CURRICULUM VITAE - MARK CUSHMAN

Professional Title: Distinguished Professor of Medicinal Chemistry

Date of Birth: August 20, 1945

Place of Birth: Fresno, California

Citizenship: United States

Education:

Undergraduate: Fresno State College
Fresno, California
1963-1965

Professional: Doctor of Pharmacy
University of California
San Francisco, California
1965-1969

Graduate: Ph.D., Pharmaceutical Chemistry
University of California
San Francisco, California
1969-1973

Postdoctoral: Organic Chemistry
Massachusetts Institute of Technology
Cambridge, Massachusetts
1973-1975

Academic Appointments: Assistant Professor of Medicinal Chemistry
Purdue University, 1975-1980

Associate Professor of Medicinal Chemistry
Purdue University, 1980-1985

Professor of Medicinal Chemistry
Purdue University, 1985-2010

Distinguished Professor of Medicinal Chemistry
Purdue University, 2010-present

Adjunct Professor of Pharmacology and Toxicology
Indiana University School of Medicine, Lafayette, 2014-present

Sabbatical: Senior Fulbright Scholar
Lehrstuhl für Organische Chemie und Biochemie
der Technische Universität München
Garching, West Germany, 1983-1984

Present Position: Distinguished Professor of Medicinal Chemistry
Purdue University, 2012-present

Awards and Honors:

Bank of America Achievement Award in Music, 1963

University of California Regents Scholarship, 1965-1969

American Foundation for Pharmaceutical Education Fellowship, 1969-1973

National Defense Education Act Title IV Fellowship, 1969-1973

National Institutes of Health Postdoctoral Fellowship, 1973-1975

Senior Fulbright Scholar Award, 1983-1984

Purdue Cancer Research Award, 2004

Appointed Distinguished Professor, Purdue University, 2010

Webster-Sibilsky Lecturer, University of Illinois, Chicago, 2012

Chaney Scholar Award for Exceptional Research, Purdue, 2012

Awarded the distinction of Fellow of the American Association for the Advancement of Science, 2012

Appointed Associate Editor, Journal of Medicinal Chemistry, 2012

Appointed to Board of Directors, Linus Pharmaceuticals, 2014

University of California San Francisco 150th Anniversary Alumni Excellence Award, 2015. This award was given to the 150 most distinguished graduates of UCSF in its 150-year history, and it included representatives from the nursing, pharmacy, dentistry, medical, and graduate schools.

2016 Purdue Innovators Hall of Fame Inductee

Selected as a Highly Prolific Author (most published articles in the past five years) by the Journal of Medicinal Chemistry, 2017 (journalstars.acs.org/biological/journal/journal-of-medicinal-chemistry)

The Ole Gisvold Lectureship Award in Medicinal Chemistry, Department of Medicinal Chemistry, University of Minnesota, 2018.

The Philip S. Portoghese Journal of Medicinal Chemistry - Division of Medicinal Chemistry Joint Lectureship, 2018.

Selected as a Fellow of the National Academy of Inventors, 2018.

Purdue University Chapter of Sigma Xi Research Award in Science and Engineering, 2019.

Memberships:

American Chemical Society
American Association for Cancer Research
American Association for the Advancement of Science
Rho Chi Pharmacy Honorary Society
Fulbright Alumni Association

Publications:

1. M. Cushman and N. Castagnoli, Jr., "The Condensation of Schiff Bases with Succinic Anhydrides. Scope and Mechanism," *J. Org. Chem.*, **36**, 3404 (1971).
2. M. Cushman and N. Castagnoli, Jr., "The Synthesis of *trans*-3'-Methylnicotine," *J. Org. Chem.*, **37**, 1268 (1972).
3. M. Cushman and N. Castagnoli, Jr., "A Novel Approach to the Synthesis of Nitrogen Analogs of the Tetrahydrocannabinols," *J. Org. Chem.*, **38**, 440 (1973).
4. M. Cushman and N. Castagnoli, Jr., "Synthesis of Pharmacologically Active Nitrogen Analogs of the Tetrahydrocannabinols," *J. Org. Chem.*, **39**, 1546 (1974).
5. G. Büchi, M. Cushman, and H. Wüest, "The Conversion of Allylic Alcohols to Homologous Amides by *N*,*N*-Dimethylformamide Acetals," *J. Amer. Chem. Soc.*, **96**, 5563 (1974).
6. R.J. Anderegg, K. Biemann, G. Büchi, and M. Cushman, "Malformin C, a New Metabolite of *Aspergillus niger*," *J. Amer. Chem. Soc.*, **98**, 3365 (1976).
7. M. Cushman, J. Gentry, and F.W. Dekow, "The Condensation of Imines with Homophthalic Anhydrides. A Convergent Synthesis of *cis*- and *trans*-13-Methyltetrahydroprotoberberines," *J. Org. Chem.*, **42**, 1111 (1977).
8. B. Kolbe, M. Cushman, G.N. Wogan, and A. Demain, "Production and Antibacterial Activity of Malformin C, a Toxic Metabolite of *Aspergillus niger*", *Appl. Environ. Microbiol.*, **33**, 996 (1977).
9. M. Cushman and L. Cheng, "Total Synthesis of Nitidine Chloride," *J. Org. Chem.*, **43**, 286 (1978).
10. M. Cushman and L. Cheng, "A Stereoselective Oxidation by Thionyl Chloride Leading to the Indeno[1,2-*c*]isoquinoline System," *J. Org. Chem.*, **43**, 3781 (1978).
11. M. Cushman and F.W. Dekow, "A Total Synthesis of Corydaline," *Tetrahedron*, **34**, 1435 (1978).
12. M. Cushman and F.W. Dekow, "Synthesis of (±)-Thalictricavine, Berlambine, and (±)-Canadine from a Common Intermediate," *J. Org. Chem.*, **44**, 407 (1979).
13. M. Cushman, F.W. Dekow, and L.B. Jacobsen, "Conformations, DNA Binding Parameters, and Antileukemic Activity of Certain Cytotoxic Protoberberine Alkaloids," *J. Med. Chem.*, **22**, 331 (1979).
14. M. Cushman, T.-C. Choong, J.T. Valko, and M.P. Koleck, "A Total Synthesis of Chelidonine," *Tetrahedron Lett.*, **21**, 3845 (1980).
15. M. Cushman and T.-C. Choong, "The Conformation of Chelidonine," *Heterocycles*, **14**, 1935 (1980).
16. M. Cushman and D.K. Dikshit, "Formation of the 5-Benzo[*d*]naphtho[2,3-*b*]pyran System during an Attempted Benzophenanthridine Synthesis," *J. Org. Chem.*, **45**, 5064 (1980).
17. M. Cushman, T.-C. Choong, J.T. Valko, and M.P. Koleck, "A Total Synthesis of Chelidonine," *J. Org. Chem.*, **45**, 5067 (1980).
18. K. Iwasa, Y.P. Gupta, and M. Cushman, "The Absolute Configurations of (+)-Thalictrifoline and (+)-Corydalic Acid Methyl Ester. Total Synthesis of (+)-Thalictrifoline," *Tetrahedron Lett.*, **22**, 2333 (1981).

