33. Paolucci, P., Layward, L., Hayward, A.R., Rapson, N.T. and Soothill, J.F. (1981) Increase and inhibition of pre-B proliferation in culture by T cells. *Clin. Exp. Immunol.* 43, 336.
34. Hayward, A.R. and Merrill, D.A. (1981) Requirement for OKT 8⁺ suppressor cell proliferation for suppression by human newborn T cells. *Clin. Exp. Immunol.* 45, 468.
35. Triebel, F., Robinson, W.A., Hayward, A.R. and Groube de LaForest, P. (1981) Characterisation of the T lymphocyte colony forming cells and evidence for the acquisition of T cell markers in the absence of the thymic microenvironment in man. *J. Immunol.* 126, 2020.
36. Hayward, A.R., Kurnick, J.T. and Clarke, D. (1981) T cell growth factor enhanced PHA response of human thymus cells: requirement for T 3⁺ cells. *J. Immunol.* 127, 2079.
37. Triebel, F., Robinson, W.A., Hayward, A.R. and Groube de LaForest, P. (1981) Existence of a pool of T lymphocyte colony forming cells in human bone marrows and their place in the differentiation of T lymphocyte lineage. *Blood.* 58, 911-5.
38. Stumpf D.A., Hayward, A.R., Hass, R., Frost, M. and Schaumberger, H.H. (1981) Adrenoleukodystrophy. Failure of immunosuppression to prevent neurological progression. *Arch. Neurol.* 38, 48.
39. Hoffman, A.A., Hayward, A.R., Kurnick, J.T., DeFreitas, E., McGregor, J. and Harbeck, R.J. (1981) Presentation of antigen by human newborn monocytes to maternal tetanus toxoid specific T cell blasts. *J. Clin. Immunol.* 1, 217.
40. Hayward, A.R., Murphy, S., Githens, J., Troup, G. and Ambruso, D. (1982) Failure of OKT 3 to prevent versus host disease in SCID. *J. Pediatr.* 100, 665.

41. Mori, M. and Hayward, A.R. (1982) Phenotype and function of human milk monocytes as antigen presenting cells. *Clin. Immunol. Immunopathol.* 23, 94.
42. Hayward, A.R., Paolucci, P., Webster, A.D.B. and Kohler, P. (1982) Pre-B cell suppression by thymoma patient lymphocytes. *Clin. Exp. Immunol.* 48, 437-42.
43. Anderson, D.W., Githens, J.H., Hayward, A.R. and Jones, C. (1982) An acute lymphoblastic leukemia which produces human T cell growth factor. *Immunol. Commun.* 10, 697.
44. Lauer, B.A., Githens, J.H., Hayward, A.R., Conrad, P.D., Yanigihara, R.T. and Tubergren, D.G. (1982) Probable graft-versus-graft rejection in an infant after exchange transfusion and marrow transplantation. *Pediatr.* 70, 43-7.
45. Flomenberg, N., Dupont, B., O'Reilly, R.J., Hayward, A.R. and Pollack, M.S. (1983) The use of T cell culture techniques to establish the presence of an intrauterine derived maternal T cell graft in a patient with severe combined immunodeficiency. *Transplantation.* 36, 734.
46. Hayward, A.R. and Herberger, M. (1984) Culture and phenotype of activated T cells from patients with type 1 (insulin dependent) diabetes mellitus. *Diabetes,* 33, 319.
47. Caballero, F., Brown, W.R., Kohler, P.F. and Hayward, A.R. (1984) B cell numbers and responses in patients with common variable immunodeficiency and nodular lymphoid hyperplasia of the bowel. *J. Clin. Lab. Immunol.,* 13, 59.
48. Hayward, A.R. and Malmberg, S. (1984) Response of human newborn lymphocytes to alloantigen: lack of evidence for suppression induction. *Ped. Res.,* 18, 414.
49. Mori, M. and Hayward, A.R. (1984) Persistence of Ia antigen and antigen presenting activity by cultured human monocytes. *Clin. Immunol. Immunopathol.,* 30, 387.
50. Mori, M. and Hayward, A.R. (1984) Human newborn autologous mixed lymphocyte response: frequency and phenotype of responders and xenoantigen specificity. *J. Immunol.,* 133, 719-723.
51. Hayward, A.R., Herberger, M.J., Groothuis, J. and Levin, M.J. (1984) Specific immunity following congenital or neonatal infection with cytomegalovirus or herpes simplex virus. *J. Immunol.,* 133, 2469-2473.
52. Giller, R.H., Mori, M. and Hayward, A.R. (1984) Dissociation between Ia antigen expression, accessory cell function and antigen processing in two acute monoblastic leukemia lines. *J. Clin. Immunol.,* 4, 429-.
53. Bowden, R.A., McGavren, L., Hayward, A.R. and Levin, M.J. (1984) Use of bone marrow fibroblasts to prepare targets for an HLA restricted cytotoxicity assay system. *J. Clin. Microbiol.* 20, 696-700.
54. Bowden, R.A., Levin, M.J., Giller, R.H., Tubergen, D.G. and Hayward, A.R. (1985). Lysis of varicella zoster virus infected cells by lymphocytes from normal humans and immunosuppressed pediatric leukemic patients. *Clin. Exp. Immunol.,* 60, 387.
55. Suez, D. and Hayward, A.R. (1985) Phenotyping of proliferating cells in cultures of human lymphocytes. *J. Immunol. Methods,* 78, 49-57.

