

October, 2009

STEPHEN G. EMERSON, M.D., Ph.D.

Home Address: 1 College Circle
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Haverford College
Haverford, PA 19041

Education: 1970-1974 B.A., summa cum laude, Haverford College (Chemistry & Philosophy)
1974-1976 M.Sc., Yale University (Molecular Biophysics & Biochemistry)
1976-1980 Ph.D., Yale University (Cell Biology & Immunology)
1974-1980 M.D., Yale University

Postgraduate Training and Fellowship Appointments:

1980-1981 Intern in Medicine, Massachusetts General Hospital, Boston, MA
1981-1982 Assistant Resident in Medicine, Massachusetts General Hospital, Boston, MA
1982-1985 Clinical Fellowship in Hematology, Brigham and Women's Hospital, Boston, MA
1983-1985 Research Fellow, Dana-Farber Cancer Institute, Brigham and Women's Hospital, & Children's Hospital Medical Center, Boston, MA

Military Service: None

Faculty Appointments:

1984-1986 Instructor in Medicine, Department of Internal Medicine
Harvard Medical School
1986-1990 Assistant Professor in Internal Medicine
University of Michigan
1988-1990 Assistant Professor in Pediatrics
University of Michigan, Ann Arbor, Michigan,
1990-1994 Associate Professor in Internal Medicine and Pediatrics
University of Michigan
1994-2007 Professor in Medicine and Pediatrics
University of Pennsylvania
1997-2007 Francis C. Wood Professor in Medicine
University of Pennsylvania
2003-2007 Professor in Pathology and Laboratory Medicine
University of Pennsylvania
2007- Adjunct Professor in Medicine, University of Pennsylvania
2007- Professor & President, Haverford College, Haverford, PA

Hospital and Administrative Appointments:

1987-1994	Scientific Director, Bone Marrow Transplantation Program, University of Michigan
1990-1994	Chief of Hematology and Associate Chief, Division of Hematology/Oncology, Department of Internal Medicine, University of Michigan
1994-	Chief, Division of Hematology/Oncology, Department of Medicine, Hospital of the University of Pennsylvania
1994-	Associate Director for Clinical Research, University of Pennsylvania Abramson Cancer Center
2003-	Investigator, Abramson Family Cancer Research Institute
2006-2007	Founding Director, Institute for Stem Cell Biology and Regenerative Medicine, University of Pennsylvania

Specialty Certification:

1983	American Board of Internal Medicine
1986	American Board of Internal Medicine (Hematology)
1987	American Board of Internal Medicine (Medical Oncology)

Licensure:

Michigan, Massachusetts, Pennsylvania

Awards, Honors and Membership in Honorary Societies:

1969	National Science Foundation Student Fellowship in Mathematics, San Diego State College
1973	Phi Beta Kappa (Zeta of Pennsylvania)
1974	B.A., summa cum laude, with honors in Philosophy and Chemistry, Haverford College
1974	George Pierce Chemistry Prize, Haverford College
1974-1980	National Institutes of Health Medical Scientist Training Fellowship, Yale University
1977-1980	Upjohn Graduate Research Fellowship
1980	Medical Scientist Trainee Prize, Yale University
1982-1983	American Cancer Society Clinical Fellowship
1984-1989	National Heart, Lung and Blood Institute Clinical Investigator Award
1989	Frank E. Trobaugh Young Hematology Investigator Award, Midwest Blood Club
1990	Jerome W. Conn Faculty Research Award, University of Michigan
1990-1995	Leukemia Society of America Scholar Award
1992	American Society for Clinical Investigation
1994	Stohlman Award, Leukemia Society of America
1994	M.A. (Hon.), University of Pennsylvania
1995	Fellow of the American College of Physicians
1996	Association of Subspecialty Professors
1997	Francis C. Wood Professorship
1997	Interurban Clinical Club; Councilor, 1999-2002; Secretary 2003-2005, President, 2006-2007
1998,00,02,04,05,06	"Top Doc" for Hematology, Philadelphia Magazine
1999	Rolex Career Achievement Award
2000	Association of American Physicians
2005	Donald B. Martin Teaching Service Award
2006	Bai-Yu-Lan Prize, Fudan University, China
2007	Ocala Royal Dame Prize in Cancer Research, University of Florida

2007 American Clinical and Climatological Association
2008 Selma and Karl Folkers Lectureship Prize, Yale University
2008 Wilbur Cross Medal, Yale University

Memberships in Professional and Scientific Societies:

National Societies:

American Association for the Advancement of Science
American Federation for Clinical Research (Councilor, 1978-1992)
International Society for Experimental Hematology (International Advisor 1997-2000)
American Society for Hematology
American Society of Clinical Oncology
American Society for Blood and Marrow Transplantation
American Society for Cell Biology
American Society for Clinical Investigation
American College of Physicians, Fellow
Association of Subspecialty Professors
Leukemia and Lymphoma Society of America (National Trustee, 1998-)
Association of American Physicians
American Society for Blood and Marrow Transplantation

National Scientific Committees:

International Society for Experimental Hematology
International Scientific Advisory Committee, 1997-2000

American Society of Hematology
Scientific Subcommittee on Hematopoietic Growth Factors, 1989-1993
Special Awards Committee, 1999-2000
Program Committee 2000-
Scientific Subcommittee on Stem Cells, 2001-2004
Chairman, Communications Committee, 2003-
Scientific Agenda Committee, 2006

American Society of Clinical Oncology
Special Awards Committee 1995-1996

Leukemia and Lymphoma Society of American
Medical & Scientific Affairs Committee, Vice-President, 1998-2003

American Society for Blood and Marrow Transplantation
Program Committee, 2002-, Chairman, 2004

Membership in National and International Scientific Review Panels:

American Society of Hematology Program Selection Committee and Session Chairman (1987, 1990, 1991, 1993, 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006),
National Program Selection Committee, 2000-2006

American Federation for Clinical Research Program Selection Committee and Session
Chairman (1988, 1990)

NIH/NCI Ad Hoc Review Committees: 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996,
1997, 1998, 1999(Chairman), 2000, 2001(Chairman), 2002, 2003, 2004

NIH Study Sections

ARRE 1988-1992
Hematology 1 1992-1998
Cell/Developmental Biology 5 Study Section 2002,2003
Immunobiology 2003
Hematopoiesis 2004
KO8/K02 2005
Bioengineering, 2006

NIH Study Section Redesign Team, 2001

NSF Advisory Panel 1989, 1994,1997, 2002

American Red Cross Ad Hoc Review, 1990

March of Dimes Peer Review, 1990

AFCR M.D.-Ph.D. Post-Doctoral Fellowship Award Review, 1990

Leukemia Society of American Translational Awards Committee 1995-2002
Chairman, 1999-2002

Canadian Red Cross Review 1997

National Institute of Standards and Technology Advanced Technology Program 1997, 1998

Doris Duke Distinguished Clinical Professor Review & Selection Committee, 2001-5

British Medical Research Council External Review 2003-

Wellcome Trust External Review 2003-

Canadian Institute for Health Research 2006

Rosenzweig Foundation for Pancreatic Cancer Research, 2007-

Abramson Cancer Center/University of Pennsylvania Scientific Advisory Board, 2009

Editorial Positions:

1975-1980	Editorial Board, <u>Yale Journal of Biology and Medicine</u>
1994-1997	Editorial Board, <u>Experimental Hematology</u>
1996-2002	Editorial Board, <u>Blood</u>
1999-	Editorial Board, <u>Cell Transplantation</u>
2003-	Editorial Board, <u>Stem Cells</u>
2004-	Associate Editor, <u>The Hematologist</u>
2004-	Editorial Board, <u>Biology of Blood and Marrow Transplantation</u>
2007- 2012	Deputy Editor, Senior Editor, <u>The Journal of Clinical Investigation</u>
2006-	Editorial Advisory Board, <u>The Journal of Experimental Medicine</u>

Lectures by Invitation (past 4 years):

January 29, 2003, "Dendritic Cells Regulate T Cell Tissue Recruitment & Retention in GVHD." ASBMT, Keystone, CO.

February 12, 2004, "Genes that Control Stem Cell Proliferation and Expansion." ASBMT Plenary Session, Orlando, FL.

February 15, 2004, "Memory Cells Contribute to Ongoing GVHD in vivo." ASBMT, Orlando, FL.

May 7, 2004, "NF-Y Integrates Stem Cell Gene Activation." 2nd Shanghai Medical School, 10th Plenary Presentation, International Differentiation Cell Therapy Conference, Shanghai, China.

May 9, 2004, "The Control of Hematopoietic Stem Cell Proliferation," Visiting Professor, Institute of Hematology, Souzou University, Souzou, China.

December 4,5, 2004, "Expansion of Umbilical Cord Blood Cells: Basic Science and Clinical Translation," American Society for Hematology National Meeting, San Diego, CA.

December 6, 2004, "Osteoblasts Support B Lymphopoiesis," American Society for Hematology National Meeting, San Diego, CA.