19. K. Iwasa and M. Cushman, "The Absolute Configuration of (+)-Thalictricavine," *Heterocycles*, **16**, 901 (1981).
20. K. Iwasa, Y.P. Gupta, and M. Cushman, "The Absolute Configurations of the *cis*- and *trans*-13-Methyltetrahydroprotoberberines. Total Synthesis of (+)-Thalictricavine, (+)-Canadine, (±)-, (-)-, and (+)-Thalictifoline, and (±)-, (-)-, and (+)-Cavidine," *J. Org. Chem.*, **46**, 4744 (1981).
21. M. Cushman and J. Mathew, "A Novel Synthesis of the Tetracyclic Ring System Present in Streptonigrin," *J. Org. Chem.*, **46**, 4921 (1981).
22. K. Iwasa and M. Cushman, "Characterization of an Unusual Tetrahydroprotoberberine Conformer by ^{13}C NMR Spectroscopy," *J. Org. Chem.*, **47**, 545 (1982).
23. M. Cushman and J. Mathew, "Nitration of the Lithium Potassium Dianions of Phenolic Alkyl Aryl Ketones with *n*-Propylnitrate. Synthesis of Phenolic α-Nitroalkyl Aryl Ketones," *Synthesis*, 397 (1982).
24. M. Cushman and Y.P. Gupta, "Total Synthesis of (±)-Corynoline and (±)-6-Oxocorynoline," *Heterocycles*, **19**, 1431 (1982).
25. M. Cushman, A. Abbaspour, and Y.P. Gupta, "The Structure of (+)-Isocorynoline," *Heterocycles*, **19**, 1587 (1982).
26. J. Ulrichová, D. Walterová, V. Prininger, J. Slavik, J. Lenfeld, M. Cushman, and V. Simánek, "Inhibition of Acetylcholinesterase Activity by Some Isoquinoline Alkaloids," *Planta Medica*, **48**, 111 (1983).
27. P. Nielsen, A. Bacher, D. Darling, and M. Cushman, "Synthesis and Biological Evaluation of 7α,7α,7α,8α,8α,8α-Hexafluororiboflavin and 7α,7α,7α,8α,8α,8α-Hexafluoro-FMN," *Z. Naturforsch.*, **38c**, 701 (1983).
28. M. Cushman, A. Abbaspour, and Y.P. Gupta, "Total Synthesis of (±)-14-Epicorynoline, (±)-Corynoline, and (±)-6-Oxocorynoline," *J. Amer. Chem. Soc.* **105**, 2873 (1983).
29. D.P. Kessler, M. Cushman, I. Ghebre-Sellassie, A.M. Knevel, and S.L. Hem., "Investigation of a Proposed Penicillin G Acidic Degradation Scheme using High-Pressure Liquid Chromatography and Optimization Techniques and Mechanistic Considerations," *J. Chem. Soc. Perkin Trans. II*, 1699 (1983).
30. M. Cushman and W.C. Wong, "Total Synthesis of Corydalic Acid Methyl Ester," *J. Org. Chem.*, **49**, 1278 (1984).
31. M. Cushman, P. Mohan, and E.C.R. Smith, "Synthesis and Biological Activity of Structural Analogues of the Anticancer Benzophenanthridine Alkaloid Nitidine Chloride," *J. Med. Chem.*, **27**, 544 (1984).
32. M. Cushman and A. Abbaspour, "Utilization of Magnesium Chelates in the Synthesis of 3-Nitro and 3-(Methoxycarbonyl)-Substituted 2'-Arylchromones," *J. Org. Chem.*, **49**, 1280 (1984).
33. M. Cushman, A. Abbaspour, K. Iwasa, and N. Takao, "Reinvestigation of the Conformations of a Variety of Hexahydrobenzo[*c*]phenanthridine Alkaloids by 470 MHz PMR and 50 MHz CMR Spectroscopy," *J. Nat. Prod.*, **47**, 630 (1984).
34. M. Cushman and P. Mohan, "Synthesis and Antitumor Activity of Structural Analogues of the Anticancer Benzophenanthridine Alkaloid Fagaronine Chloride," *J. Med. Chem.*, **28**, 1031 (1985).
35. M. Cushman and P. Mohan, "The Synthesis of a 4-Phenylisoquinoline from a 3-Phenylisoquinoline by Utilization of the Nitrogen Analog of the Pinacol Rearrangement," *Tetrahedron Lett.* **26**, 4563 (1985).
36. M. Cushman and W.C. Wong, "Synthesis of a Hypothetical Intermediate in the Biosynthesis of the 13-Methylbenzophenanthridine Alkaloids Corynoline and 14-Epicorynoline and the B-Secoprotoberberine Alkaloid Corydalic Acid Methyl Ester", *Tetrahedron Lett.*, **27**, 2103 (1986).
37. J. Ulrichová, J. Lenfeld, M. Cushman, P. Mohan, and V. Simánek, "Comparison of Biological Activity of some Benzo[*c*]phenanthridine Alkaloids and their Structural Analogs", *Acta Univ. Palacki Olomuc. (Olomouc), Fac. Med.*, **113**, 401 (1986).
38. M. Cushman, W.C. Wong, and A. Bacher, "Synthesis of Bis(trifluoromethyl) Pyrazine-Containing Nitrogen Heterocycles from Hexafluorobiacetyl and *ortho*-Diamines.

Stabilization of the Covalent Dihydrates of Pteridines and Pyrido[3,4-*b*]pyrazines by Trifluoromethyl Groups", *J. Chem. Soc. Perkin Trans. 1*, 1043 (1986).

39. M. Cushman, W.C. Wong, and A. Bacher, "Synthesis of 6,7-Bis(trifluoromethyl)-8-substituted Pteridine (Lumazine) Hydrates from 4,5-Diaminouracil Hydrochlorides and Perfluorobutane-2,3-dione. Stabilization of the Transmolecular Hydrates of 8-Substituted Pteridinediones by Trifluoromethyl Groups", *J. Chem. Soc. Perkin Trans.1*, 105l (1986).
40. N. Kubová, E. Šmékal, V. Kleinwächter, and M. Cushman, "Binding Properties of Nitidine and Its Indenoisoquinoline Analogue with DNA", *Studia Biophys.*, **114**, 25l (1986).
41. E. Smëkal, N. Kubová, V. Kleinwächter, and M. Cushman, "DNA-Binding Studies-Selected Benzophenanthridine Alkaloids as Binding Probes", *Studia Biophys.*, **114**, 257 (1986).
42. M. Cushman and E.J. Madaj, "A Study and Mechanistic Interpretation of the Electronic and Steric Effects that Determine the Stereochemical Outcome of the Reaction of Schiff Bases with Homophthalic Anhydride and 3-Phenylsuccinic Anhydride," *J. Org. Chem*., **52**, 907 (1987).
43. M. Cushman and J.-k. Chen, "Utilization of the l-Ferrocenyl-2-methylpropyl Substituent and a Chiral Auxiliary in the Asymmetric Synthesis of the Benzophenanthridine Alkaloids (+)- and (-)-Corynoline," *J. Org. Chem*., **52**, 1517 (1987).
44. M. Cushman, H. Patel, and A. McKenzie, "Synthesis of Trifluoromethylated Pyrazine-Containing Nitrogen Heterocycles From Trifluoropyruvaldehyde and Ortho-Diamines: Scope and Regiochemistry," *J. Org. Chem.*, **53**, 5088 (1988).
45. K. Iwasa, M. Kamigauchi, N. Takao, M. Cushman, W.C. Wong, and J.-K. Chen, "Formation of Benzo[*c*]phenanthridines by Oxidative C-N Bond Fission Followed by Intramolecular Recyclization in Cell Cultures of *Corydalis incisa*," *Tetrahedron Lett.*, **29**, 6457 (1988).
46. K. Iwasa, M. Kamigauchi, N. Takao, M. Cushman, J.-K. Chen, W.C. Wong, and A. McKenzie, "Synthesis and Evaluation of Hypothetical Intermediates in the Biosynthetic Conversion of Protoberberine to Benzo[*c*]phenanthridine Alkaloids. Evidence for Oxidative C-N Bond Cleavage Followed by Intramolecular Recyclization in Cell Cultures of *Corydalis incisa*," *J. Amer. Chem. Soc.*, **111**, 7925 (1989).
47. M. Cushman, D.A. Patrick, P.H. Toma, and S.R. Byrn, "A Novel Ring System Arising From Intramolecular Oxidative Cyclization of 8-(4-Pentyl)dihydroberberine," *Tetrahedron Lett.*, **30**, 7161 (1989).
48. M. Cushman and S. Kanamathareddy, "Synthesis of the Covalent Hydrate of the Incorrectly Assumed Structure of Aurintricarboxylic Acid," *Tetrahedron*, **46**, 1491 (1990).
49. M. Cushman, J. Jurayj, and J. D. Moyer, "Synthesis, Biological Testing and Stereochemical Assignment of an End Group Modified Retro-Inverso Bombesin C-Terminal Nonapeptide," *J. Org. Chem.*, **55**, 3186 (1990).
50. M. Cushman and J. Jurayj, "A Synthesis of 2-Alkyl and 2-Benzyl Substituted Acrylonitriles from 2-Alkyl and 2-Benzylidene Cyanoacetate Esters under Mild Conditions," *Synth. Commun*., **20**, 1463 (1990).
51. M. Cushman, P. Chinnasamy, D. A. Patrick, A. T. McKenzie, and P. H. Toma, "A Novel Ring Expansion Observed during the Lithium Aluminum Hydride Reduction of 13-Nitrooxyberberine," *J. Org. Chem* ., **55**, 5995 (1990).
52. M. Cushman, H. H. Patel, D. A. Patrick, A. Bacher, and K. Schott, "Synthesis of Fluorinated 8-Ribityllumazines as ^{19}F NMR Probes and Potential Inhibitors of the Light Riboflavin Synthase of *Bacillus subtilis*" in "Chemistry and Biology of Pteridines 1989, Pteridines and Folic Acid Derivatives, Proceedings of the Ninth International Symposuim on Pteridines and Folic Acid Derivatives, Chemical, Biological and Clinical Aspects, Zurich, Switzerland, September 3-8, 1989", H.-Ch. Curtius, S. Ghisla, and N. Blau, Eds., Walter de Gruyter: Berlin, 1990, p 249.
53. M. Cushman, P. Chinnasamy, A. K. Chakraborti, J. Jurayj, R; L. Geahlen, and R. D. Haugwitz, "Synthesis of [β-(4-pyridyl-1-oxide-L-alanine^4]-angiotensin as a potential

