

Fred David Ledley, MD

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CURRENT POSITIONS:

Professor of Biology and Medicine and Chair, Department of Natural and Applied Sciences, Bentley University, Waltham MA

Member and Director, National Biomedical Research Foundation, Bethesda, MD.

PREVIOUS POSITIONS:

2002-2004 Founder and Chairman, Mygenome, Inc. Needham, MA
2000- 2002 Co-founder, Chief Scientific Officer, Framingham Genomic Medicine, Framingham, MA
1999-2000 Acting Medical Director Valentis, Inc. (GENEMEDICINE), Burlingame CA
1996 - 1999 President, Director, Chief Operating Officer (1996), Chief Executive Officer (1997-1999), VARIAGENICS, INC., (Nasdaq:VGNX) Cambridge MA.
1993 - 1996 Scientific Co-founder, Vice President, Research & Development, GENEMEDICINE, INC. (Nasdaq:GMED) The Woodlands, TX. Adjunct Associate Professor, Departments of Cell Biology and Pediatrics Baylor College of Medicine, Houston, TX.
1985 - 1992 Assistant Investigator, Howard Hughes Medical Institute. Baylor College of Medicine, Houston, TX.
1988 - 1993 Associate Professor (tenured), Department of Cell Biology, Baylor College of Medicine, Houston, TX. Associate Professor, Department of Pediatrics, Texas Children's Hospital, Baylor College of Medicine, Houston TX.
1985 - 1998 Assistant Professor, Department of Cell Biology, Baylor College of Medicine, Houston, TX.

EDUCATION:

M.D. Georgetown University School of Medicine, 1978; Upjohn Research Award
 B.S. University of Maryland (College Park), 1971-1974; Major: Physical Science
 Citation in General Honors, Academic Honors (Cum Laude)
 Phi Beta Kappa, Phi Kappa Phi, Sklaar award in Honors (Junior)

RESEARCH AND POST DOCTORAL TRAINING:

1983 - 1984 Dr. Savio Woo, Department of Cell Biology. Baylor College of Medicine,
 Howard Hughes Medical Institute Post-Doctoral Fellow.
 1981 - 1983 Dr. David Baltimore, Massachusetts Institute of Technology; American
 Cancer Society Post Doctoral Fellowship.
 1981 - 1983 Research Fellow in Genetics, Clinical Fellow Pediatrics, Children's Hospital,
 Harvard Medical School. Charles Janeway Scholarship.
 1978 - 1981 Internship and Residency (PL-1, PL-2, PL-3) in Pediatrics, Children's Hospital,
 Clinical Fellow in Medicine, Harvard Medical School
 1975 - 1978 Student Researcher, Laboratory of Dr. Leonard Kohn National Institute of
 Arthritis Metabolism and Digestive Diseases, National Institutes of Health,
 and Laboratory of Dr. Caroline Hardegree, Food and Drug Administration,
 1972-1974 Summer Research, National Biomedical Research Institute, Atlas of Protein
 Sequence and Structure, with Dr. Margaret Dayhoff. Computer
 applications in Medicine with Dr. Robert Ledley.

NATIONAL COMMITTEES AND BOARDS:

BEN Scholar (Bioscience Education Network) – 2008-present
 Board of Directors, Hillel Council of New England, 2007-present
 Organizer, "The Nature of Being Human," Andover Newton Theological School,
 2007.
 Core Scholar, New Visions: Nature, Science, & Religion. UC Santa Barbara, 2004-
 2007
 Board of Overseers, Children's Hospital, Boston, 2000-2006
 Massachusetts Biotechnology Council, Board of Directors, 1998-2001
 Advisory Committee on Predictive Medicine, National Institute Child Health and
 Human Development (NICHD), 1999-2000
 Advisor to National Children's Study, NICHD, 2000-2003
 Biotechnology Industry Organization, Regulatory Affairs Committee, Government
 Affairs Committee, Bioethics Committee, 1994-2001
 Associate Editor, Deputy Editor, *Computers in Biology and Medicine*, 1980-present
 Editor, *Human Gene Therapy*, 1992-1998
 Editor, *Expert Opinion in Investigational Drugs*, 1992-1996
 Council of Society for Pediatric Research, 1993 – 1997
 Pediatric Scientist Development Program. Association of Medical School Pediatric

