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CURRICULUM VITAE

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EDUCATIONAL:

Western Kentucky State (Bowling Green, KY), B.S., Biology/Chemistry, 1965
Vanderbilt University (Nashville, TN), Ph.D., Dept. of Physiology, 1970
Advisor: Dr. Jane Park
Washington University (St. Louis, MO), Postdoctoral Fellow, Dept. of Microbiology, 1970-73; Advisor: Dr. Herman Eisen
National Institutes of Health (Bethesda, MD), Staff Fellow, Laboratory of Biochemistry, 1973-75; Advisor: Dr. Earl Stadtman

RESEARCH AND PROFESSIONAL EXPERIENCE:

1965-1970	Predoctoral Trainee, Department of Physiology, Vanderbilt University Medical School. Advisor: Dr. Jane Park; Research into enzymatic mechanisms and metabolite effects on enzymatic activity.
1970-1973	Research Associate and Postdoctoral Fellow, Washington University School of Medicine. Advisor: Dr. Herman N. Eisen, then Chairman of the Department of Medicine. Structure and sequence of a myeloma protein with a known hapten binding activity.
1973-1975	Staff Fellow, Laboratory of Biochemistry, National Heart and Lung Institute. Advisor: Dr. Earl Stadtman, Chief of the Laboratory of Biochemistry. Enzyme purification and the identification of metabolite effectors on enzymes involved in the cascade control of E. coli glutamine synthetase.
1975-1989	Assistant Professor, Department of Molecular Physiology and Biophysics, Vanderbilt University Medical School. Research into the regulatory and catalytic mechanisms of enzymes involved in cyclic nucleotide mechanism. The primary research interests include the cGMP-binding phosphodiesterase, and the involvement of these enzymes in the regulation of smooth muscle tone.
1979-1984	Director of Core Laboratory for Diabetes Endocrinology Research Training Center at Vanderbilt
1984-1989	Associate of the Howard Hughes Medical Institute at Vanderbilt
1990-1995	Research Associate Professor, Department of Molecular Physiology and Biophysics, Vanderbilt University School of Medicine
1996-pres	Research Professor, Department of Molecular Physiology and Biophysics, Vanderbilt University School of Medicine

HONORS:

1964-1965	Most Outstanding Biology Student, Western Kentucky State
1970-1971	American Cancer Society Postdoctoral Fellow
1971-1972	USPHS Postdoctoral Fellow
1976-1981	USPHS Research Career Development Award
1982-Present	ASBC Member
1995	General Secretary and Co-organizer of the Ninth International Conference on Second Messengers and Phosphoproteins

1998	Visiting Prof.,Natl.Defense School of Medicine, Taipei, Taiwan
1998-2003	Scientific Advisory Board Member for Cell Pathways, Inc.
2000	Organizer of Two Symposia for 11th International Conference on Second Messenger Signaling and Phosphoproteins, Melbourne, Australia. Workshop 1. "cGMP Signalling, Guanylyl Cyclase, Desensitization, Differentiation and Apoptosis." Workshop 2. "Cyclic Nucleotide Signalling: Kinases, PDEs and Inhibitors."
2002	Chair (along with Eva Degerman, Univ. of Lund) for Gordon Research Conference on Cyclic Nucleotide Phosphodiesterases 2002
2003	Chair (along with Gideon Bollag, Plexxikon Corp.) for conference on "Phosphodiesterases in Disease."

UNIVERSITY AND PROFESSIONAL SERVICE:

1. Committee for the Protection of Human Subjects 1993-1996
2. Standing Policy Committee Biomedical Sciences 1993-1996
3. Regular ad hoc reviewer for Journal of Biological Chemistry
4. Ad hoc reviewer for American Journal of Physiology
5. Ad hoc reviewer for NIH
6. Ad hoc reviewer for General Pharmacology
7. Adhoc reviewer for NSF.
8. Adhoc reviewer for Eur. J. Biochem
9. Adhoc reviewer for J. Neurochemistry
10. University Research Council Peer Review Committee 1996
11. American Heart Association-Southeast Affiliate Peer Review Committee 1994-99
12. University Research Council Peer Review Committee 1996
13. 1997 Editor, "Advances in Second Messenger and Phosphoprotein Res." Vol. 31
14. Committee supervising "Earl Sutherland Lecture" series 1996-Present.
15. Committee supervising Molecular Physiology & Biophysics Graduate Student Travel Awards 1996-Present.
16. Expert consultant for Lilly/ICOS International
17. Elected Member of Advisory Council for Vanderbilt School of Medicine 2001-2003
18. Regular interviewer for applicants to IGP and Medical School 2000-2002.
19. Scientific Advisory Board for Cell Pathways, Inc. 1999-2003
20. Chair of Advisory Council for Vanderbilt School of Medicine 2002-2003
21. Medical School Representative to Graduate Student Conduct Committee 2002-2004.
22. Editorial Board for Frontiers in Bioscience.
23. Editorial Board for International Journal of Impotence Research

INVITED SPEAKER

Conference on "Cyclic GMP" in Miami, FL, Nov. 1987
Conference on "Cyclic AMP-Dependent Protein Kinase," May 1989
Department of Pharmacology, Univ. of Illinois, Chicago, 1994
Ninth International Conference on Second Messengers and Phosphoproteins, October, 1995
International Conference on Cyclic Nucleotide Phosphodiesterases: from genes to therapies. Glasgow, Scotland, July 1996
10th International Protein Kinase Seminar, Oslo, Norway, September, 1996
Visiting Professor, National Defense Medical University, Taipei, Taiwan, May, 1998

National Research Institutes, Taipei, Taiwan, May 1998
Gordon Research Conference: Cyclic Nucleotide Phosphodiesterases, June, 1998
Gordon Research Conference: Cyclic Nucleotide Phosphodiesterases, June, 1999
Association of American Medical Colleges: GREAT Group Annual Conference, Bermuda, 1999
Pfizer Cyclic Nucleotide Phosphodiesterase Symposium, 1999, Sandwich, UK
Gordon Research Conference on "Second Messengers," June, 2000
12th International Protein Kinase Symposium, "NO/cGMP Signaling,"Bad Bruckenau, Germany, August, 2000
Gordon Research Conference on "Cyclic Nucleotide Phosphodiesterases," Oxford, England, September, 2000
Dept. of Chemistry, Western Kentucky State University, February, 2001.
11th International Second Messengers & Phosphoproteins Meeting, 2001, Melbourne, Australia.
Cyclic Nucleotide Phosphodiesterases Gordon Research Conference 2002.
13th Protein Kinase Symposium, Oslo, Norway 2002
Department of Pharmacology, University of Vermont, 2002
Cyclic Nucleotide Phosphodiesterases Conference, Strategic Research Institute, 2003
First International Conference on NO/cGMP Signaling, Leipzig, Germany, 2003
8th World Congress on Advances in Oncology and 6th International Symposium on Molecular Medicine, Crete, Greece 2003
Department of Pharmacology, University of Minnesota, 2003
Cyclic Nucleotide Phosphodiesterases Gordon Research Conference, Il Ciocco, Italy 2004
Department of Pharmacology, Univ. of Missouri, 2004
15th Annual Vascular Biology and Hypertension Symposium, Destin, FL

PUBLICATIONS (Chronological Order):