suicide substrate for protein-tyrosine kinases," *Int. J. Peptide Protein Res.* **36**, 538 (1990).

54. M. Cushman and D. Nagarathnam, "A Method of the Facile Synthesis of Ring-A Hydroxylated Flavones," *Tetrahedron Lett.* **31**, 6497 (1990).
55. M. Cushman, P. Wang, S. H. Chang, C. Wild, E. De Clercq, D. Schols, M. E. Goldman, and J. A. Bowen, "Preparation and Anti-HIV Activities of ATA Fractions and Analogs: Direct Correlation of Antiviral Potency with Molecular Weight," *J. Med. Chem.* **34**, 329 (1991).
56. M. Cushman, S. Kanamathareddy, E. De Clercq, D. Schols, M. E. Goldman, and J. A. Bowen, "Synthesis and Anti-HIV Activities of Low Molecular Weight Aurintricarboxylic Acid (ATA) Fragments and Related Compounds." *J. Med. Chem.* **34**, 337 (1991).
57. M. Cushman, D. Nagarathnam, D. L. Burg, and R. L. Geahlen,"Synthesis and Protein-tyrosine Kinase Inhibitory Activities of Flavonoid Analogs," *J. Med. Chem.* **34**, 798 (1991).
58. M. Cushman and S. Kanamathareddy, "Synthesis and Evaluation of a Triphenylcarbinol Related to the Incorrectly Assumed Structure of Aurintricarboxylic Acid," *Ann. N. Y. Acad. Sci.* ***616***, 499 (1991).
59. M. Cushman, Y.-i. Oh, T. D. Copeland, S. W. Snyder, and S. Oroszlan, "An Approach to the Synthesis of HIV Protease Inhibitors: Stereochemically Pure Peptide Substrate Analogs Containing [Phe-ψCH_2N-Pro] Linkages," *Ann. N. Y. Acad. Sci.* **616**, 503 (1991).
60. C. Pidgeon, H. L. Weith, E. Darbashire-Weith, M. Cushman, J.-k. Chen, J. G. Stowell, K. Ray, and D. Carlson, "Synthesis and Liposome Encapsulation of Antisense Oligonucleotide-Intercalator Conjugates," Ann. N. Y. Acad. Sci. **616**, 593 (1991).
61. G. Wang and M. Cushman, "A Convenient Method for the Conversion of α-Tetralones to Aryl Acetates," *Synth. Commun.* **29**, 989 (1991).
62. M. Cushman, Y-i. Oh, T. D. Copeland, S. W. Snyder, and Stephen Oroszlan, "Development of Methodology for the Synthesis of Stereochemically Pure Phe$\Psi[CH_2N]$Pro Linkages in HIV Protease Inhibitors," *J. Org. Chem.* **56**, 4161 (1991).
63. M. Cushman, D. A. Patrick, A. Bacher, and J. Scheuring, "Synthesis of Epimeric 6,7-Bis(trifluoromethyl)-8-Ribityllumazine Hydrates. Stereoselective Interaction with the Light Riboflavin Synthase of *Bacillus subtilis*," *J. Org. Chem.* **56**, 4603 (1991).
64. M. Cushman, D. Nagarathnam, D. Gopal, A. K. Chakraborti, C. M. Lin, and E. Hamel, "Synthesis and Evaluation of Stilbene and Dihydrostilbene Derivatives as Potential Anticancer Agents that Inhibit Tubulin Polymerization," *J. Med. Chem.* **34**, 2579-2588 (1991).
65. D. Nagarathnam and M. Cushman, "A Practical Synthesis of Flavones from Methyl Salicylate," *Tetrahedron* **47**, 5071-2306 (1991).
66. D. Nagarathnam and M. Cushman, "A Short and Facile Synthetic Route to Hydroxylated Flavones. New Syntheses of Apigenin, Tricin, and Luteolin," *J. Org. Chem.* **56**, 4884 (1991).
67. M. Cushman, D. Nagarathnam, D. Gopal, and R. L. Geahlen, "Synthesis and Evaluation of New Protein-Tyrosine Kinase Inhibitors. Part 1. Pyridine-Containing Stilbenes and Amides," *Bioorg. Med. Chem. Lett.* **1**, 211 (1991).
68. M. Cushman, D. Nagarathnam, D. Gopal, and R. L. Geahlen, "Synthesis and Evaluation of New Protein-Tyrosine Kinase Inhibitors. Part 2. Phenylhydrazones," *Bioorg. Med. Chem. Lett.* **1**, 215 (1991).
69. M. Cushman and D. Nagarathnam, "Cytotoxicities of Some Flavonoid Analogues," *J. Nat. Prod.* **54**, 1656 (1991)
70. M. Cushman, D. Nagarathnam, and R. L. Geahlen, "Synthesis and Evaluation of Hydroxylated Flavones and Related Compounds as Potential Inhibitors of the Protein-tyrosine Kinase $p56^{lck}$," *J. Nat. Prod.* **54**, 1345 (1991).
71. S. R. Byrn, D. V. Carlson, J. K. Chen, M. S. Cushman, M. E. Goldman, W. P. Ma, C. L. Pidgeon; K. A. Ray, J. G. Stowell, and H. L. Weith, "Drug-oligonucleotide Conjugates", *Adv. Drug Delivery Rev.* **6**, 287 (1991).