Department Chairmen (AMSPDC), 1993-1998
 Mexico National Academy of Medicine Panel on Genome Project, 1993 -1997
 Advisory Panel on Genetics Clearinghouse, National Institutes of Health, 1994
 Genetics Advisory Committee, American Academy of Pediatrics, 1993
 Advisor on Gene Therapy. NICHD, 1993
 Advisory Group on Gene Therapy. National Heart Lung and Blood Institute, 1992
 National Advisory Panel, "Conference on Genetics, Religion, and Ethics"; Institute of Religion, Institute for Human Genetics, Baylor College of Medicine, 1990-1992
 Organizer, Advisory presentation on Gene Therapy. National Institute Arthritis and Metabolic Diseases, 1991
 National Advisory Committee, Protein Identification Resource (PIR), National Biomedical Research Foundation, Georgetown University, 1989-2000

INSTITUTIONAL COMMITTEES AND BOARDS:

IRB (Institutional Review Board) – 2008-present
 Graduate Program Strategy Committee (A&S). 2007-present
 Chair's Interview Committee for Dean of Business and McCallum Graduate School, 2007
 Leadership Forum organizing committee for TIME/Bentley Leadership Forum and Tomorrow 25 awards. 2007-present
 MS Task Force, McCallum graduate School of Business, 2006
 Profile, Promotion, & Tenure Proposal Editing Committee. Bentley 2005
 Joint Chair's Meetings, A&S Chairs meetings, Bentley 2005 – present
 Chair's Interview Committee for Presidential Candidates, 2005-2007.
 Spiritual Life Advisory Committee, Bentley 2005-present
 Scientific Advisory Committee, General Clinical Research Center, Baylor College of Medicine and Texas Children's Hospital, 1987-1993
 Graduate Program Cell & Molecular Genetics, Baylor College of Medicine, 1988-1994
 Co-chairman: Houston study group in Genetics, Religion, and Ethics.1990-1993
 Recombinant DNA Safety Committee, Baylor College of Medicine, 1990-1993
 Radiation Safety Committee, Baylor College of Medicine.1989-1993
 Biosafety Committee, Texas Children's Hospital.1992-1993
 Graduate Education Committee, Department of Cell Biology, 1986-1990
 Institutional (Bioethics) Review Board (IRB), Children's Hospital, Boston, 1980-1983

US PATENTS¹

Issued

¹ Additional international patents have been issued. Other patent applications related to Variagenics and Mygenome are in prosecution which have not been published.

1. Singer, D.S., Kohn, L.D., Mozes, E., Saji, M., Weisman, J., Napolitano, G., and Ledley, F.D. Methods for Assessing the Ability of a Candidate Drug to Suppress MHC Class Expression. #5,556,754. *Method for treating inflammatory diseases and transplantation.*
2. Singer, D.S., Kohn, L.D., Mozes, E., Saji, M., Weissman, J., Napolitano, G., and Ledley, F.D. Methods of treating autoimmune diseases and transplantation rejection. #5,871,950. *Method for treating inflammatory diseases and transplantation.*
3. Ledley, F.D. and O'Malley, B.O. Jr., Somatic Gene Therapy to Cells Associated With Fluid Spaces. # 5,770,580. *Methods for somatic gene therapy targeted to joints, thyroid, eye, and ear.*
4. Ledley, F.D. and O'Malley, B.O. Jr., Transformation of cells association with fluid spaces. #5,792,751. *Methods for somatic gene therapy targeted to joints, thyroid, eye, and ear.*
5. Ledley, F.D., and Henning, S.J. Gene Therapy Using the Intestines. #5,821,235 *Methods for orally administered gene therapy*
6. Ledley, F.D. and Henning, S.J., Gene Transfer to Intestines. #5,786,340 *Methods for orally administered gene therapy.*
7. Housman, D.E., Ledley, F.D., Stanton, V.P. Inhibitors of Alternative Alleles of Genes Encoding Products that Mediate Cell Response to Environmental Changes. #6,200,754. *Methods for developing novel drugs targeted to normal genetic variations.*
8. Ledley, F.D. and Stankovics, J. Natural or Recombinant DNA Binding Proteins as Carriers for Gene Transfer or Gene Therapy. #6,191,257. *Biofunctional proteins with DNA binding activity and tropism for membrane receptors for gene therapy.*

Published (in prosecution)