1. Bond, J., Francis, S.H., and Park, J.H. (1970) An essential histidine in the catalytic activities of 3-phosphoglyceraldehyde dehydrogenase. J. Biol. Chem. 245:1041-1053.
2. Francis, S.H., Meriwether, B.P., and Park, J.H. (1971) Interaction between adenine nucleotides and 3-phosphoglyceraldehyde dehydrogenase. I. Inhibition of the hydrolysis of S-acetyl-enzyme intermediate in the esterase reaction. J. Biol. Chem 246:5427-5432.
3. Francis, S.H., Meriwether, B.P., and Park, J.H. (1971) Interaction between adenine nucleotides and 3-phosphoglyceraldehyde dehydrogenase. II. A study of the mechanism of catalysis and metabolic control of the multi-functional enzyme. J. Biol. Chem 246:5433-5441.
4. Francis, S.H., Meriwether, B.P., and Park, J.H. (1973) Effects of photo- oxidation of histidine-38 on the various catalytic activities of 3- phosphoglyceraldehyde dehydrogenase. Biochem. 12:346-354.
5. Francis, S.H., Meriwether, B.P., and Park, J.H. (1973) Effects of photo- oxidation of histidine-38 on the acetyl phosphatase activity of 3- phosphoglyceraldehyde dehydrogenase. Biochem. 12:355-359.
6. Francis, S.H., Leslie, R.G.Q., Hood, L., and Eisen, H.N. (1974) Amino acid sequence of the variable region of the heavy alpha chain of a mouse myeloma proteins with anti-hapten activity. Proc. Natl. Acad. Sci. USA 71:1123-1127.
7. Stadtman, E.R., Chock, P.B., Adler, S.T., Francis, S., and Engleman, E. (1975) Metabolic regulation of coupled covalent modification cascade systems. (Published in Conference on Metabolic Interconversion of Enzymes, Jerusalem, Israel.)
8. Francis, S. and Engleman, E.G. (1978) Cascade control of E. coli glutamine synthetase. I. Studies on the uridylyl-transferase and uridylyl-removing enzyme(s) from E. coli. Arch. Biochem. Biophys. 191, 590-601. (Work completed while a staff fellow with Dr. Earl Stadtman, NHLI.)
9. Engleman, E. and Francis, S. (1978) Cascade control of E. coli glutamine synthetase. II.

Metabolite regulation of the enzymes in the cascade. Arch. Biochem. Biophys. 191, 602-612. (Work completed while a staff fellow with Dr. Earl Stadtman, NHLI.)