72. M. Cushman and E.-S. Lee, "Preparation of an Angiotensin I Analog Containing a *p*-Phosphonomethyl-L-phenylalanine Residue Via Asymmetric Synthesis of *t*-BOC-*p*-Dimethylphosphonomethyl-L-Phenylalanine," *Tetrahedron Lett.* **33**, 1193 (1992).
73. P. Wang, J. Kozlowski, and M. Cushman, "Isolation and Structure Elucidation of Low Molecular Weight Components of Aurintricarboxylic Acid (ATA)," *J. Org. Chem.* **57**, 3861 (1992).
74. M. Cushman and P. Sherman, "Inhibition of HIV-1 Integration Protein by Aurintricarboxylic Acid (ATA) Monomers, Monomer Analogs, and Polymer Fractions," *Biochem. Biophys. Res. Commun.* **185**, 85 (1992).
75. M. Cushman, D. Nagarathnam, D. Gopal, H.-M. He, C. M. Lin, and E. Hamel, "Synthesis and Evaluation of Analogues of (Z)-1-(4-Methoxyphenyl)-2-(3,4,5-trimethoxyphenyl)ethene as Potential Cytotoxic and Antimitotic Agents," *J. Med. Chem.* **35**, 2293-2306 (1992).
76. J.-k. Chen, D. V. Carlson, H. L. Weith, J. A. O'Brien, M. E. Goldman, and M. Cushman, "Synthesis of an Oligonucleotide-Intercalator Conjugate in Which the Linker Chain is Attached Via the Phenolic Hydroxyl Group of Fagaronine," *Tetrahedron Lett.* **33**, 2275 (1992).
77. J. Neyts, R. Snoeck, P. Wutzler, M. Cushman, R Klöcking, B. Helbig, P. Wang, and E. De Clercq, "Poly(hydroxy)carboxylates as Selective Inhibitors of Cytomegalovirus and Herpes Simplex Virus Replication," *Antiviral Chem. Chemother.* **3**, 215 (1992).
78. M. T. Konieczny and M. Cushman, "A Novel Synthesis of Compounds Containing a Fused Pyrrole Ring from Cyclic Ketones and *N*-BOC-L-Phenylalaninal," *Tetrahedron Lett.* **33**, 6939-6940 (1992).
79. J. Jurayj and M. Cushman, "Approaches to the Synthesis of Endothiopeptides: Synthesis of a Thioamide-Containing C-Terminal Bombesin Nonapeptide," *Tetrahedron* **48**, 8601 (1992).
80. M. Cushman, P. Wang, J. G. Stowell, D. Schols, and E. De Clercq, "Structural Investigation and Anti-HIV Activities of High Molecular Weight ATA Polymers," *J. Org. Chem.* **57**, 7241 (1992).
81. M. Cushman, H. H. Patel, J. Scheuring, and A. Bacher,"^{19}F NMR Studies on the Mechanism of Riboflavin Synthase. Synthesis of 6-(Trifluoromethyl)-7-oxo-8-(D-ribityl)lumazine and 6-(Trifluoromethyl)-7-methyl-8-(D-ribityl)lumazine," *J. Org. Chem.* **57**, 5630 (1992).
82. M. Cushman, H. H. Patel, J. Scheuring, and A. Bacher, "^{19}F NMR Studies on the Mechanism of Riboflavin Synthase. Synthesis of 6-Trifluoromethyl-8-(D-ribityl)lumazine and Derivatives," *J. Org. Chem* **58**, 4033 (1993).
83. M. T. Konieczny, P. H. Toma, and M. Cushman, "Synthesis of Hydroxyethylene Isosteres of the Transition State of the HIV Protease-Catalyzed Phe-Pro Hydrolysis: Reaction of 2-(Boc)amino-1-(2'-oxocyclopentyl)-3-phenylpropanols with Diethyl Phosphorocyanidate and Lithium Cyanide Followed by Samarium Iodide," *J. Org. Chem.* **58**, 4619 (1993).
84. M. Cushman, H.-M. He, C. M. Lin, and E. Hamel, "Synthesis and Evaluation of a Series of Benzylaniline Hydrochlorides as Potential Cytotoxic and Antimitotic Agents Acting by Inhibition of Tubulin Polymerization," *J. Med. Chem.* **36**, 2817-2821 (1993).
85. K. Thakkar, R. L. Geahlen, and M. Cushman, "Synthesis and Protein-Tyrosine Kinase Inhibitory Activity of Polyhydroxylated Stilbene Analogs of Piceatannol," *J. Med. Chem.* **36**, 2950 (1993).
86. W. M. Golebiewski, J. P. Bader, and M. Cushman, "Design and Synthesis of Cosalane, a Novel anti-HIV Agent," *Bioorg. Med. Chem. Lett.* **3**, 1739 (1993).
87. K. Iwasa, M. Kamigauchi, N. Takao, and M. Cushman, "Stereochemical Studies on the Biosynthesis of Protoberberine, Protopine, and Benzophenanthridine Alkaloids Using Papaveraceae Cell Cultures," *J. Nat. Prod.* **56**, 2053 (1993).
88. A. Bacher, K. Ritsert, K. Kis, K. Schmidt-Bäse, R. Huber, R. Ladenstein, J. Scheuring, S. Weinkauf, and M. Cushman, "Studies on the Biosynthesis of Flavins. Structure and Mechanism of 6,7-Dimethyl-8-ribityllumazine Synthase," Flavins and Flavoproteins 1993, Walter de Gruyter and Co., Berlin, 1994, pp 53-62.

89. J. Scheuring, J. Lee, M. Cushman, H. Oschkinat, and A. Bacher, "^{19}F NMR Studies on Lumazine Protein from *Photobacterium phosphoreum*," Flavins and Flavoproteins 1993, Walter de Gruyter and Co., Berlin, 1994, pp 75-78.
90. J. Scheuring, M. Cushman, H. Oschkinat, and A. Bacher, "^{19}F NMR Studies on the Mechanism of Riboflavin Synthase," Flavins and Flavoproteins 1993, Walter de Gruyter and Co., Berlin, 1994, pp 79-82.
91. E.-S. Lee and Mark Cushman, "Synthesis of a Phosphotyrosine-containing Peptide Fragment of the Regulatory Domain of pp60*c-src*," *J. Org. Chem.* **59**, 2086 (1994).
92. J. Jurayj, R. D. Haugwitz, R. K. Varma, J. F. Barrett, and M. Cushman, "Design and Synthesis of Ellipticinium Salts and 1,2-Dihydroellipticines with High Selectivities against Human CNS Cancers *In Vitro*," *J. Med. Chem.* **37**, 2190 (1994).
93. J. Scheuring, J. Lee, M. Cushman, H. Patel, D. A. Patrick, and A. Bacher, "(Trifluoromethyl)lumazine Derivatives as ^{19}F NMR Probes for Lumazine Protein," *Biochemistry* **33**, 7634 (1994).
94. H.-M. He and M. Cushman, "A Versatile Synthesis of 2-Methoxyestradiol, an Endogenous Metabolite of Estradiol which Inhibits Tubulin Polymerization by Binding to the Colchicine Binding Site," *Bioorg. Med. Chem. Lett.* **4**, 1725-1728 (1994).
95. H.-M. He, R. L. Geahlen and M. Cushman, "Synthesis of a Series of Brominated 1-Phenyl-2-pyridylethenes as Inhibitors of the Protein-tyrosine Kinase p56^{lck}," *Bioorg. Med. Chem. Lett.* **4**, 1729 (1994).
96. M. Cushman, W. M. Golebiewski, J. B. McMahon, R. W. Buckheit, Jr., D. A. Clanton, O. Weislow, R. D. Haugwitz, J. P. Bader, L. Grahm, and W. G. Rice, "Design, Synthesis, and Biological Evaluation of Cosalane, a Novel Anti-HIV Agent which Inhibits Multiple Features of Virus Replication," *J. Med. Chem.* **37**, 3040 (1994).
97. K. Thakkar and M. Cushman, "A Novel Oxidative Cyclization of 2'-Hydroxychalcones to 4-Methoxyaurones by Thallium(III) Nitrate," *Tetrahedron Lett.* **35**, 6441 (1994).
98. E. S. Lee, J. J. Jurayj, and M. Cushman, "Synthesis of [L-3-deoxymimosine(4)]-angiotensin I as an Approach to the Preparation of Selective Protein-tyrosine Kinase (PTK) Inhibitors," *Tetrahedron* **50**, 9873 (1994).
99. Y.-i. Oh and M. Cushman, "Synthesis and Anti-HIV Activity of Poly(cysteic acid)," *Bioorg. Med. Chem. Lett.* **4**, 2245 (1994).
100. M. Cushman, H. Zhu, R. L. Geahlen, and A. J. Kraker, "Synthesis and Biochemical Evaluation of a Series of Aminoflavones as Potential Inhibitors of Protein-Tyrosine Kinases p56^{lck}, EGFr, and p60$^{v\text{-}src}$, "*J. Med. Chem.* **37**, 3353 (1994).
101. J. Scheuring, M. Cushman, and A. Bacher, "Elimination of the 7-Trifluoromethyl Group from 6,7-Bis(Trifluoromethyl)-8-ribityllumazines. Stereoselective Catalysis by the Lumazine Synthase of *Bacillus subtilis*," *J. Org. Chem.* **60**, 243 (1995).
102. M. Cushman, W. M. Golebiewski, Y. Pommier, A. Mazumder, D. Reymen, E. De Clercq, L. Grahm, and W. G. Rice, "Cosalane Analogues with Enhanced Potencies as Inhibitors of HIV-1 Protease and Integrase," *J. Med. Chem.* **38**, 443 (1995).
103. M. Cushman, P. Wang, D. Reymen, J. Este, M. Witvrouw, J. Neyts, and E. De Clercq, "Anti-HIV and Anti-HCMV Activities of New Aurintricarboxylic Acid Analogues," *Antiviral Chem. Chemother*. **6**, 179-186 (1995).
104. M. Cushman, H.-M. He, J. A. Katzenellenbogen, C. M. Lin, and E. Hamel, "Synthesis, Antitubulin and Antimitotic Activity, and Cytotoxicity of Analogs of 2-Methoxyestradiol, an Endogenous Mammalian Metabolite of Estradiol that Inhibits Tubulin Polymerization by Binding to the Colchicine Binding Site," *J. Med. Chem.* **38**, 2041-2049 (1995).
105. J.-k. Chen, H. L. Weith, R. S. Grewal, G. Wang, and M. Cushman, "Synthesis of Novel Phosphoramidite Reagents for the Attachment of Antisense Oligonucleotides to Various Regions of the Benzophenanthridine Ring System," *Bioconjugate Chem.* **6**, 473-482 (1995).
106. H.-M. He, P. E. Fanwick, K. Wood, and M. Cushman, "A Novel 1,3 O→C Silyl Shift and Deacylation Reaction Mediated by Tetra-*n*-butylammonium Fluoride in an Aromatic System," *J. Org. Chem.* **60**, 5905-5909 (1995).