9. Housman, D.E., Ledley, F.D., Stanton, V.P. Inhibitors of Alternative Alleles of Genes Encoding Products that Mediate Cell Response to Environmental Changes. Pub. No.: UA2002/0127714 *Continuation of #6,200,754*
10. Ledley, F.D. Methods for providing current assessments of genetic risk. US 2003/0040002. *Information systems that provide updated assessment of genetic risk based on genetic test results and emerging clinical data.*
11. Ledley, F.D. Instruments and methods for obtaining informed consent to genetic tests. US 2003/0204418. *Information systems that provide patient education and obtain informed consent for genetic testing.*
13. Ledley, F.D. Method for increasing utilization of genetic testing. 09/630,631 *Information systems that provide consumers with direct access to genetic tests and services.*

PUBLICATIONS²:

²Publications on which Dr. Ledley is the first or senior author are indicated by double underlines. Since 1993, Dr. Ledley has served in senior executive positions in biotechnology companies. Research performed under his direction was often proprietary or published by members of the scientific team.

1. Ledley, F.D., Wilson, J.B. (1974) Computer analysis of ultrasound cardiograms. *Computers in Biology and Medicine* 4:27-41.
2. Mullin, B.R., Lee, G., Ledley, F.D., Winand, R.J., Kohn, L.D. (1976) Thyrotropin interactions with human fat cell membrane preparations and the finding of a soluble thyrotropin binding component. *Biochemical and Biophysical Research Communications* 69:55-62.
3. Mullin, B.R., Fishman, P.H., Lee, G., Aloj, S.M., Ledley, F.D., Winand, R.J., Kohn, L.D., Brady, R.O. (1976) Thyrotropin-ganglioside interactions and their relationship to the structure and function of thyrotropin receptors. *Proceedings of the National Academy of Science USA* 73:842-846.
4. Ledley, F.D., Mullin, B.R., Lee, G., Aloj, S.M., Fishman, P.H., Hunt, L.T., Dayhoff, M.O., Kohn, L.D. (1976) Sequence similarity between cholera toxin and the glycoprotein hormones: implications for structure activity relationships and the mechanism of action. *Biochemical Biophysical Research Communications* 69:852-859.
5. Meldolesi, M.F., Fishman, P.H., Aloj, S.M., Ledley, F.D., Lee, G., Bradley, R.M., Brady, R.O., Kohn, L.D. (1977) Separation of the glycoprotein and ganglioside components of thyrotropin receptor activity in plasma membranes. *Biochemical and Biophysical Research Communications* 75:581-588.
6. Kohn, L.D., Lee, G., Grollman, E.F., Ledley, F.D., Mullin, B.R., Friedman, R.M., Aloj, S.M., Meldolesi, M.F., Mullin, B.R. (1977) Membrane glycolipid and their relationship to the structure and function of cell surface receptors for glycoprotein hormones, bacterial toxins, and interferon. In: Harmon, R.E. *Cell surface carbohydrate chemistry*. Academic Press, San Francisco.
7. Ledley, F.D., Lee, G., Kohn, L.D., Habig, W.H., Hardegree, M.D. (1977) Tetanus toxin interactions with thyroid plasma membranes: implications for the structure and function of tetanus toxin receptors and potential pathophysiological significance. *Journal of Biological Chemistry* 252:4029-4055.
8. Habig, W.H., Ledley, F.D., Grollman, E.F., Meldolesi, M.F., Aloj, S.M., Hardegree, M.C., Kohn, L.D. (1978) Tetanus toxin interactions with the thyroid: decreased toxin binding to membranes from a thyroid tumor with a thyrotropin receptor defect and *in vivo* stimulation of thyroid function. *Endocrinology* 102:844-851.
9. Hunt, L.T., Ledley, F.D., Dayhoff, M.O. (1979) Hormones and active peptides. In: Dayhoff, M.O. (ed): *Atlas of Protein Sequence and Structure*, Vol. 5, supplement 3. National Biomedical Research Foundation, Washington, D.C.
10. Kohn, L.D., Consiglio, E., DeWolf, M.J.S., Grollman, E.F., Ledley, F.D., Lee, G., Morris, N.P. (1980) Thyrotropin receptors and gangliosides. In: Svennerholm, L., Mardel, P., Dreyfus, H., Urban, P.F. (eds): *Structure and Function of Gangliosides, Advances in Experimental Medicine*, Vol. 125, Plenum Press, New York. pp. 487-504.
11. Ledley, F.D. (1982) Evolution and the human tail, a case report. *The New England Journal of Medicine* 306:1212-1215. [also correspondence: 307:1089-1090.]
12. Ledley, F.D. (1983) Recombinant DNA and the Copernican world view. *Perspectives in Biology and Medicine* 26:245-260.
13. Wang, J.Y.J., Ledley, F.D., Goff, S., Lee, R., Groner, Y., Baltimore, D. (1984) The mouse c-abl locus: Molecular cloning and characterization. *Cell* 36:349-356.
14. Ledley, F.D. (1984) Metabolic disease. In: Graef, J.W., Cone, T.E. (eds): *Manual of*