56. Chilmonczyk, B., Levin, M.J., McDuffie, R., and Hayward, A.R. (1985) Characterization of the newborn response to herpes virus antigens. *J. Immunol.* 134, 4184-8.
57. Tellez, A.A., Odom, L. and Hayward, A.R. (1985) Immunity to herpes simplex virus in children receiving treatment for acute lymphoblastic leukemia. *Clin. Exp. Immunol.*, 62, 525-9.
58. Hayward, A.R., Herberger, M. and Laszlo, M. (1986) Cellular inter-actions in the lysis of varicella zoster virus infected human fibroblasts. *Clin. Exp. Immunol.* 63, 141.
59. Ozturk, G.E., Hayward, A.R., Weil, R. and Kohler, P.F. (1986) Double fluorescence technique for measurement of complement-fixing antibody to lymphocyte subsets. *J. Immunol. Methods*, 85, 163.
60. Leibson, P.J., Hunter-Laszlo, M. and Hayward, A.R. (1986) Inhibition of HSV-1 replication in fibroblast cultures by human blood mononuclear cells. *J. Virol.*, 57, 976-982.
61. Carotenuto, P., Pontesilli, O., Cambier, J.C. and Hayward, A.R. (1986) Desferoxamine blocks IL-2 receptor expression on human T lymphocytes. *J. Immunol.* 136, 2342-7.
62. Hayward, A.R., Pontesilli, O., Herberger, M., Laszlo, M. and Levin, M. (1986) Specific lysis of VZV infected B lymphoblasts by human T cells. *J. Virol.*, 58, 179.
63. Hayward, A.R., Herberger, M. and Saunders, D. (1986) HSV-stimulated gamma interferon production by newborn mononuclear cells. *Ped. Res.* 20, 398.
64. Hayward, A.R., Herberger, M. and Corey, L. (1986) IgG subclass of anti-HSV antibodies following neonatal HSV infections. *Eur. J. Pediat.* 145:250.
65. Leibson, P.J., Hunter-Laszlo, M., Douvas, G.M. and Hayward, A.R. (1986) Impaired neonatal natural killer cell activity to herpes simplex virus. *J. Clin. Immunol.* 6, 216.
66. Giller RH Bowden RA Levin MJ Walker LJ Tubergen DG Hayward AR. 1986. Reduced cellular immunity to varicella zoster virus during treatment for acute lymphoblastic leukemia of childhood: in vitro studies of possible mechanisms. *J Clin Immunol* 6:472-80
67. Pontesilli, O., Chase, H.P., Carotenuto, P., Herberger, M.J. and Hayward, A.R. (1986) T lymphocyte subpopulations in insulin dependent (type 1) diabetes. *Clin. Exp. Immunol.* 63, 68.
68. Hayward, A.R. and Herberger, M. (1987) Lymphocyte responses to varicella zoster virus in the elderly. *J. Clin. Immunol.* 7, 174-8.
69. Gilden, D.H., Hayward, A.R., Krupp, J., Hunter-Laszlo, M., Huff, J.C., Vafai, A. (1987) Varicella zoster virus infection of human mononuclear cells. *Virus Research.* 7:117.
70. Pontesilli, O., Carotenuto, P., Levin, M.J., Suez, D.J. and Hayward, A.R. (1987) Processing and presentation of cell-associated varicella zoster antigens by human monocytes. *Clin. Exp. Immunol.* 70: 127-135.
71. Hayward, A.R., Cobbold, S.P., Waldmann, H., Cooke, A. and Simpson, E. (1987) Delay in onset of insulinitis in NOD mice following a single injection of CD 4 and CD 8 antibodies. *J. Autoimmunity.* 1: 91-96.