107. E. Hejchman, R. D. Haugwitz, and M. Cushman, "Synthesis and Cytotoxicity of Water-soluble Ambrosin Prodrug Candidates," *J. Med. Chem.* **38**, 3407-3410 (1995).
108. K. Thakkar and M. Cushman, "A Novel Oxidative Cyclization of 2'-Hydroxychalcones to 4,5-Dialkoxyaurones by Thallium(III) Nitrate," *J. Org. Chem.* **60**, 6499-6510 (1995).
109. M. Cushman, M. Golebiewski, R. W. Buckheit, Jr., L. Graham, and W. G. Rice, "Synthesis and Biological Evaluation of an Alkenyldiarylmethane (ADAM) which Acts as a Novel Non-nucleoside HIV-1 Reverse Transcriptase Inhibitor," *Bioorg. Med. Chem. Lett.* **5**, 2713-2716 (1995).
110. Robert F. Keyes, W. Marek Golebiewski, and M. Cushman, "Correlation of Anti-HIV Potency with Lipophilicity in a Series of Cosalane Analogs Having Normal Alkenyl and Phosphodiester Side Chains as Cholestane Replacements," *J. Med. Chem.* **39**, 508-514 (1996).
111. D. Reymen, M. Witvrouw, J. A. Este, J. Neyts, D. Schols, G. Andrei, R. Snoeck, M. Cushman, E. Hejchman, and E. De Clercq, "Mechanism of the Antiviral Activity of New Aurintricarboxylic Acid Analogues," *Antiviral Chem. Chemother.* **7**, 142-152 (1996).
112. H.-M. He, P. E. Fanwick, K. Wood, and M. Cushman, "A Novel 1,3 O→C Silyl Shift and Deacylation Reaction Mediated by Tetra-*n*-butylammonium Fluoride in an Aromatic System," *J. Org. Chem.* **61**, 1554 (1996).
113. A. Bacher, M. Fischer, K. Kis, K. Kugelbrey, S. Mörtl, J. Scheuring, S. Weinkauf, S. Eberhardt, K. Schmidt-Bäse, R. Huber, K. Ritsert, M. Cushman, and R. Ladenstein, "Biosynthesis of Riboflavin: Structure and Mechanism of Lumazine Synthase," *Biochem. Soc. Trans.* 24, 89-94, (1996).
114. J. Scheuring, M. Fischer, M. Cushman, J. Lee, A. Bacher, H. Oschkinat, "NMR Analysis of Site-specific Ligand Binding in Oligomeric Proteins. Dynamic Studies on the Interaction of Riboflavin Synthase with Trifluoromethyl-substituted Intermediates," *Biochemistry* **35**, 9637 (1996).
115. P. Nagafuji and M. Cushman, "A General Synthesis of Pyrroles and Fused Pyrrole Systems from Ketones and Amino Acids," *J. Org. Chem.* **61**, 4999 (1996).
116. M. Cushman, W. M. Golebiewski, L. Graham, J. A. Turpin, W. G. Rice, V. Fliakas-Boltz, and R. W. Buckheit, Jr. "Synthesis and Biological Evaluation of Certain Alkenyldiarylmethanes (ADAMs) as Anti-HIV Agents which Act as Non-Nucleoside Reverse Transcriptase Inhibitors, " *J. Med. Chem.* **39**, 3217 (1996).
117. R. Devraj, J. F. Barrett, J. A. Fernandez, J. A. Katzenellenbogen, "Design, Synthesis, and Biological Evaluation of Ellipticine-Estradiol Conjugates," *J. Med. Chem.* **39**, 3367 (1996).
118. R. F. Keyes and M. Cushman, "Studies Directed Toward a More Potent Cosalane Pharmacophore: Synthesis of a Substituted Tetraphenylethylene which Inhibits the Cytopathic Effect of HIV-1," *Med. Chem. Res.* **39**, 372 (1996).
119. W. M. Golebiewski, R. F. Keyes, and M. Cushman, "Exploration of the Effects of Linker Chain Modifications on Anti-HIV Activities in a Series of Cosalane Analogs," *Bioorg. Med. Chem.* **4**, 1637 (1996).
120. R. Devraj and M. Cushman, "A Versatile Solid Phase Synthesis of Lavendustin A and Certain Biologically Active Analogs," *J. Org. Chem.* **61**, 9368 (1996).
121. R. Devraj, J. Jurayj, J. A. Fernandez, J. F. Barrett, and M. Cushman, "Synthesis of a Series of Cytotoxic 2-Acyl-1,2-Dihydroellipticines which Inhibit Topoisomerase II," Anti-Cancer Drug Des. **11**, 311 (1996).
122. R. Devraj and M. Cushman, "Selective Cytotoxicity of Certain 9-Substituted Ellipticines for Leukemia Cells in a Variety of Leukemia Cell Cultures," *Bioorg. Med. Chem. Lett.***7**, 369 (1997).
123. M. Cushman, H.-M. He, J. A. Katzenellenbogen, R. K. Varma, E, Hamel, C. M. Lin, S. Ram, and Y. P. Sachedeva, "Synthesis of Analogs of 2-Methoxyestradiol with Enhanced Inhibitory Effects on Tubulin Polymerization and Cancer Cell Growth," *J. Med. Chem.* **40**, 2323-2334 (1997).
124. M. Cushman, F. Mavandadi, K. Kugelbrey, and A. Bacher, "Design and Synthesis of Ribitylaminouracils Bearing Fluorosulfonyl, Sulfonic Acid, and Carboxylic Acid Functionality as Inhibitors of Lumazine Synthase," *J. Org. Chem.* **62**, 8944-8947 (1997).