- Pediatric Therapeutics*, third edition, Little, Brown and Company, Boston. pp. 341-350.
15. Ledley, F.D., Levy, H.L., Shih, V.E., Benjamin, R., Mahoney, M.J. (1984) Benign methylmalonic aciduria. *New England Journal of Medicine* 311:1015-1018.
 16. DiLella, A.G., Ledley, F.D., Rey, F., Munich, A., Woo, S.L.C. (1985) Detection of phenylalanine hydroxylase messenger RNA in PKU liver biopsy samples from patients with phenylketonuria. *Lancet* 19:160-161.
 17. Kwok, S.C.M., Ledley, F.D., DiLella, A.G., Robson, K.J.H., Woo, S.L.C. (1985) Nucleotide sequence of a full-length cDNA clone and amino acid sequence of human phenylalanine hydroxylase. *Biochemistry* 24:556-561.
 18. Ledley, F.D., Grenett, H.E., DiLella, A.G., Kwok, S.C.M., Woo, S.L.C. (1985) Gene transfer and expression of human phenylalanine hydroxylase. *Science* 228:77-79.
 19. Woo, S.L.C., Güttler, F., Ledley, F.D., Lidsky, A.S., Kwok, S.C.M., DiLella, A.G., and Robson, K.J.H. (1985) The human phenylalanine hydroxylase gene. In: Berg, K. (ed) Vol. 177 *Medical Genetics Past, Present, Future*. Alan R. Liss, New York. pp. 123-138.
 20. Ledley, F.D., Woo, S.L.C., Güttler, F. (1985) Cloning and expression of the human phenylalanine hydroxylase gene. In: Bickel, H., Wachtel, U.: *Inherited Diseases of Amino Acid Metabolism*. Georg Thieme Verlag, Stuttgart, New York. pp. 37-50.
 21. DiLella, A.G., Ledley, F.D., Woo, S.L.C. (1985) Prenatal Diagnosis and Carrier Detection of Phenylketonuria by Gene Mapping. In: H. Koprowski, S. Ferrone, and A. Albertini (eds) *Biotechnology in Diagnostics*. Elsevier Science Publishers, Rome, Italy. pp. 295-307.
 22. Ledley, F.D., DiLella, A.G., Kwok, S.C.M. Woo, S.L.C. (1985) Homology between phenylalanine and tyrosine hydroxylases reveals common structural and functional domains. *Biochemistry* 24:3389-3394.
 23. Lidsky, A., Ledley, F.D., DiLella, A.G., Kwok, S.C.M., Daiger, S.P., Robson, K.J.H., Woo, S.L.C. (1985) Extensive restriction site polymorphisms in the human phenylalanine hydroxylase locus and application in prenatal diagnosis of phenylketonuria. *American Journal of Human Genetics* 37:619-634.
 24. Ledley, F.D., DiLella, A.G., Woo, S.L.C. (1985) Molecular biology of phenylalanine hydroxylase and phenylketonuria. *Trends in Genetics* 1:309-313.
 25. Ledley, F.D., Grenett, H.E., McGinnis-Shelnuitt, M., Woo, S.L.C. (1986) Retroviral mediated gene transfer of human phenylalanine hydroxylase into NIH3T3 and hepatoma cells. *Proceedings of the National Academy of Sciences*, 83:409-413.
 26. Ledley, F.D., DiLella, A.G., Woo, S.L.C. (1986) Molecular biology of phenylalanine hydroxylase and phenylketonuria. In: Y. Tsukata (ed) *The Ninth International Symposium on Brain Sciences. Molecular Genetics in Developmental Neurobiology*. Japan Scientific Societies Press (JSSP), Tokyo, Japan. pp. 201-214.
 27. DiLella, A.G., Kwok, S.C.M., Ledley, F.D., Marvit, J., Woo, S.L.C. (1986) Molecular structure and polymorphic map of the human phenylalanine hydroxylase gene. *Biochemistry* 25:743-749.
 28. Ledley, F.D., Levy, H., Woo, S.L.C. (1986) Molecular analysis of the inheritance of phenylketonuria and mild hyperphenylalaninemia in families with both disorders. *New England Journal of Medicine* 314:1276-1280.
 29. Ledley, F.D., Woo, S.L.C. (1986) Molecular basis of alpha₁-antitrypsin deficiency and its potential therapy by gene transfer. *Journal of Inherited and Metabolic Disease*