72. Ohta, K., Rozzo, S. J., Hayward, A.R., Harbeck, R. J., Kirkpatrick, C.H. 1988 Human tonsillar IgE biosynthesis *in vitro*. II. Analysis of T cell regulation with monoclonal antibodies. *J. All. Clin. Immunol.* 81:401-12.
73. Rotbart, H., Levin, M.J., Jones, J.F., Hayward, A.R., Allman, J., McLane, M.F. and Essex, M. (1986) Noma in children with severe combined immunodeficiency. *J. Ped.* 109, 596-600.
74. Hayward, A.R. & Herberger, M. (1988). Nicotinamide protects target cells from cell mediated cytotoxicity. *Cellular Immunology*, 113: 414-422.
75. Hayward, A.R., Jones, J & Robinson, C. (1988), Fatal EBV infections following T depleted marrow grafting for severe combined immunodeficiency. *Medical Science Research*, 16: 187-188
76. Hayward, A., Boylston, A. & Beverley, P. 1988. Lysis of CD 3 hybridoma targets by cloned human CD4 lymphocytes. *Immunology* 64: 87-92.
77. Hayward, A., Laszlo, Turman MA, M., Vafai, A. & Tedder, D. 1988. Non-productive infection of human newborn blood mononuclear cells with herpes simplex virus: effect on T cell activation, IL 2 production and proliferation. *Clin Exp Immunol.* 74: 196-201.
78. Hayward, A., Laszlo, M. & Vafai, A. 1989. Human newborn natural killer cell responses to activation by monoclonal antibodies: effect of culture with herpes simplex virus. *J. Immunol.* 142: 1139.
79. Hayward, A.R., Lee, J & Beverley, P.C.L. 1989. Ontogeny of expression of UCHL1 antigen on TcR1 (CD4/8) and TcR δ T cells. *Eur. J. Immunol.* 19: 771-3.
80. Gilden, D.H., Devlin, M., Wellish, M., Cabirac, G., Mahalingham, R., Murray, R., Huff, C., Hayward, A. & Vafai, A. 1989. Persistence of varicella zoster virus DNA in blood mononuclear cells of patients with varicella or zoster. *Virus Genes.* 2:299
81. Hayward, A.R. & Nakada, P. 1989. Hepatic veno-occlusive disease in an infant following marrow grafting for severe combined immunodeficiency. *Transplantation.* 48: 708.
82. G.P. Rabalais, F.E. Berkowitz, A.R. Hayward & M.J. Levin. 1989. Inhibition of varicella zoster virus *in vitro* by human peripheral blood mononuclear cells. *Clin. Exp. Immunol.* 75: 381-6.
83. Hayward, A. R. & M. Shriber. 1989. Neonatal injection of CD3 antibody into NOD mice reduces the incidence of insulinitis and diabetes. *J. Immunol.* 143:1555.
84. Hayward, A., R. Giller & M. Levin. 1989. Phenotype, cytotoxic and helper functions of T cells from varicella zoster virus stimulated cultures of human lymphocytes. *Viral Immunology.* 2:175.
85. Pontesilli, O., Carotenuto, P., Hayward, A.R. & Prowse, S.J. 1989. A cytotoxic monoclonal islet cell surface antibody from the NOD mouse. *J. Lab. Clin. Immunol.* 28:161-8.
86. Hayward, A. R. 1990. T cell response to predicted amphipathic peptides of varicella zoster virus glycoproteins II and IV. *J. Virol.* 64:651-655.