125. G. Kohlhagen, K. Paull, M. Cushman, P. Nagafuji, and Y. Pommier, "Protein-linked DNA Strand Breaks Induced by NSC 314622, a Non-camptothecin Topoisomerase I Poison," *Mol. Pharmacol.* **54**, 50-58 (1998).
126. A. B. Argade, R. D. Haugwitz, R. Devraj, J. Kozlowski, P. E. Fanwick, and M. Cushman, "Highly Efficient Diastereoselective Michael Addition of Various Thiols to (+)-Brefeldin A," *J. Org. Chem.* **63**, 273-278 (1998).
127. M. Cushman, F. Mavandadi, K. Kugelbrey, and A. Bacher, "Synthesis of 2,6-Dioxo-(1*H*,3*H*)-9-*N*-ribitylpurine and 2,6-Dioxo-(1*H*,3*H*)-8-aza-9-*N*-ribitylpurine as Inhibitors of Lumazine Synthase and Riboflavin Synthase," *Bioorg. Med. Chem.* **6**, 409-415 (1998).
128. M. Cushman, A. Casimiro-Garcia, K. Williamson, and W. G. Rice, "Synthesis of a Non-nucleoside Reverse Transcriptase Inhibitor in the Alkenyldiarylmethane (ADAM) Series with Optimized Potency and Therapeutic Index," *Bioorg. Med. Chem. Lett.* **8**, 195-198 (1998).
129. M. Cushman, S. Insaf, J. A. Ruell, C. A. Schaeffer, and W. G. Rice, "Synthesis of a Cosalane Analog with an Extended Polyanionic Pharmacophore Conferring Enhanced Potency as an Anti-HIV Agent," *Bioorg. Med. Chem. Lett.* **8**, 833-836 (1998).
130. M. Cushman, A. Casimiro-Garcia, E. Hejchman, J. A. Ruell, M. Huang, C. A. Schaeffer, K. Williamson, W. G. Rice, and R. W. Buckheit, Jr. "New Alkenyldiarylmethanes (ADAMs) with Enhanced Potencies as Anti-HIV Agents Which Act as Non-Nucleoside Reverse Transcriptase Inhibitors," *J. Med. Chem.* **41**, 2076-2089 (1998).
131. M. Jayaraman, P. E. Fanwick, and M. Cushman, "Novel Oxidative Transformation of Indenoisoquinolines to Isoquinoline-3-spiro-3'-phthalides in the Presence of Osmium Tetroxide and 4-Methylmorpholine *N*-Oxide," *J. Org. Chem.* **63**, 5736-5737 (1998).
132. A. B. Argade, R. Devraj, J. A. Vroman, R. D. Haugwitz, M. Hollingshead, and M. Cushman, "Design and Synthesis of Brefeldin A Sulfide Derivatives as Prodrug Candidates with Enhanced Aqueous Solubilities," *J. Med. Chem.* **41**, 3337-3346 (1998).
133. Z. Wang and M. Cushman, "An Optimized Synthesis of 2-Methoxyestradiol, a Naturally Occurring Human Metabolite with Anticancer Activity," *Synth. Commun.* **28**, 4431-4437 (1998).
134. M. Cushman, J. T. Mihalic, K. Kis, and A. Bacher "Design and Synthesis of 6-(6-D-Ribitylamino-2,4-dihydroxypyrimidin-5-yl)-1-hexylphosphonic Acid, a Potent Inhibitor of Lumazine Synthase," *Bioorg. Med. Chem. Lett.* **9**, 39-42 (1999).
135. D. Strumberg, Y. Pommier, K. Paull, M. Jayaraman, P. Nagafuji, and M. Cushman, "Synthesis of Cytotoxic Indenoisoquinoline Topoisomerase I Poisons," *J. Med. Chem.* **42**, 446-457 (1999).
136. M. Cushman, S. Insaf, G. Paul, J. A. Ruell, E. De Clercq, D. Schols, C. Pannecouque, M. Witvrouw, C. A. Schaeffer, J. A. Turpin, K. Williamson, and W. G. Rice, "Extension of the Polyanionic Cosalane Pharmacophore as a Strategy for Increasing Anti-HIV Potency," *J. Med. Chem.* **42**, 1767-1777 (1999).
137. K. Mohanakrishnan and M. Cushman, "Pd(0)-Mediated Cross Coupling of 2-Iodoestradiol with Organozinc Bromides: A General Route to the Synthesis of 2-Alkynyl, 2-Alkenyl and 2-Alkylestradiols," *Synlett.* 1097-1099 (1999).
138. M. Cushman, J. T. Mihalic, K. Kis, and A. Bacher, "Design, Synthesis, and Biological Evaluation of Homologous Phosphonic Acids as Inhibitors of Lumazine Synthase," *J. Org. Chem.* **64**, 3838-3845 (1999).
139. M. Cushman, F. Mavandadi, D. Yang, K. Kugelbrey, K. Kis, and A. Bacher, "Synthesis and Biochemical Evaluation of Bis(6,7-dimethyl-8-D-ribityllumazines) as Potential Bisubstrate Analogue Inhibitors of Riboflavin Synthase," *J. Org. Chem.* **64**, 4635-4642 (1999).
140. J. M. Goetz, B. Poliks, D. R. Studelska, M. Fischer, K. Kugelbrey, A. Bacher, M. Cushman, and J. Schaefer, "Investigation of the Binding of Certain Fluorolumazines to Lumazine Synthase by $^{15}N\{^{19}F\}$ REDOR NMR," *J. Amer. Chem. Soc.* **121**, 7500-7508 (1999).
141. M. L. Micklatcher and M. Cushman, "An Improved Method for the Synthesis of 3-Fluorosalicylic Acid with Application to the Synthesis of 3-(Trifluoromethyl)salicylic Acid," *Synthesis* 1878-1880 (1999).