February 2, 2005, "NF-Y, "Osteoblasts, and the Integration of Stem Cell Self-Renewal," Roger Williams Medical Center, Providence, RI.

March 1, 2005, "Stem Cells, Memory Cells and Memory Stem Cells," Skirball Institute, New York University School of Medicine, New York, NY.

May 2, 2005, "Integration of Stem Cell Signals by NF-Y," Six Annual International Workshop on Molecular Aspects of Myeloid Differentiation and Leukemia, Annapolis, MD.

June 1, 2005, "NF-Y and Stem Cell Activation," Fels Institute, Temple University Medical Center, Philadelphia, PA.

June 16, 2005, "Memory Stem Cells and GVHD," European Bone Marrow Transplant Society, Sesimbra, Portugal.

January 12, 2006, "Osteoblasts, B Cells, and Stem Cells," Aastrom Biosciences, Ann Arbor, MI.

January 31, 2006, "Host APCs, Memory Stem Cells and CD4 Help in the Induction and Evolution of GVHD," M.D. Anderson Cancer Institute, Houston, Texas.

March 25, 2006, "Memory Stem Cells and Chronic Immune Responses," French Society of Hematology, Paris, Francis.

May 18, 2006, "Stem Cells and Memory T Cell Subsets," Memorial Sloan Kettering Cancer Institute, New York, N.Y.

August 29, 2006, "The Cellular Cascade of GVHD," Jiao-Tong University, Shanghai, China

August 30, 2006, Bai-Yu-Lan Prize Lecture, Fudan University, Shanghai, China

September 30, 2006, Ocala Royal Dames Visiting Prize Lectureship, University of Florida, Gainesville, FL

October 12, 2006, "Cellular Determinants of GVHD," Dana Farber Cancer Institute, Harvard Medical School, Boston, MA.

January 25, 2007. "NF- κ B and Stem Cell Renewal." Yale University, New Haven, CT.

May 25, 2007, "Stem Cell and the Immune Response." Northwestern University School of Medicine, Chicago, IL.

October 3, 2007, "The Stem Cell Revolution in Biology and Medicine," American Clinical and Climatological Association, Tucson, AR.

January 11, 2008, "From Dendritic Exosomes to Memory Stem Cells," Selma and Karl Folkers Lecture, M.D.-Ph.D. retreat, Yale University, Westbrook, CT.

September 4, 2008, "Learning and Discovery in Friends Education," Friends Central School Faculty Convocation, Merion, PA.

May 20, 2009, "Academic Careers for Physician Scientists," National Institutes of Health, Bethesda, MD

June 5, 2009, "Individuals, Leadership and History," Haverford School Commencement, Haverford, PA.

Organizing Role in Scientific Meetings:

September 15, 1999. "Advances in Translational Research in Leukemia," Leukemia Society of America, Washington, DC.

September 25, 2000. "Novel Diagnostic, Prognostic and Treatment Advances in Leukemia and Lymphoma," Leukemia and Lymphoma Society of American, Washington, DC.

September 13, 2001. "Advances in Translational Research in Lymphoma and Leukemia," Leukemia and Lymphoma Society of American, Washington, DC.

December 2-6, 2000. 42nd Annual Meeting of the American Society of Hematology, San Francisco, CA.

November 2, 2001. 184th Meeting of the Interurban Clinical Club, "Advances in Medical Research," Philadelphia, PA.

December 7-11, 2001. 43rd Annual Meeting of the American Society of Hematology, Orlando, FL.

December 7-12, 2003. 45th Annual Meeting of the American Society of Hematology, San Francisco, CA.

December 2-5, 2004. 46th Annual Meeting of the American Society of Hematology, San Diego, CA.

December 8-12, 2005. 47th Annual Meeting of the American Society of Hematology, Atlanta, GA.

February 13-17, 2004. American Society for Bone Marrow Transplantation, Orlando, Florida.

February 10-24, 2005. American Society for Bone Marrow Transplantation, Keystone, Colorado.

December 1-4, 2006. Annual Meeting of the American Society of Hematology, Orlando, FL.