10. Francis, S.H., Lincoln, T.M., and Corbin, J.D. (1980) Studies on a novel cGMP binding protein. J. Biol. Chem 255:620-626.
11. Loten, E.G., Francis, S.H., and Corbin, J.D. (1980) Proteolytic solubilization and modification of hormone sensitive cyclic nucleotide phosphodiesterase. J. Biol. Chem 255:7838-7844.
12. Francis, S.H. and Kono, T. (1982) Hormone sensitive cAMP phosphodiesterase in liver and fat cells. Mol. and Cell. Biochem. 42:109-115.
13. Francis, S.H. (1985) Effectors of rat lung cGMP binding protein phosphodiesterase. Current Topics in Cellular Regulation 26:247-262.
14. Corbin, J.D., Beebe, S.J., Cobb, C.E., Francis, S.H., Wells, J.N., Keely, S.L., Gettys, T.W., Blackmore, P.F., Wolfe, L., Landiss, L.R. (1987) Signal transduction through cAMP and cGMP. In Signal Transduction and Protein Phosphorylation (L.M.G. Heilmeyer, ed.) Plenum Pub., 11-15.
15. Wolfe, L., Francis, S.H., Landiss, L.R., and Corbin, J.D. (1987) Interconvertible cGMP-free and cGMP-bound forms of cGMP-dependent protein kinase in mammalian tissues. J. Biol. Chem. 262:16906-16913.
16. Francis, S.H. and Corbin, J.D. (1988) Purification of cGMP-binding protein phosphodiesterase from rat lung. Methods in Enzymol. 159:722-729.
17. Corbin, J.D., Gettys, T.W., Blackmore, P.F., Beebe, S.J., Francis, S.H., Glass, D.B., Redmon, J.B., Sheorain, V.S., and Landiss, L.R. (1988) Purification and assay of cAMP, cGMP, and cyclic nucleotide analogs in cells treated with cyclic nucleotides analogs. Methods Enzymol. 159:74- 82.
18. Corbin, J.D., Cobb, C.E., Beebe, S.J., Granner, D.K., Koch, S.R., Gettys, T.W., Blackmore, P.F., Francis, S.H., and Wells, J.N. (1988) Mechanism and function of cAMP- and cGMP-dependent protein kinases. In Advances in Second Messenger and Protein Phosphorylation Research, Vol. 21 (R. Adelstein, C. Klee, and M. Rodbell, Eds.) New York: Raven Press, pp. 75- 86.
19. Francis, S.H., Noblett, B.D., Todd, B.W., Wells, J.N., and Corbin, J.D. (1988) Relaxation of vascular and tracheal smooth muscle by cyclic nucleotide analogs that preferentially activate purified cGMP-dependent protein kinase. Mol. Pharm. 34:506-517.
20. Wolfe, L., Francis, S.H., and Corbin, J.D. (1989) Properties of a cGMP-dependent monomeric protein kinase from bovine aorta. J. Biol. Chem. 264:4157-4162.
21. Wolfe, L., Corbin, J.D., and Francis, S.H. (1989) Characterization of a novel isozyme of cGMP-dependent protein kinase from bovine aorta. J. Biol. Chem. 264:7734-7741.
22. Inagami, T., Takayanagi, R., Pandey, K.N., Snajdar, R.M., Corbin, J.D.and Francis, S.H. (1989) Mechanism of action of atrial natriuretic factor in the adrenal gland. In: Endocrinology of the Heart (W. Kaufman and G. Wambach, Eds.), Springer-Verlag, Berlin, pp 46-52.
23. Wolfe, L., Woodford, T.A., Francis, S.H., and Corbin, J.D. (1990) Direct involvement of the cyclic nucleotide binding sites in the cyclic-nucleotide-induced charge shift of protein kinases, NATO ASI Series, Activation and Densensitization of Transducing Pathways, (Edited by T.M. Konijn, M.D. Houslay, P.J.M. Van Haastert), Springer-Verlag Berlin Heidelberg, Vol. H, pp.133-149.
24. Corbin, J.D., Thomas, M.K., Wolfe, L., Shabb, J.B., Woodford, T.A. and Francis, S.H. (1990) New insights into cGMP action. Adv. Second Messenger Phosphoprotein Res., The Biology and Medicine of Signal Transduction, (Edited by Y. Nishizuka, et al.), Raven Press, New York, pp. 411-418.
25. Francis, S.H., Woodford, T.A., Wolfe, L., and Corbin, J.D. (1988-89) Types I□ and I□ isozymes of cGMP-dependent protein kinase:alternative mRNA splicing may produce different inhibitory domains. Second Messengers and Phosphoproteins 12:301-310.
26. Thomas, M.K., Francis, S.H., and Corbin, J.D. (1990) Characterization of a purified bovine lung

cGMP-binding cGMP phosphodiesterase. J. Biol. Chem. 265:14964-14970.