142. J. A. Ruell, E. De Clercq, C. Pannecouque, M. Witvrouw, T. L. Stup, J. A. Turpin, R. W. Buckheit, Jr., M. Cushman, "Synthesis and Anti-HIV Activity of Cosalane Analogues with Substituted Benzoic Acid Rings Attached to the Pharmacophore through Methylene and Amide Linkers," *J. Org. Chem.* **64**, 5858-5866 (1999).
143. A. Casimiro-Garcia, M. Micklatcher, J. A. Turpin, T. L. Stup, K. Watson, R. W. Buckheit, Jr., and M. Cushman, "Novel Modifications in the Alkenyldiarylmethane (ADAM) Series of Non-Nucleoside Reverse Transcriptase Inhibitors," *J. Med. Chem.* **42**, 4861-4874 (1999).
144. A. Casimiro-Garcia, E. De Clercq, C. Pannecouque, M. Witvrouw, T. L. Stup, J. A. Turpin, R. W. Buckheit, Jr., and Mark Cushman, "Synthesis and Anti-HIV Activity of Cosalane Analogs Incorporating Nitrogen in the Linker Chain," *Bioorg. Med. Chem.* **8**, 191-200 (2000).
145. P. Verdier-Pinard, Z. Wang, A. K. Mohanakrishnan, M. Cushman, and E. Hamel, "A Steroid Derivative with Paclitaxel-Like Effects on Tubulin Polymerization," *Molecular Pharmacol.* **57**, 568-575 (2000).
146. W. Meining, S. Mörtl, S.; M. Fischer, M. Cushman, A. Bacher, R. Ladenstein, "The Atomic Structure of Pentameric Lumazine Synthase from *Saccharomyces cerevisiae* at 1.85 Å Resolution Reveals the Binding Mode of a Phosphonate Intermediate Analog, " *J. Mol. Biol.* **299**, 181-197 (2000).
147. Z. Wang., D. Tang, A. K. Mohanakrishnan, P. E. Fanwick, P. Nampoothiri, E. Hamel, and M. Cushman, "Synthesis of B-Ring Homologated Estradiol Analogues that Modulate Tubulin Polymerization and Microtubule Stability," *J. Med. Chem.* **43**, 2419-2429 (2000).
148. M. Cushman, M. Jayaraman, J. A. Vroman, A. K. Fukunaga, B. M. Fox, G. Kohlhagen, D. Strumberg, and Y. Pommier "Synthesis of New Indeno[1,2-*c*]isoquinolines: Cytotoxic Non-Camptothecin Topoisomerase I Inhibitors," *J. Med. Chem.* **43**, 3688-3698 (2000).
149. G. C. Paul, E. De Clercq, C. Pannecouque, M. Vitvrouw, T. L. Loftus, J. A. Turpin, R. W. Buckheit, Jr., and M. Cushman, "Identification of Optimal Anion Spacing for Anti-HIV Activity in a Series of Cosalane Tetracarboxylates," *Bioorg. Med. Chem. Lett.* **10**, 2149-2152 (2000).
150. K. C. Santhosh, E. De Clercq, C. Pannecouque, M. Witvrouw, T. L. Loftus, J. Turpin, and R. W. Buckheit, Jr., and M. Cushman "Anti-HIV Activity of a Series of Cosalane Amino Acid Conjugates," *Bioorg. Med. Chem. Lett.* **10**, 2505-2508 (2000).
151. O. M. Z. Howard, H. F. Dong, J. J. Oppenheim, S. Insaf, K. C. Santhosh, G. Paul, and M. Cushman, "Inhibition of RANTES/CCR1-Mediated Chemotaxis by Cosalane and Related Compounds," *Bioorg. Med. Chem. Lett.* **11**, 59-62 (2000).
152. F. Mu, S. L. Coffing, D. J. Riese II, R. L. Geahlen, P. Verdier-Pinnard, E. Hamel, J. Johnson, and M. Cushman, "Design, Synthesis, and Biological Evaluation of a Series of Lavendustin A Analogues That Inhibit EGFR and Syk Tyrosine Kinases, as Well as Tubulin Polymerization," *J. Med. Chem.* **44**, 441-452 (2001).
153. K. C. Santhosh, G. C. Paul, E. De Clercq, C. Pannecouque, M. Witvrouw, T. L. Loftus, J. A. Turpin, R. W. Buckheit, Jr., and M. Cushman, "Correlation of Anti-HIV Activity with Anion Spacing in a Series of Cosalane Analogs with Extended Polycarboxylate Pharmacophores," *J. Med. Chem.* **44**, 703-714 (2001).
154. B. Illarianov, K. Kemter, S. Eberhardt,, G. Richter, M. Cushman, and A. Bacher, "Riboflavin Synthase of *Escherichia coli.* Effect of Single Amino Acid Substitutions on Reaction Rate and Ligand Binding Properties," *J. Biol. Chem.* **276**, 11524-11530 (2001).
155. T. Sambaiah, P. E. Fanwick, and M. Cushman, "Regioselective 1-*O*-Acyl Hydrolysis of Peracylated Glycopyranoses by Mercuric Chloride and Mercuric Oxide," *Synthesis* 1450-1452 (2001).
156. G. Xu, T. L. Loftus, H. Wargo, J. A. Turpin, R W. Buckheit, Jr., and M. Cushman, "Solid Phase Synthesis of the Alkenyldiarylmethane (ADAM) Series of Non-Nucleoside HIV-1 Reverse Transcriptase Inhibitors," *J. Org. Chem.* **66**, 5958-5964 (2001).
157. T. Sambaiah, P. E. Fanwick, and M. Cushman, "Investigation of an Unexpected Addition Reaction that Occurs when 2,3:4,5-Di-*O*-isopropylidene-D-ribose Diethyl Dithioacetal Is

Treated with Mercuric Oxide and Mercuric Chloride," *J. Org. Chem.* **66**, 4405-4408 (2001).

158. J. Scheuring, K. Kugelbrey, S. Weinkauf, M. Cushman, A. Bacher, and M. Fischer, "^{19}F NMR Ligand Perturbation Studies on 6.7-Bis(trifluoromethyl)-8-ribityllumazine-7-hydrates and the Lumazine Synthase Complex of *Bacillus subtilis.* Site-directed Mutagenesis Changes the Mechanism and the Stereoselectivity of the Catalyzed Haloform Reaction," *J. Org. Chem.* **66**, 3811-3819 (2001).
159. A. Casimiro-Garcia, E. De Clercq, C. Pannecouque, M. Witvrouw, T. L. Loftus, J. A. Turpin, R. W. Buckheit, Jr., P. E. Fanwick, and M. Cushman, "Synthesis and Anti-HIV Activity of Cosalane Analogs Incorporating Two Dichlorodisalicylmethane Fragments," *Bioorg. Med. Chem.* **9**, 2827-2841 (2001).
160. S. Eberhardt, N. Ziegler, K. Kemter, G. Richter, M. Cushman, and A. Bacher, "Domain Structure of Riboflavin Synthase," *Eur. J. Biochem.* **268**, 4315-4323 (2001).
161. B. M. Fox, J. A. Vroman, P. E. Fanwick, and M. Cushman, "Preparation and Evaluation of Sulfide Derivatives of the Antibiotic Brefeldin A as Potential Prodrug Candidates with Enhanced Aqueous Solubilities," *J. Med. Chem.* **44**, 3915-3924 (2001).
162. A. Kannan, E. De Clercq, C. Pannecouque, M. Witvrouw, T. L. Hartman, J. A. Turpin, R. W. Buckheit, Jr., and M. Cushman, "Synthesis and Anti-HIV Activity of a Bile Acid Analog of Cosalane," *Tetrahedron* **57**, 9385-9391 (2001).
163. G. Xu, M. Micklatcher, M. A. Silvestri, T. L. Hartman, J. Burrier, M. O. Osterling, H. Wargo, J. A. Turpin, R. W. Buckheit, Jr., and M. Cushman, "The Biological Effects of Structural Variation at the Meta Position of the Aromatic Ring and at the End of the Alkenyl Chain in the Alkenyldiarylmethane Series of Non-Nucleoside Reverse Transcriptase Inhibitors," *J. Med. Chem.* **44**, 4092-4113 (2001).
164. M. Cushman, D. Yang, K. Kis, and A. Bacher, "Design, Synthesis, and Evaluation of 9-D-Ribityl-1,3,7-trihydro-2,6,8-purinetrione, a Potent Inhibitor of Riboflavin Synthase and Lumazine Synthase," *J. Org. Chem.* **66**, 8320-8327 (2001).
165. G. Xu, T. L. Hartman, H. Wargo, J. A. Turpin, Robert W. Buckheit, Jr., and M. Cushman, "Synthesis of Alkenyldiarylmethane (ADAM) Non-Nucleoside Reverse Transcriptase Inhibitors with Non-Identical Aromatic Rings," *Bioorg. Med. Chem.* **10**, 283-290 (2002).
166. M. Jayaraman, B. M. Fox, M. Hollingshead, G. Kohlhagen, Y. Pommier, and M. Cushman, "Synthesis of New Dihydroindeno[1,2-*c*]isoquinoline and Indenoisoquinolinium Chloride Topoisomerase I Inhibitors Having High in Vivo Anticancer Activity in the Hollow Fiber Animal Model," *J. Med. Chem.* **45**, 242-249 (2002).
167. K. R. Kuchimanchi, M. D. Gandhi, R. R. Sheta, T. P. Johnson, K. C. Santhosh, M. Cushman, and A. K. Mitra, "Intestinal Absorption and Biodistribution of Cosalane and Its Amino Acid Conjugates: Novel Anti-HIV Agents," *Int. J. Pharm.* **231**, 197-211 (2002).
168. A. K. Mehta, D. R. Studelska, M. Fischer, A. Gieβuaf, K. Kemter, A. Bacher, M. Cushman, and J. Schaefer, "Investigation of the Binding of Epimer A of the Covalent Hydrate of 6,7-Bis(trifluoromethyl)-8-D-ribityllumazine to a Recombinant F22W *Bacillus subtilits* Lumazine Synthase Mutant by ^{15}N{^{19}F} REDOR NMR," *J. Org. Chem.* **67**, 2087-2092 (2002).
169. R. A. Hughes, T. Harris, E. Altmann, D. McAllister, R. Vlahos, A. Robertson, M. Cushman, Z. Wang, and A. G. Stewart, "2-Methoxyestradiol and Analogues as Novel Antiproliferative Agents: Analysis of Three-Dimensional Quantitative Structure-Activity Relationships for Cell-Cycle Arrest and Estrogenic Receptor Binding," *Mol. Pharmacol.* **61**, 1053-1069 (2002).
170. S. Gerhardt, I. Haase, S. Steinbacher, J. T. Kaiser, M. Cushman, A. Bacher, R. Huber, and M. Fischer, "The Structural Basis of Riboflavin Binding to *Schizosaccharomyces pombe* 6,7-Dimethyl-8-ribityllumazine Synthase, *J. Mol. Biol.* **318**, 1317-1329 (2002).
171. G. Xu, A. Kannan, T. L. Hartman, H. Wargo, K. Watson, J. A. Turpin, R. W. Buckheit, Jr., A. A. Johnson, Y. Pommier, and M. Cushman, "Synthesis of Substituted Diarylmethylenepiperidines (DAMPs), a Novel Class of Anti-HIV Agents," *Bioorg. Med. Chem.* **10**, 2807-2816 (2002).