87. Chase, H. P., Butler-Simon, N., Garg, S.K., Hayward, A.R., Klingensmith, G.J., Hamman, R.F. & O'Brien, D. 1990. Cyclosporine A for the treatment of new-onset insulin-dependent diabetes mellitus. *Pediatrics*. 85:241-245.
88. A. R. Hayward, J. Clarke & M. Cosyns. 1990. $V_{\beta}5$ and $V_{\beta}8$ memory T cells in adults and infancy: co-ordinated increase in response to early antigen stimulus. *Clin. Exp. Immunol.* 81:475-479.
89. Chinn, A., Cosyns, M. & Hayward, A. R. 1990. T cell proliferative response to IL2: Greater frequency of responders amongst $CD45R0^{+}$ subset from adult blood. *Cellular Immunology*, 131:132-139.
90. Hayward, A., Levin, M., Wolf, W. & Gilden, D. 1991. Varicella zoster virus specific immunity following herpes zoster. *J. Infect. Dis.* 163: 873-875.
91. Hayward, A. R., R. Burger, R. Scheper & Ann M. Arvin. 1991 MHC Restriction Of T Cell Responses To Varicella Zoster Virus In Guinea Pigs. *J. Virol.* 65:1491-1495.
92. Hayward, A. R. & Shriber, M. 1991. Reduced incidence of insulinitis in NOD mice following anti-CD3 injection: requirement for neonatal injection. *J. Autoimmunity.* 5:59
93. Hayward, A.R., Shriber, M & Sokol, R. 1991. Vitamin E supplementation reduces the incidence of diabetes but not insulinitis in NOD mice. *J. Lab. Clin. Med.* 119:503-507
94. Jones, J.F., Ritenbaugh, C.K., Marsh, D., Spence, M.A. & Hayward, A.R. 1991. Severe combined immunodeficiency amongst the Navajo: 1. Characterization of phenotypes, epidemiology and population genetics. *Human Biology* 63:669-682.
95. Hayward AR Groothuis J 1991. Development of T cells with memory phenotype in infancy. *Adv Exp Med Biol* 310:71-6
96. Li, J., Campbell, D & Hayward, AR. 1991. Differential response of human thymus cells to CD2 antibodies: fragmentation of DNA of $CD45R0^{+}$ and proliferation of $CD45R0^{-}$ subsets. *Immunology.* 75:305-310.
97. Groothuis JR, Levin MJ, Lehr MV, Weston JA, Hayward AR 1992 Impaired immune response to split product influenza vaccine in high-risk young children. *Vaccine.* 10:221:225
98. Huang Z, A. Vafai, . J. Lee, R. Mahalingam & A. R. Hayward. 1992. Specific lysis Of Targets Expressing Varicella Zoster Virus GpI Or GpIV By $CD4^{+}$ Human T Cell Clones. *J. Virol.* 66:2664-2669
99. Hayward A, Shriber M, Kubo R, McDuffie M. 1992. T cell repopulation following neonatal injection of NOD mice with anti-T cell antibodies. *Immunology.* 76:110-116
100. Hayward, AR, E Villanueva, M Cosyns, MJ Levin. 1992. Varicella zoster virus specific cytotoxicity following immunization of non-immune adults with Oka strain vaccine. *J. Inf. Dis.* 166:260-264.
101. Levin MJ, M. Murray, H. Rotbart, AR Hayward. 1992. Immune response of elderly individuals to live attenuated varicella zoster vaccine. *J. Inf. Dis.* 166:253-259.