- 9(suppl 1):85-91.
30. Ledley, F.D. (1987) Somatic gene therapy for human disease: background and prospects (Part I). *Journal of Pediatrics* 110:1-8. *ibid* (Part II). *Journal of Pediatrics* 110:167-174.
 31. Güttler, F., Lidsky, A.S., Ledley, F.D., DiLella, A.G., Sullivan, S.E., Woo, S.L.C. (1987) Correlation between polymorphic DNA haplotypes at phenylalanine hydroxylase locus and clinical phenotypes of phenylketonuria. *Journal of Pediatrics* 110:68-71.
 32. Ledley, F.D., Woo, S.L.C. (1987) P-chlorophenylalanine does not inhibit production of recombinant human phenylalanine hydroxylase in NIH3T3 cells or *E. Coli*. *Biochemical and Biophysical Research Communications* 142:302-308.
 33. Ledley, F.D., Grenett, H.E., Woo, S.L.C. (1987) Biochemical characterization of recombinant human phenylalanine hydroxylase produced in *E. Coli*. *Journal of Biological Chemistry* 262:2228-2233.
 34. Ledley, F.D., Hahn, T., Woo, S.L.C. (1987) Selection for phenylalanine hydroxylase activity in cells transformed with recombinant retrovirus. *Somatic Cell and Molecular Genetics* 13:145-154.
 35. Lockyer, J., Cook, R.G., Milstein, S., Kaufman, S., Woo, S.L.C., Ledley, F.D. (1987) Structure and expression of human dihydropteridine reductase. *Proceedings of the National Academy of Science USA* 84:3329-3333.
 36. Ledley, F.D. (1987) Somatic gene therapy for human disease: a problem of eugenics? *Trends in Genetics* 3:112-115.
 37. Marvitt, J., DiLella, A.G., Brayton, K., Ledley, F.D., Robson, K.J., Woo, S.L.C. (1987) GT to AT transition at a splice donor site causes skipping of the preceding exon in phenylketonuria. *Nucleic Acids Research* 15:5613-5628.
 38. Ledley, F.D., Darlington, G.J., Hahn, T., Woo, S.L.C. (1987) Retroviral gene transfer into primary hepatocytes: implications for genetic therapy of liver specific functions. *Proceedings of the National Academy of Science USA* 84:5335-5339.
 39. Ledley, F.D., Grenett, H.E., Bartos, D.P., van Tuinen, P., Ledbetter, D.H., Woo, S.L.C. (1987) Assignment of human tryptophan hydroxylase locus to chromosome 11: gene duplication and translocation in evolution of the aromatic amino acid hydroxylases. *Somatic Cell and Molecular Genetics* 13:575-580.
 40. Grenett, H.E., Ledley, F.D., Reed, L.L., Woo, S.L.C. (1987) Full length cDNA for rabbit tryptophan hydroxylase: functional domains and evolution of aromatic amino acid hydroxylases. *Proceedings of the National Academy of Science USA* 84:5530-5534.
 41. Güttler, F., DiLella, A.G., Ledley, F.D., Lidsky, A.S., Kwok, S.C., Marvit, J., Woo, S. (1987) Molecular Biology of Phenylketonuria. *European Journal of Pediatrics* 146(sup1):5-11.
 42. MacDonald, M.E., Anderson, M.A., Lockyer, J.L., Milstein, S., Hobbs, W.J., Faryniarz, A.G., Kaufman, S., Ledley, F.D., Woo, S.L.C., Gusella, J.F. (1987) Physical and Genetic Localization of the quinonoid dihydropteridine reductase gene (QDPR) on the short arm of chromosome-4. *Somatic Cell and Molecular Genetics* 13:569-574.
 43. Ledley, F.D., Grenett, H.E., Bartos, D.P., Woo, S.L.C. (1987) Retroviral mediated transfer and expression of human alpha₁-antitrypsin in cultured cells. *Gene* 61:113-118.
 44. Bao, J.J., Sifers, R.N., Kidd, V.J., Ledley, F.D., Woo, S.L.C. (1987) Molecular evolution of serpins: homologous structure of the human alpha₁-antichymotrypsin and