27. Thomas, M.K., Francis, S.H., and Corbin, J.D. (1990) Substrate- and kinase-directed regulation of phosphorylation of a cGMP-binding phosphodiesterase by cGMP. J. Biol. Chem. 265:14971-14978.
28. Francis, S.H., Thomas, M.K., and Corbin, J.D. (1990) Lung cGMP-binding cGMP-specific phosphodiesterase. In: Cyclic Nucleotide Phosphodiesterases (ed., Joseph Beavo and Miles Houslay), John Wiley and Sons, Ltd., Chichester, England, 117-135.
29. Francis, S.H., Wolfe, L. and Corbin, J.D. (1990) Purification of type I□ and type Iβ isozymes and proteolyzed type I§ monomeric enzyme of cGMP-dependent protein kinase from bovine aorta. Meth. in Enzymol., 200:332-341.
30. Thomas, M.K., Francis, S.H., Beebe, S.J., Gettys, T.W. and Corbin, J.D. (1991) Partial mapping of cyclic nucleotide sites and studies of regulatory mechanisms of phosphodiesterases using cyclic nucleotide analogs. Adv. Second Messenger Phosphoprotein Res., Vol. 25 (ed., S.J. Strada and H. Hidaka), Raven Press, Ltd., New York, pp. 45-53.
31. Francis, S.H., Thomas, M.K. and Corbin, J.D. (1990) cGMP-binding phosphodiesterase: Novel effects of cGMP binding on the interaction between functional domains in the enzyme. In: Purines in Cellular Signalling. Ed. K. Jacobson, Springer-Verlag, New York (In press).
32. Jiang, H., Colbran, J.L., Francis, S.H., and Corbin, J.D. (1992) Direct evidence for cross-activation of cGMP-dependent protein kinase by cAMP in pig coronary arteries. J. Biol. Chem. 267:1015-1019.
33. Miura, Y., Kaibuchi, K., Itoh, T., Corbin, J.D., Francis, S.H., and Takai, Y. (1992) Phosphorylation of SMG-P21B/RAP1B-P21 By Cyclic GMP-Dependent Protein Kinase. FEBS Letters 297:171-174.
34. Forte, L.R., Thorne, P.K., Eber, S.L., Krause, W.J., Freeman, R.H., Francis, S.H., and Corbin, J.D. (1992) Stimulation of Intestinal Cl^- Transport by Heat-Stable Enterotoxin Activation of cAMP-Dependent Protein Kinase by cGMP. Am. J. Physiology 263:C607-C615.
35. Colbran, J.L., Francis, S.H., Leach, A.B., Thomas, M.K., Jiang, H., McAllister, L.M., and Corbin, J.D. (1992) A phenylalanine in peptide substrates provides for selectivity between cGMP- and cAMP-dependent protein kinases. J. Biol. Chem. 267:9589-9594.
36. Francis, S.H. and Corbin, J.D. (1993) Progress in understanding the mechanism and function of cyclic GMP-dependent protein kinase. In: Cyclic GMP (ed., F. Murad) Academic Press, New York , pp. 115-170.
37. McAllister-Lucas, L., Kadlecek, A., Sonnenburg, W.K., Seger, D., Le Trong, H., Colbran, J.L., Thomas, M.K., Walsh, K.A., Francis, S.H., Corbin, J.D., and Beavo, J.A. (1993) The structure of a bovine lung cGMP-binding, cGMP-specific phosphodiesterase deduced from a cDNA clone. J. Biol. Chem. 268:22863-22873.
38. Francis, S.H. and Corbin, J.D. (1994) Structure and function of cyclic nucleotide kinases. Ann. Rev. Phys, Vol. 56, (ed., J. Hoffmann) Ann. Review Publishers, Palo Alto, pp. 237-272.
39. Smith, J.A., Francis, S.H., and Corbin, J.D. (1993) Autophosphorylation: A salient feature of protein kinases. "Molecular and Cellular Biochemistry, ÒReversible Protein Phosphorylation in Cell Regulation" ed. R.L. Khandelwal and J.H. Wang, Vol. 127/128, Kluwer Academic Publishers, Dordrecht, pp. 51-70.
40. Corbin, J.D., Woodall, C.C., Colbran, J.L., McAllister, L.M. Sekhar, K.R. and Francis, S.H. (1993) Identifying protein kinases in crude extracts that phosphorylate cGMP-binding cGMP-specific phosphodiesterase. Agents and Actions Supplements "New Drugs in Allergy and Asthma" pp. 27-33.
41. Francis, S.H., Colbran, J.L., McAllister-Lucas, L., and Corbin, J.D. (1994) Zinc interactions and conserved motifs of the cGMP-binding cGMP-specific phosphodiesterase suggest that it is a zinc hydrolase. J. Biol. Chem. 269:22477-22480.
42. Gamm, D.M., Francis, S.H., Anglotti, T.P., Corbin, J.D., and Uhler, M.D. (1995) The type II

isoform of cGMP-dependent protein kinase is dimeric and possesses regulatory and catalytic properties distinct form the type I isoforms. J. Biol. Chem. 270:27380-27388.