102. Rotbart, HA, MJ Levin and AR Hayward. 1993. Immune responses to varicella zoster virus infections in healthy children. *J. Inf. Dis.* 167: 195-199.
103. Li, J, J Groothuis, MV Lehr, AR Hayward. 1993. Reduced anti-influenza antibody and T cell proliferative response to staph enterotoxin B in prematurely born infants. *Immunol. Inf. Dis.* 3:113-7.
104. Hayward AR, GS Read, M. Cosyns. 1993. Herpes simplex virus interferes with monocyte accessory cell function. *J. Immunol.* 150:190-196.
105. Hayward AR, M Shriber, A Cooke and H Waldmann. 1993. Prevention of diabetes but not insulinitis in NOD mice injected with antibody to CD4. *J. Autoimmunity.* 6:301-310.
106. Clarke DR Campbell DN Hayward AR Bishop DA 1993. Degeneration of aortic valve allografts in young recipients. *J Thorac Cardiovasc Surg* 1993 May;105(5):934-41.
107. Hayward, A. M. Cosyns. 1994. Proliferative and cytokine responses by human newborn T cells stimulated with staphylococcal enterotoxin B. *Ped Res* 35: 293-8.
108. Hayward, AR, GO Zerbe, MJ Levin. 1994. Clinical application of responder cell frequency estimates with four years of follow up. *J. Immunol. Methods.* 170:27-36.
109. Nyquist AC, Rotbart HA, Cotton M, Robinson C, Weinberg A, Hayward AR, Berens RL, Levin MJ. 1994. Acyclovir resistant neonatal herpes simplex virus infection of the larynx. *J Pediatr* 124:967-71.
110. Hayward AR, Buda K, Levin MJ. 1994. Immune Response to Secondary Immunization with Live or Inactivated VZV Vaccine in Elderly Adults. *Viral Immunology* 7: 31-36
111. Levin MJ, Murray M, Zerbe GO, White CJ and Hayward AR. 1994. Immune response of elderly individuals four years after receiving a live attenuated varicella vaccine.. *J. Inf Dis.* 170:522-6
112. Byars NE, Fraser-Smith E, Pecyk RA, Welch M, Nakano G, Burke RL, Hayward AR, Allison AC. 1994. Vaccinating guinea pigs with recombinant glycoprotein D of herpes simplex virus in an efficacious adjuvant elicits protection against vaginal infection. *Vaccine* 12:200-209.
113. Zhang Y, Cosyns M, Levin MJ, Hayward AR. 1994. Cytokine production in varicella zoster virus stimulated limiting dilution lymphocyte cultures. *Clin. Exp. Immunol.* 98: 128-133
114. Hayward AR, Cosyns M, Zhang Y. 1995. Frequency and cytokine phenotype of blood T cells from premature infants responding to staphylococcal enterotoxin B. *Ped. Res.* 37:455-459.
115. Li M, Groothuis JR, Lehr MV, Cosyns M, Hayward AR. 1995. Time dependent maturation of antibody response to influenza vaccine in premature infants. *Immunology & Inf. Dis.* 5:211-217.
116. Zhang Y, White J, Levin M, Hayward A. 1995. Cytokine production in varicella zoster virus stimulated lymphocyte cultures. *Neurology* 45: S38-40.

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BOOKS AND BOOK CHAPTERS

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ABSTRACTS AND INVITED PRESENTATIONS

In the past, abstract and meeting presentations were not tracked by Dr. Hayward. Recent abstracts:

Hayward AR, Kasper V, Uzun A & Mangray, S TLR7/9 variants in a case of giant cell hepatitis with autoimmune hemolytic anemia and pneumonitis: just a co-incidence? Given at European Society for Immunodeficiencies meeting, Barcelona, September 2017.