- alpha₁-antitrypsin genes. *Biochemistry* 26:7755-7759.
45. Woo, S.L.C., DiLella, A.G., Marvit, J., Ledley, F.D. (1987) Molecular Basis of Phenylketonuria and recombinant DNA strategies for therapy. *Enzyme* 38:207-213.
 46. Ledley, F.D., Grenett, H.E., Woo, S.L.C. (1987) Structure of aromatic amino acid hydroxylases. In: S. Kaufman (ed) *Amino Acids in Health and Disease: New Perspectives*. UCLA symposia on molecular and cellular biology New Series V. 55. Alan R. Liss, New York. pp.267-284.
 47. Ledley, F.D. Woo, S.L.C. (1987) Prospects for somatic gene therapy of phenylketonuria. In: S. Kaufman (ed) *Amino Acids in Health and Disease, New Perspectives*. UCLA symposia on molecular and cellular biology New Series V. 55. Alan R. Liss, New York. pp. 565-580.
 48. Woo, S.L.C., DiLella, A.G., Marvit, J., Ledley, F.D. (1987) Molecular basis of phenylketonuria and potential somatic gene therapy. *Cold Spring Harbor Symposium in Quantitative Biology* 51:395-401.
 49. McDonald, J.D., Cotton, R.G., Jennings, I., Ledley, F., Woo, S.L.C., Bode, V.C. (1988) Biochemical defect of the hph-1 mouse mutant is a deficiency of GTP-cyclohydrolase activity. *Journal of Neurochemistry* 50:655-657.
 50. Ledley, F.D., Lumetta, M.R., Zoghbi, H.Y., VanTuinen, P., Ledbetter, S.A., Ledbetter, D.H. (1988) Mapping of human methylmalonyl CoA mutase (MUT) locus on chromosome 6. *American Journal of Human Genetics* 42:839-846.
 51. Ledley, F.D. Woo, S.L.C. (1988) Reconsidering the genetics of phenylketonuria. In: Wurtman, R.J. and Ritter-Walker, E. (eds) *Dietary Phenylalanine and Brain Function*. Birkhauser, Boston/Basel. pp. 228-237.
 52. Ledley, F.D., Lumetta, M., Nguyen, P.N., Kolhouse, J.F., Allen, R.A. (1988) Molecular cloning of L-methylmalonyl CoA mutase: gene transfer and analysis of mut cell lines. *Proceedings of National Academy of Science* 85:3518-21.
 53. Ledley, F.D., Ledbetter, S.A., Ledbetter, D.H., Woo, S.L.C. (1988) Localization of mouse phenylalanine hydroxylase locus on chromosome 10. *Cytogenetics and Cell Genetics* 47:125-126.
 54. Ledley, F.D., Koch, R., Beaudet, A., O'Brien, W., Bartos, D., Woo, S.L.C. (1988) Phenylalanine hydroxylase expression in the liver of a fetus with phenylketonuria. *Journal of Pediatrics* 113:463-467. [also letter: Ledley, F.D. (1989) Genetic Counseling and the Outcome of Phenylketonuria. *Journal of Pediatrics* 114:684-685.]
 55. Zoghbi, H., O'Brien, W.E., Ledley, F.D. (1988) Linkage relationships of the human methylmalonyl CoA mutase to the HLA and D6S4 loci on chromosome 6. *Genomics* 3:396-398.
 56. Jansen, R., Kalousek, F., Fenton, W., Rosenberg, L.E., Ledley, F.D. (1989) Cloning of full-length methylmalonyl-CoA mutase from a cDNA library using the polymerase chain reaction. *Genomics* 4:198-205.
 57. Peng, H., Armentano, D., Graham, L., Ledley, F.D., Woo, S.L.C. (1988) Retroviral-mediated gene transfer and expression of human phenylalanine hydroxylase in primary mouse hepatocytes. *Proceedings of the National Academy of Sciences USA* 85:8146-8150.
 58. Cheng, S.V., Martin, G.R., Nadeau, J.H., Haines, J.L., Bucan, M., Kozak, C.A., MacDonald, M.E., Lockyer, J.L., Ledley, F.D., Woo, S.L.C., Lehrach, H., Gilliam, T.C.,