Bibliography:

Research Publications, peer reviewed:

1. Emerson, S.G., Cone, R.E.: Turnover and shedding of Ia antigens by murine spleen cells in culture. *J Immunol* 122:892-897, 1979.
2. Emerson, S.G., Reilly, P., Cone, R.E.: Differential radiolabelling of lymphocyte membrane alloantigens and immunoglobulins: Variation of H₂O₂ concentration during lactoperoxidase catalyzed cell surface radiodination. *J Immunogen* 6:87-92, 1979.
3. Emerson, S.G., Cone, R.E.: Differential effects of colchicine and cytochalasins on the shedding of murine B cell membrane IgM and IgD. *Proc Natl Acad Sci USA* 76:6582-6586, 1979.
4. Emerson, S.G.: The turnover and shedding of cell membrane proteins by murine spleen cells in culture. Yale University, Doctoral Dissertation, 1980.
5. Emerson, S.G., Murphy, D.B., Cone, R.E.: Ia antigen turnover. II. The kinetics of biosynthesis and release of Ia alpha and beta chains by murine spleen cells in culture. *J Immunol* 125:406-410, 1980.
6. Emerson, S.G., Murphy, D.B., Cone, R.E.: The selective turnover and shedding of H-2K and H-2D antigens is controlled by the major histocompatibility complex: Implications for self-restricted recognition. *J Exp Med* 152:783-795, 1980.
7. Emerson, S.G., Cone, R.E.: Murine I-A^k and H-2K^k antigens are shed as supramolecular particles in association with membrane lipids. *J Immunol* 127:482-486, 1981.
8. Emerson, S.G., Cone, R.E.: The selective control of murine B lymphocyte plasma membrane protein turnover and shedding. *J Cell Physiol* 109:25-35, 1981.
9. Emerson, S.G., Cone, R.E.: Absorption of shed I-A^k and H-2K^k antigens by lymphoid cells. *Transplantation* 33:36-40, 1982.
10. Emerson, S.G., Pretell, J., Cone, R.E.: Physical and pharmacologic inhibition of the shedding of Ia antigens. *Exp Clin Immunogen* 1:9-19, 1984.
11. Rosenthal, D.S., Emerson, S.G., Rapoport, J.M., Moloney, W.C.M., Handin, R.I.: Long term survivors of adult acute non-lymphocytic leukemia: Fact or fiction. *Hematology and Blood Transfusion* 29:44-47, 1985.
12. Emerson, S.G., Sieff, C.A., Wang, E.A., Wong, G.G., Clark, S.C., Nathan, D.G.: Purification of fetal hematopoietic progenitors and demonstration of recombinant colony stimulating activity. *J Clin Invest* 76:1286-1290, 1985.
13. Sieff, C.A., Emerson, S.G., Donahue, R.E., Nathan, D.G., Wang, E.A., Wong, G.G., Clark, S.C.: Human recombinant granulocyte-macrophage colony stimulating factor: A multilineage hemopoietin. *Science* 230:1171-1173, 1985.
14. Donahue, R.E., Emerson, S.G., Wang, E.A., Wong, G.G., Clark, S.C., Nathan, D.G.: Demonstration of burst promoting activity of recombinant human GM-CSF on circulating erythroid progenitors using an assay involving the delayed addition of erythropoietin. *Blood* 66:1479-1481, 1985.
15. Emerson, S.G.: Isolation of Erythroid and Myeloid Progenitors from Human Fetal Liver. *Prog Clin Biol Res* 193:135-148, 1985.