Hayward, AR, Cunningham-Rundles, C. & Meffre, E. Autoimmunity and Tolerance Defects in Two Boys with TLR7 Mutations. Given at European Society for Immunodeficiencies meeting, Lisbon, October 2018.

Recent invited presentations:

T cell immunodeficiencies 11/11/2015

Neonatal SCID screening: experiences to date. 11/12/2015. Both presentations at Christian Medical Center, Vellore, India.

Screening for immunodeficiencies. New England Regional Genetics Group December 2015.

GRANTS

Active, as co-investigator:

a) U54 GM115677. RI-Center for Clinical and Translational Science. PI. Dr. J. Padbury. Brown University. 2016-2021. NIGMS. \$4,000,000. Role: Co-director, tracking and evaluation core. 10% time.

Previous awards:

1. as P.I.

a) NIH RO1 AI40870. CD40-CD154 Interactions in Cryptosporidial Immunity. PI: Anthony Hayward MD. PhD. Period: 09/01/98-08/31/05.

b) NIH T32 AI 07365 (renumbered). Training Program in Pediatric Immunology. 10% time. Dates & costs: 9/1/00-8/31/05.

c). March of Dimes. CD40L deficiency and biliary tract disease. 10% time, A. Hayward PI. 6/1/97-5/31/02.

d) NIH RO3 AI41075, Cryptosporidia in the pathogenesis of sclerosing cholangitis, Hayward A, 6/1/97-5/31/99, 10% time.

e) NIH RO1 HL52962-02. Fetal Stem Cell Transplantation for alpha Thalassemia. 20% time. Dates: 8/1/94-5/31/98.

f) NIH (NICHD, HD 13733) Lymphocyte development in human newborns. 20% time. 1983-1995.

g) NIH (NIAID, AI 19841) Potential for virus immunotherapy with T cell blasts. 1-6-83 - 5-31-89.

h) March of Dimes. 6-598. Immunity Development following Premature birth. 20% time. Dates: 4/1/91-3/31/95.

i) 1974-1977. Medical Research Council (England). Lymphocyte development.

j) March of Dimes. 4-1-80 - 3-31-82. Specific immunity development in humans.

k) American Cancer Society, feasibility grant. \$2,500 in 1980, \$2,000 in 1982

l) March of Dimes. Development of virus specific responses in human newborns. 4-1-83 - 3-31-87.

m) American Diabetes Assn. Immunoregulatory abnormalities in juvenile onset diabetes mellitus. 8-1-83 - 7-31-85.

2. As Co-investigator:

b) P30 DK057516 UCHSC Diabetes Endocrinology Research Center. PI. Dr. John Hutton, University of Colorado, Denver. 2001-2006. NIDDK. \$1,030,000, 10% time

c) R01 DK059097 Immunotherapy Trial in New Onset Type 1 Diabetes. PI Dr. P. Gottlieb. University of Colorado, Denver. 2001-2006. NIDDK. \$330,720

d) T32 NS007321. NIH Neurovirology Graduate Research Training Program. P.I. - Dr. D. Gildea 5% time

d) NIH MO1 RR0069. Associate Director, Pediatric General Clinical Research Center, PI. R. Krugman. 25% time. Dates & costs: 11/30/95-12/31/00. \$ 1,600,000.

e) NIH 1R01AI37271-03, Natural and vaccine immunity to RSV in man and monkeys, PI Simoes E, 12/1/94-11/30/98, \$ 209,000, 10% time

UNIVERSITY TEACHING ROLES

During Dr. Hayward's 23 year tenure at the University of Colorado he directed the Pediatric Clerkship for 3 years and mentored residents in an academic track. At the NIH his responsibilities includes the education of Clinician Scientists, their career paths, training through T32 training programs and K programs, training in ethics and in mentor/trainee relationships. Since his move to Brown University he taught Immunodeficiency to Medical Students annually since 2016 as part of their Microbiology course.

HOSPITAL TEACHING ROLES

Since coming to Brown University in 2012 Dr. Hayward has taught Immunodeficiency to Pediatric Interns and Residents in a series of two lectures per year.