43. McAllister-Lucas, L.M., Haik, T.L., Colbran, J.L., Sonnenburg, W.K., Seger, D., Turko, I.V., Beavo, J.A., Francis, S.H., and Corbin, J.D. (1995) An essential aspartic acid at each of two allosteric cGMP-binding sites of a cGMP-specific phosphodiesterase. J. Biol. Chem. 270:30671-30679.
44. Yan, X.X., Francis, S.H., Corbin, J.D., and Lawrence, D.S. (1996) Precision substrate targeting of protein kinases: the cGMP- and cAMP-dependent protein kinases. J. Biol. Chem. 271:174-179.
45. Yan, X.X., Corbin, J.D., Francis, S.H., and Lawrence, D.S. (1996) Precision targeting of protein kinases: An affinity label that inactivates the cGMP- but not the cAMP-dependent protein kinase, J. Biol. Chem. 271:1845-1848.
46. Sekhar, K.R., Grondin, P., Francis, S.H., and Corbin , J.D. (1996) Design and synthesis of xanthines and cyclic GMP analogues as potent inhibitors of PDE5. in Handbook of Imunopharmacology, (Christian Schudt, ed.) Academic Press, pp. 135-146.
47. Reed, R.B., Sandberg, M., Jahsen, T., Lohmann, S.M., Francis, S.H., and Corbin, J.D. (1996) Fast and slow cyclic nucleotide-dissociation sites in cAMP-dependent protein kinase are transposed in type I□ cGMP-dependent protein kinase. J. Biol. Chem. 271:17570-17575.
49. Francis, S.H. and Corbin, J.D. Cyclic AMP and cyclic GMP in cell signaling. (1996) in Modular Texts in Molecular and Cell Biology: Signal Transduction, Vol. 1, (eds., M. Purton and C. Heldin) Chapman and Hall, pp. 219-236.
50. Francis, S.H., Colbran, J.L., Walsh, K.A., Kumar, S., Smith, J.A., and Corbin, J.D. (1996) Arginine-75 in the pseudosubstrate sequence of type Iβ cGMP-dependent protein kinase is critical for autoinhibition, although autophosphorylated at serine-63 is outside this sequence. J. Biol. Chem. 271:20748-20755.
51. Smith, J.A., Francis, S.H., Walsh, K.A., Kumar, S., and Corbin, J.D. (1996) Autophosphorylation of type Iβ cGMP-dependent protein kinase increases basal catalytic activity and enhances allosteric activation by cGMP or cAMP. J. Biol. Chem. 271:20756-20762.
52. Yan, X., LAwrence, D.S., Corbin, J.D., and Francis, S.H. (1996) Distinguishing between closely related protein kinases: A variation on the bisubstrate inhibitor theme. J. of Am. Chem. Soc. 118:6321-6322.
53. Turko, I.V., Haik, T.L., McAllister-Lucas, L.M., Burns, F., Francis, S.H., and Corbin, J.D. (1996) Identification of key amino acids in a conserved cGMP-binding site of cGMP-binding phosphodiesterases. J. Biol. Chem. 271:22240-22244.
54. Smith, C.P., Corbin, J.D., and Francis, S.H. (1997) Autoinhibition of cAMP- and cGMP-dependent protein kinases involves multiple structural components as determined by synthetic peptide analysis. Adv. in Second Mess. and Phosphoproteins: Signal Transduction in DiseaseÓ (ed. J. Corbin and S. Francis) Lippincott-Raven Publishers, Philadelphia, Vol. 31, pp 219-235.
55. Reed, R.B., Sandberg, M., Jahnsen, T., Lohmann, S.M., Francis, S.H., and Corbin, J.D. (1997) Structural order of the slow and fast intrasubunit cGMP-binding sites of type I □ cGMP-dependent protein kinase. Signal Transduction in Health and Disease: Adv. in Second Mess. and Phosphoproteins, (eds., J. Corbin and S. Francis) Lippincott-Raven Publishers, Philadelphia, pp 205-217.
56. Yan, X., Lawrence, D.S., Corbin, J.D., and Francis, S.H. (1996) Distinguishing between closely related protein kinases: a variation on the bisubstrate inhibitor theme. J. of Am. Chem. Soc. 118:11684-11685.
57. Zhao, J., Trewhella, J., Corbin, J., Francis, S., Mitchell, R., Brushia, R., and Walsh, D. (1997) Progressive cyclic nucleotide-induced conformational changes in the cGMP-dependent protein

kinase studied by small-angle x-ray scattering in solution. J. Biol. Chem. 272:31929-31936.