16. Rosenthal, D.S., Emerson S.G., Rapoport, J.M., Moloney, W.C., Handin, R.I.: Long-term survivors of adult acute nonlymphocytic leukemia: fact or fiction? *Hematol Bluttransfus* 29:44-7, 1985.
17. Sieff, C.A., Emerson, S.G., Mufson, A., Gesner, T.G., Nathan, D.G.: The dependence of highly enriched bone marrow progenitors on hematopoietic growth factors and their response to recombinant erythropoietin. *J Clin Invest* 77:74-81, 1986.
18. Antin, J.H., Emerson, S.G., Ault, K.A.: Leu-1 B cells are the predominant B cell phenotype in human fetal liver: Morphologic and functional analysis. *J Immunol* 136:505-510, 1986.
19. Tsai, S., Emerson, S.G., Sieff, C.A., Nathan, D.G.: Isolation of a human stromal cell secreting hematopoietic growth factors. *J Cell Physiol* 127:137-145, 1986.
20. Rozans, M.K., Smith, B.R., Emerson, S.G., Crimmins, M., Laurent, G. Reichert, T., Burakoff, S.J., Miller, R.J.: Functional assessment of T cell depletion from bone marrow prior to therapeutic transplant utilizing limiting dilution culture methods. *Transplantation* 42:380-387, 1986.
21. Emerson, S.G., Sieff, C.A., Gross, R.G., Rozans, M.K., Miller, R.A., Rapoport, J.M., Nathan, D.G.: Decreased Hematopoietic Accessory Cell Function Following Bone Marrow Transplantation. *Exp Hematol* 15:1013-1021;1986.
22. Miller, B.A., Perrine, S.P., Antognetti, G., Permuter, D.H., Emerson, S.G., Sieff, C.A., Faller, D.V.: Gamma-Interferon alters globin gene expression in neonatal and adult erythroid cells. *Blood* 69:1674-1681, 1987.
23. Emerson, S.G., Gale, R.P.: The regulation of hematopoiesis following bone marrow transplantation. *Int J Cell Cloning* 5:432-449, 1987.
24. Emerson, S.G., Yang, Y-C., Clark, S.C., Long, M.L.: Human Recombinant Granulocyte-Monocyte Colony Stimulating Factor and Interleukin 3 Have Overlapping But Distinct Hematopoietic Activities. *Clin Invest* 82:1282-1287, 1988.
25. Long, M.W., Hutchinson, R.J., Gragowski, L.L., Hefner, C.H., Emerson, S.G.: Lymphocyte Regulation of Human Megakaryocyte Development. *J Clin Invest.* 82:1779-1786, 1988.
26. Bierer, B.E., Emerson, S.G., Antin, J.H., Maziarz, R.: Rapoport JM, Smith BR, Burakoff SJ. Cytotoxic T lymphocytes mediate graft rejection following bone marrow transplantation. *Transplantation.* 46:835-839, 1988.
27. Emerson, S.G., Antin, J.H.: Bone Marrow Progenitor Cells Induce a Regulatory Autologous Proliferative T Lymphocyte Response. *J Immunol.* 142:766-772, 1989.
28. Thompson, C.B., Lindsten, T., Ledbetter, J.A., Kunkel, S.L., Young, H.A., Emerson, S.G., Leiden, J.M., June, C.H.: Activation of the CD28 Pathway Enhances the Production of Lymphokines/cytokines By Normal Human T Cells. *Proc Natl Acad Sci USA.* 86:1333-1337, 1989.
29. Adams, S., Upadhyaya, G., Clarke, M.F., Emerson, S.G.: The Proliferation of Human Leukemic Cell Line AML-193 is Regulation by Multiple Hematopoietic Growth Factors and Cytokines. *Leukemia* 3:314-315, 1989.
30. Emerson, S.G., Thomas, S., Ferrara, J., Greenstein, J.L.: The Developmental Regulation of Erythropoiesis by Hematopoietic Growth Factors: Analysis on Populations of BFU-E From Bone Marrow, Peripheral Blood and Fetal Liver. *Blood* 74:49-55, 1989.

31. Guba, S.C., Stella, G., Turka, L.A., June, C.H., Lindsten, T., Thompson, C.B., Emerson, S.G.: Regulation of T Cell Interleukin 3 Gene Expression Via the CD3 and CD28 Pathways. *J Clin Invest* 84:1701-1706, 1989.
32. Palsson, B.O., Keasling, T., Emerson, S.G.: The Kinetics of HIV Replication Predict Multiple Expression Rates. *Proc Acad Natl Sci USA* 87:772-776, 1990.
33. Thomas, S., Clark, S.C., Rapoport, J.M., Nathan, D.G., Emerson, S.G.: Deficient T cell GM-CSF Production in Alogeneic Bone Marrow Transplant Recipients. *Transplantation*, 49:703-707, 1990.
34. Fishel R., Farnen, J.P., Hansen, C., Silver, S., Emerson, S.G.: Acute Lymphoblastic Leukemia with Hypereosinophilia. *Medicine* 69:232-243, 1990.
35. Emerson, S.G.: The Regulation of Hematopoiesis in the Fetal Liver. *Prog Clin Biol Res* 352:21-28, 1990.
36. Seong, D., Sims, S.S., Johnson, E., Swan, F., Lyding, J., Lopez, A., Talpaz, G., Kantarjian, H., Emerson, S., Lopez-Berestein, G., Reading, C., Deisseroth, A.B.: Regulation of Gene Expression by Tumor Necrosis Factor-alpha and Interferon-Gamma in Chronic Myelogenous Leukemia. *Trans. Assoc. Amer. Phys.* 103:236-241, 1990.
37. Emerson, S.G., Palsson, B.O., Clarke, M.F.: The Application of Molecular and Tissue Engineering to *In Vitro* Hematopoietic Cultures. *J Cell Biochem* 45:268-272, 1991.
38. Caldwell, J., Locey, B., Palsson, B.O., Emerson, S.G.: The influence of culture perfusion conditions on normal human bone marrow stromal cell metabolism. *J Cell Physiol* 147:344-353, 1991.
39. Schwartz, R., Palsson, B.O., Emerson, S.G.: Rapid medium and serum exchange increases the longevity and productivity of human bone marrow cultures. *Proc Nat Acad Sci USA* 88:6760-6764, 1991.
40. Caldwell, J., Locey, B., Clarke, M.F., Emerson, S.G., Palsson, B.O.: The influence of culture conditions on genetically engineered NIH-3T3 cells. *Biotech Prog* 7:1-8, 1991.
41. Farnen J, Tyrkus M, Hanson C, Cody R, Emerson S.: Characterization of a new human multiple myeloma cell line, UMJF-2, which suppresses antibody production by B-lymphocytes *in vitro*. *Leukemia* 5:574-584, 1991.
42. Schwartz, R., Emerson, S.G., Clarke, M.F., Palsson, B.O.: In vitro myelopoiesis stimulated by rapid medium exchange and supplementation with hematopoietic growth factors. *Blood* 78:3155-3161, 1991.
43. Upadhyaya, G., Guba, S.G., Deisseroth, A.B., Emerson, S.G.: CML Progenitor Cells Fail to Stimulate the APLR and are deficient in Cell Surface LFA-3: Modulation by a-Interferon *in vitro* and *in vivo*. *J Clin Invest* 88:2131-2136, 1991.
44. Angelotti, T.P., Clarke, M.F., Longino, M.A., Emerson S.G.: Biotinylated GM-CSF analogs: Effect of linkage chemistry on activity and binding. *Bioconjugate Chemistry*, 2:466-474, 1991.
45. Varma, A., Palsson, B.O, Emerson, S.G., Clarke, M.F.: Can dexter cultures support stem cell proliferation? *Exper Hematol* 20:87-91, 1992.
46. Guba, S.C., Sartor, C.I., Gottschalk, L.R., Ye-Hu, J., Xiao, L.C., Mulligan, T., Emerson, S.G. Bone marrow stromal cells secrete IL-6 and GM-CSF in the absence of inflammatory stimuli:

- Demonstration by serum-free bioassay, ELISA, and reverse transcriptase polymerase chain reaction. *Blood* 80:1190-1198, 1992.
47. Mattano, L., Moss, T.C., Emerson, S.G.: Detection of circulating neuroblastoma cells by reverse transcriptase polymerase chain reaction. *Cancer Res* 52:4701-4706, 1992.
 48. Freedman, A.R., Sharma, R.J., Nabel, G.J., Emerson, S.G., Griffin, G.E.: Cellular distribution of NF- κ B binding activity in rat liver. *Biochem J* 287:645-649, 1992.
 49. Schwartz, R.M., Caldwell, J.C., Clarke, M.F., Emerson, S.G., Palsson, B.O.: The influence of Extracellular Matrix and Stromal Remodeling on the Productivity of Long Term Human Bone Marrow Cultures. *Cytotechnology* 10:217-224, 1992.
 50. Boxer, L.A., Hutchinson, R, Emerson, S.G.: Recombinant Human Granulocyte-Colony Stimulating Factor in the Treatment of Patients with Neutropenia.: *Clin Immunol Immunopath* 62:S39-S46, 1992.
 51. Palsson, B.O. Paek, S.W., Palsson, M, Schwartz, R.M., Lee, M., Silver, S., Emerson, S.G.: Expansion of Human Bone Marrow Progenitor Cells in a Continuous Perfusion Hematopoietic Bioreactor. *Bio/Technology* 11:268-371, 1993.
 52. Biesecker, L., Emerson, S.G. The role of IL-6 in hematopoietic induction of embryonic stem cells in vitro. *Exp Hematol* 21:774-778, 1993.
 53. Eck, S.L., Morse, J.H., Janssen, D.A., Emerson, S.G., Markovitz, D.M.: Angioedema presenting as chronic gastrointestinal symptoms. *Am J Gastroenterology* 88:436-439, 1993.
 54. Dale, D.C., Bonilla, M.A., Davis, M.W., Winton, E., Lalezari P., Peters, W., Wang, W., Robinson, W., Glaspy, J.A., Emerson, S.G., Gabrilove, J.L., Vincent, M., Boxer, L.A. A randomized controlled phase III trial of recombinant human G-CSF in treatment of patients with severe chronic neutropenia. *Blood* 81:2496-2502, 1993.
 55. Koller, M.R., Emerson, S.G. Palsson, B.O. Large-Scale Expansion of Human Hematopoietic Stem and Progenitor Cells from Bone Marrow Mononuclear Cells in Continuous Perfusion Culture. *Blood* 82:378-384, 1993.
 56. Biesecker, L., Gottschalk, L., Emerson, S.G. Isolation of novel protein tyrosine kinase genes from developing mouse multipotent and hematopoietic stem cells. *Proc Nat Acad Sci USA* 90:7044-7048;1993.
 57. Gottschalk, L., Giannola, D., Emerson, S.G. Molecular regulation of the human IL-3 gene: Inducible T cell restricted expression requires intact AP-1 and Elf-1 nuclear protein binding sites. *J Exp Med* 178:1681-1692;1993.
 58. Guba, S.C., Boxer, L.A., Emerson, S.G. G-CSF Production and G-CSF Receptor Structure in Patients with Congenital Neutropenia. *Blood* 80:1190-1198;1994.
 59. Taichman, R.S., Emerson, S.G. Human osteoblasts support hematopoiesis through the production of granulocyte colony stimulating factor. *J Exp Med* 179:1677-1682;1994.
 60. Caldwell, J., Emerson, S.G. IL-1 α and TNF α act synergistically to stimulate high level GM-CSF and G-CSF production from human bone marrow stromal cells and stromal cell strains. *J. Cell Physiol* 159:221-228, 1994.