- Gusella, J.F. (1989) Synteny on mouse chromosome 5 of human loci linked to Huntington's Disease. *Genomics* 4:419-426.
59. Jansen, R., Ledley, F.D. (1989) Production of high specific activity DNA probes by the polymerase chain reaction. *Gene Analysis Techniques* 6:79-83.
60. Ledley, F.D. (1989) Human gene therapy In: Jacobson, G.K., Jolly S.O. (eds) *Biotechnology, a comprehensive treatise*, Vol 7b. VCH Verlagsgesellschaft. Weinheim, pp. 399-461.
61. Armentano, D., Peng, H., MacKenzie-Graham, L., Seh, M., Shen, R-F., Ledley, F.D., Darlington, G.J., Woo, S.L.C. (1989) Retroviral-mediated gene transfer of human PAH into mouse primary hepatocytes. In: A.L. Beaudet, R. Mulligan, I.M. Verma (eds) *Gene Transfer and Gene Therapy*. Alan R. Liss, New York. pp. 355-363.
62. Ledley, F.D. (1989) Molecular Genetic Studies in Methylmalonic acidemia. UCLA symposium on gene transfer in animals. In: A.L. Beaudet, R. Mulligan, I.M. Verma (eds) *Gene Transfer and Gene Therapy*. Alan R. Liss, New York. pp. 335-344.
63. Ledley, F.D. (1990) Prospects for somatic gene therapy in the management of inborn errors of metabolism. In: Fernandes, J., Bremer, H.J., Saudubray, J.M. (eds): *Inherited metabolic disease. Diagnosis and treatment*. Springer-Verlag pp. 671-680.
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65. Ledley, F.D., Grenett, H.E., Dunbar, B.S. Woo, S.L.C. (1990) Mouse phenylalanine hydroxylase: homology and divergence from human phenylalanine hydroxylase. *The Biochemical Journal* 267:399-406.
66. Ledley, F.D., Crane, A.M., Lumetta, M. (1990) Heterogenous alleles and expression of methylmalonyl CoA mutase in mut methylmalonic acidemia. *American Journal of Human Genetics* 46:539-547.
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68. Sertic, J., Vincek, V., Ledley, F.D., Figueroa, F., Klein, J. (1990) Mapping of the L-methylmalonyl CoA mutase gene to mouse chromosome 17. *Genomics* 6:560-564.
69. Ledley, F.D., Jansen, R., Nham, S.U., Fenton, W.E., Rosenberg, L.E. (1990) Mutation eliminating mitochondrial leader sequence of methylmalonyl CoA mutase causes mut^o Methylmalonic Acidemia. *Proceedings of the National Academy of Sciences USA* 87:3147-3150.
70. Ledley, F.D. (1990) Clinical application of somatic gene therapy in inborn errors of metabolism. *Journal of Inherited Metabolic Disease* 13:597-616.
71. Ledley, F.D. (1990) Perspectives on methylmalonic acidemia resulting from molecular cloning of methylmalonyl CoA mutase. *Bioessays* 12:335-340.
72. Wilkemeyer, M.F., Crane, A.M., Ledley, F.D. (1990) Primary structure and activity of murine methylmalonyl CoA mutase. *The Biochemical Journal* 271:449-455.
73. Ledley, F.D. (1990) Molecular Cloning and Characterization of Human Methylmalonyl CoA Mutase. In: Linnell, J.C., Bhatt, H.R. (eds) *Cobalamin '88, Proceedings of the First International Symposium on Biomedicine and Physiology of*

- Vitamin B12*. Children's Medical Charity, London, pp 333-342.
74. Leadlay, P., Ledley, F.D. (1990) Primary sequence homology between methylmalonyl CoA mutase from *Propionibacterium shermanii* and *Homo sapiens*. In: Linnell, J.C., Bhatt, H.R. (eds) *Cobalamin '88, Proceedings of the First International Symposium on Biomedicine and Physiology of Vitamin B12*. Children's Medical Charity, London, pp 343-354.
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