58. Chu, D.-M., Corbin, J.D., Grimes, K.A., and Francis, S.J. (1997) Activation by cyclic GMP binding causes an apparent conformational change in cGMP-dependent protein kinase. J. Biol. Chem. 272:31922-31928.

59. Wyatt, T.A., Naftilan, A.J., Francis, S.H., and Corbin, J.D. (1997) ANF elicits phosphorylation of the cGMP phosphodiesterase (PDE5) in vascular smooth muscle cells. Am. J. Physiol. 273:H448-H455.

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61. Francis, S.H., Chu, D.-M., Thomas, M.K., Beasley, A., Grimes, K., Busch, J.L., Turko, I.V., Haik, T.L., and Corbin, J.D. (1998) Ligand-induced conformational changes in cyclic nucleotide phosphodiesterases and cyclic nucleotide-dependent protein kinases. Methods: A Companion to Methods in Enzymology. "Methods in Phosphodiesterase Research" (M. Conti, ed.) Academic Press, New York, Vol 14, p. 81-92.

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63. Francis, S.H., Wolfe, L., and Corbin, J.D. (1998) Purification of type I□ and type Iβ isozymes and proteolyzed type Iβ monomeric enzyme of cGMP-dependent protein kinase from bovine aorta. Selected Methods in Enzymology Series (eds. B.M. Sefton and T. Hunter) Academic Press, San Diego.

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66. Chu, D.-M., Francis, S.H., Thomas, J., Maksymovitch, E., and Corbin, J.D. (1998) Activation by autophosphorylation or cGMP binding produces a similar apparent conformational change in cGMP-dependent protein kinase. J. Biol. Chem. 273:14649-14656.

67. Loughney, K., Hill, T.R., Florio, V.A., Uher, L., Rosman, G.J., Wolda, S.L., Jones, B.A., Howard, M.L., McAllister-Lucas, L.M., Sonnenberg, W.K., Francis, S.H., Corbin, J.D., Beavo, J.A., and Ferguson, K. (1998) Isolation and characterization of cDNAs encoding PDE5A, a human cGMP-binding, cGMP-specific 3',5'-cyclic nucleotide phosphodiesterase. Gene 216:139-147

68. Granovsky, A.E., Natochin, M., McEntaffer, R.L., Haik, T.L., Francis, S.H., Corbin, J.D. and Artemyev, N.O. (1998) Probing domain functions of chimeric PDE6□β/PDE5 cGMP-phosphodiesterase. J. Biol. Chem. 273, 24485-24490.

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70. Francis, S.H. and Corbin, J.D. (1999) Cyclic nucleotide-dependent protein kinases: intracellular receptors for cAMP and cGMP action. Crit. Rev. Clin. Lab. Sci. 36, 275-328.

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73. Fink, T.H., Francis, S.H., Beasley, A., grimes, K.A., and Corbin, J.D. (1999) Expression of a fully active, monomeric catalytic domain of the cGMP-binding cGMP-specific phosphodiesterase (PDE5). J. Biol. Chem. 274, 34613-34620.
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75. Turko, I.V., Francis, S.H., and Corbin, J.D. (1999) Inhibition of cGMP binding cAMP-specific phosphodiesterase (PDE5) by sildenafil and related compounds. Mol. Pharm. 56, 124-130.
76. Turko, I.V., Francis, S.H., and Corbin, J.D. (1999) Studies of the molecular mechanism that provides for discrimination between cGMP and cAMP in the allosteric cyclic nucleotide-binding sites of the cGMP-binding cGMP-specific phosphodiesterase. J. Biol. Chem. 274, 29038-29041.
77. Smith, J.A., Reed, R.B., Grimes, K.A., Francis, S.H., and Corbin, J.D. (2000) Distinguishing the roles of the two different cGMP-binding sites for modulating phosphorylation of exogenous substrate terophosphorylation) and autophosphorylation of cGMP-dependent protein kinase. J. Biol. Chem. 275, 154-158.
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