61. Van Zant, G., Drubachevsky, I., Rummel, S., Koller, M.F., Emerson, S.G. Expansion of hematopoietic progenitor cells from umbilical cord blood via continuous perfusion culture. *Blood Cells* 20:482-491, 1994.
62. El-Awar, F., Krause, J.C., Palsson, B.O., Emerson, S.G., and Clarke, M.F. Retroviral Gene Transfer into Human Hematopoietic Cells Using Rapidly Perfused Long Term Bone Marrow Culture. *Cancer Bulletin* 179:1677-1682, 1994.
63. Biesecker, L., Giannola, D., Emerson, S.G. Molecular cloning of the ETK-2 gene reveals alternative exon usage in the extracellular receptor domain. *Oncogene*, 10:2239-2242;1995 .
64. Caldwell, J., Emerson, S.G. IL-1a upregulates TNF receptors expressed by a clonally derived bone marrow stromal cell strain: Implications for cytokine redundancy and synergy. *Blood* 86:3364-3372;1995.
65. Eipers, P.G., Krause, J.C., Palsson, B.O., Emerson, S.G., Todd, R.F., Clarke, M.F. Retroviral infection of primitive hematopoietic cells in continuous perfusion culture. *Blood* 86:3754-3762;1995.
66. Taichman, R.S., Reilly, M.J., Emerson, S.G. Human osteoblasts support human hematopoietic progenitor cells in long term in vitro bone marrow cultures. *Blood* 87:518-524;1996.
67. Nassiri, M.R., Emerson, S.G., Townsend, L.B., Drach, J.C., Taichman, R.S. Comparison of benzimidazole nucleosides and ganciclovir on the in vitro proliferation and colony formation of human bone marrow progenitor cells. *Br J Haematol* 93:273-279;1996.
68. Taichman, R.S., Emerson, S.G. Human MG-63 and SaOS-2 osteosarcoma cell lines produce G-CSF and GM-CSF: Identification and partial characterization of cell-associated isoforms. *Exp Hematol* 24:509-517; 1996.
69. Emerson, S.G. The Potential for Clinical Ex Vivo Hematopoiesis. *Proc New York Acad Sci* 770:99-105;1996.
70. Emerson, S.G. Ex-Vivo Expansion of Hematopoietic Precursors, Progenitors, and Stem Cells: The Next Generation of Cellular Therapeutics. *Blood* 87:3082-3088;1996.
71. Shlomchik, W., Emerson, S.G. The Immune Response to Leukemias. *Acta Haematologica*. 96:189-213;1996.
72. Taichman, R.S., Reilly, M.J., Verma, R.S., Emerson, S.G. CD34+ bone marrow cells induce the expression and secretion of interleukin 6 (IL-6) by normal human osteoblasts. *Blood* 89:1165-1172;1997.
73. Taichman R.S., Nassiri M.R., Reilly M.J., Ptak R.G., Emerson S.G., Drach J.C. Infection and replication of human cytomegalovirus in bone marrow stromal cells: Effects on the production of IL-6, MIP-1alpha, and TGF-beta1. *Bone Marrow Transplantation* 19:471-80, 1997
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None

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Hematopoietic Transplantation Educational Program. Emerson, S.G. Biology of Blood and Marrow Transplantation 11:2:Suppl. 2005.

U.S. Patents:

"Methods and Compositions for the Optimization of Human Hematopoietic Progenitor Cell Cultures," Stephen G. Emerson, Michael F. Clarke, Bernhard O. Palsson, Richard M. Schwartz, No. 5,399,493.

"Method for the Ex Vivo Replication of Stem Cells, for the Optimization of Hematopoietic Progenitor Cell Cultures, and for Increasing the Metabolism, GM-CSF Secretion and/or IL-6 Secretion of Human Stromal Cells," Stephen G. Emerson, Michael F. Clarke, Bernhard O. Palsson, No. 5,437,994.

"Device for maintaining and growing human stem and/or hematopoietic cells," Bernhard O. Palsson, Stephen G. Emerson, Richard M. Schwartz.

"Methods for Regulating the Specific Lineages of Cells Produced in a Human Hematopoietic Cell Culture," Bernhard O. Palsson, R. Douglas Armstrong, Michael F. Clarke, Stephen G. Emerson, No. 5,635,386.

"Methods and Compositions for the Ex Vivo Replication of Human Hematopoietic Stem Cells," Bernhard O. Palsson, R. Douglas Armstrong, Michael F. Clarke, Stephen G. Emerson, No. 5,670,351.

"Compositions Containing Cultured Mitotic Human Stem Cells," Bernhard O. Palsson, R. Douglas Armstrong, Michael F. Clarke, Stephen G. Emerson, No. 5,670,147.

"Methods, Compositions and Devices for Maintaining and Growing Human Stem and/or Hematopoietic Cells," Bernhard O. Palsson, Stephen G. Emerson, Richard M. Schwartz, No. 8,290,773.

"Methods, compositions and devices for maintaining and growing human stem and/or hematopoietic cells." Palsson, Bernhard O., Stephen G. Emerson, Richard M. Schwartz, No. 5,763,266

"Hematopoietic Cells: Compositions & Methods Concerning Stem Cell Co-Culture with Osteoblasts," Russell S. Taichman, Stephen G. Emerson, No 5,733,541.

"Devices for maintaining and growing human stem and/or hematopoietic cells," Bernhard O. Palsson, Stephen G. Emerson, Richard M., Schwartz. No 5,888,807.

"Methods and compositions for the ex vivo replication of stem cells, for the optimization of hematopoietic progenitor cell cultures, and for increasing the metabolism, GM-CSF secretion and/or IL-6 secretion of human stromal cells," Stephen G. Emerson, Michael F. Clarke, Bernhard O. Palsson, No 6,326,198

"Methods For Regulating The Specific Lineages Of Cells Produced In A Human Hematopoietic Cell Culture, Methods For Assaying The Effect Of Substances On Lineage-Specific Cell Production, And Cell Compositions Produced By These Cultures," Bernhard O., Palsson, R. Douglas Armstrong, Michael F. Clarke, Stephen G. Emerson, No 6,667,034

"Inhibition of Immune Function by Targeting Antigen Presenting Cells." Warren Shlomchik, Mark Shlomchik, Stephen G. Emerson.

Research Funding

Active

2RO1 CA90833-05 (Emerson)	6/1/06-5/31/11	25%
NIH	\$176,000	
Stem Cell Manipulation via HOX Gene Regulation		

This project seeks to overexpress and underexpress NF-Ya in normal hematopoietic stem cells via retroviral gene transfer, focusing on mutant mouse strains that lack one or more candidate signal transduction pathways, and to develop HIV-TAT protein constructs to modulate NF-Y activity in stem cells.

1 RO1 HL81185-01 (Zhou)	4/1/06-3/31/11	1%
NIH	\$279,933	
Imaging Stem Cells Grafted in the Infarcted Myocardium.		

This project seeks to image hematopoietic, and mesenchymal stem cells following myocardial infarction. Dr. Emerson serves as a consultant to Dr. Zhou.

Leukemia and Lymphoma Society SCOR (June)	7/1/06 – 6/30/11	1%
	\$118,747	
Immune Amplification to Accelerate UCB Grafts (E. Hexner, Project 2 PI)		

This project, part of the LLS SCOR renewal application, seeks understand the role of T cell activation in HSC grafts using human to NOD/SCID mouse transplant models, and in particular to apply this understanding to correcting engraftment defects in UCB grafts. Dr. Emerson was previously the project PI for Project 2, and now consults Dr. Hexner on the conduct of this project.

Commonwealth of PA (Epstein)	7/1/08-6/30/12	2%
	\$30,000	
Penn Regenerative Medicine Center		

These funds support the teaching of an undergraduate course in stem cell biology, as well as summer research stipends for undergraduates to work in stem cell biology laboratories.