172. F. Mu, D. J. Lee, D. E. Pryor, E. Hamel, and M. Cushman, "Synthesis and Investigation of Conformationally Restricted Analogues of Lavendustin A as Cytotoxic Inhibitors of Tubulin Polymerization," *J. Med. Chem.* **45**, 4774-4785 (2002).
173. M. Cushman, A. K. Mohanakrishnan, M. Hollingshead, and E. Hamel, "The Effect of Exchanging Various Substituents at the 2-Position of 2-Methoxyestradiol on Cytotoxicity in Human Cancer Cell Cultures and Inhibition of Tubulin Polymerization," *J. Med. Chem.* **45**, 4748-4754 (2002).
174. M. Cushman, D. Yang, S. Gerhardt, R. Huber, M. Fischer, K. Kis, and A. Bacher, "Design, Synthesis, and Evaluation of 6-Carboxyalkyl and 6-Phosphonoxyalkyl Derivatives of 7-Oxo-8-Ribitylaminolumazines as Inhibitors of Riboflavin Synthase and Lumazine Synthase," *J. Org. Chem.* **67**, 5807-5816 (2002).
175. S. Gerhardt, A.-K. Schott, N. Kairies, M. Cushman, B. Illarionov, W. Eisenreich, A. Bacher, R. Huber, S. Steinbacher, and M. Fischer "Studies on the Reaction Mechanism of Riboflavin Synthase: X-ray Crystal Structure of a Complex with 6-Carboxyethyl-7-oxo-8-ribityllumazine," *Structure* **10**, 1371-1381 (2002).
176. M. Cushman, D. Yang, J. T. Mihalic, J. Chen, S. Gerhardt, R. Huber, M. Fischer, K. Kis, and A. Bacher, "Incorporation of an Amide into 5-Phosphonoalkyl-6-D-ribitylaminopyrimidinedione Lumazine Synthase Inhibitors Results in an Unexpected Reversal of Selectivity for Riboflavin Synthase vs. Lumazine Synthase," *J. Org. Chem.* **67**, 6871-6877 (2002).
177. M. Fischer, A.-K. Schott, K. Kemter, R. Feicht, G. Richter, B. Illarionov, W. Eisenreich, A. Bacher, S. Gerhardt, S. Steinbacher, R. Huber, and M. Cushman, "^{19}F NMR Ligand Perturbation Studies on the Riboflavin Synthase of *Schizosaccharomyces pombe*" Flavins and Flavoproteins (S. Chapman, R. Perham, N. Scrutton, Eds.), Rudolf Weber Verlag, Berlin, 2002, pp. 161-166.
178. S. Gerhardt, S. Steinbacher, J. T. Kaiser, R. Huber, I. Haase, A. Bacher, M. Fischer, M. Cushman, "The Crystal Structure of Lumazine Synthase from *Schizosaccharomyces pombe* Reveals Its Binding Mode to Riboflavin," Flavins and Flavoproteins (S. Chapman, R. Perham, N. Scrutton, Eds.), Rudolf Weber Verlag, Berlin, 2002, pp. 857-862.
179. S. Gerhardt, S. Steinbacher, N. Kairies, R. Huber, A.-K Schott, A, B. Illarionov, W. Eisenreich, A. Bacher, M. Fischer, M. Cushman, "The Crystal Structure of Riboflavin Synthase of *Schizosaccharomyces pombe* in Complex with 6-Carboxyethyl-7-oxo-8-ribityllumazine Reveals Insights into the Reaction Mechanism," Flavins and Flavoproteins (S. Chapman, R. Perham, N. Scrutton, Eds.), Rudolf Weber Verlag, Berlin, 2002, pp 45-50.
180. C. Udata, J. Patel, D. Pal, E. Hejchman, M. Cushman, and A. K. Mitra, "Enhanced Transport of a Novel Anti-HIV Agents – Cosalane and its Congeners across Human Intestinal Epithelial (Caco-2) Cell Monolayers," *Int. J. Pharm.* **250**, 157-168 (2003).
181. M. Fischer, I. Haase, K. Kis, W. Meining, R. Ladenstein, M. Cushman, N. Schramek, R. Huber, and A. Bacher, "Enzyme Catalysis via Control of Activation Entropy. Site Directed Mutagenesis of 6,7-Dimethyl-8-ribityllumazine Synthase," *J. Mol. Biol.* **326**, 783-793 (2003).
182. F. Mu, E. Hamel, D, J. Lee, D. E. Pryor, and M. Cushman, "Synthesis, Anticancer Activity, and Inhibition of Tubulin Polymerization by Conformationally Restricted Analogues of Lavendustin A," *J. Med. Chem.* **46**, 1670-1682 (2003).
183. M. A. Silvestri, D. Miles, A. P. Rothwell, K. V. Wood, and M. Cushman, "The "Apparent" Hydrolysis of Alkyl Esters During Electrospray Ionization," *Rapid Commun. Mass Spectrom.* **17**, 1703-1708 (2003).
184. X. Zhang, W. Meining, M. Cushman, I. Haase, M. Fischer, A. Bacher, and R. Ladenstein, "A Structure-based Model of the Reaction Catalyzed by Lumazine Synthase from *Aquifex aeolicus*, "*J. Mol. Biol* **328**, 167-182 (2003).
185. B. M. Fox, X. Xiao, S. Antony, G. Kohlhagen, Y. Pommier, B. L. Staker, L. Stewart, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Cytotoxic 11-

Alkenylindenoisoquinoline Topoisomerase I Inhibitors and Indenoisoquinoline-Camptothecin Hybrids," *J. Med. Chem.* **46**, 3275-3282 (2003).

186. S. Antony, M. Jayaraman, G. Laco, G. Kohlhagen, K. W. Kohn, M. Cushman, and Y. Pommier, "Differential Induction of Topoisomerase I-DNA Cleavage Complexes by the Indenoisoquinoline MJ-III-65 (NSC 706744) and Camptothecin: Base Sequence Analysis and Activity against Camptothecin-Resistant Topoisomerase I," *Cancer Res.* **63**, 7428-7435 (2003).
187. M. Nagarajan, X. Xiao, S. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Indenoisoquinoline Topoisomerase I Inhibitors Featuring Polyamine Side Chains on the Lactam Nitrogen," *J. Med. Chem.* **46**, 5712-5724 (2003).
188. M. Fischer, A.-K. Schott, K. Kempter, R. Feicht, G. Richter, B. Illarionov, W. Eisenreich, S. Gerhardt, M. Cushman, S. Steinbacher, R. Huber, and A. Bacher, "Riboflavin Synthase of *Saccharomyces pombe*. Protein Dynamics Revealed by ^{19}F NMR Protein Perturbation Experiments," *BMC Biochem.* **4**, 18 (2003).
189. M. Cushman, T. Sambaiah, G. Jin, B. Illarionov, M. Fischer, and A. Bacher, "Design, Synthesis, and Evaluation of 9-D-Ribitylamino-1,3,7,9-tetrahydro-2,6,8-purinetriones Bearing Alkyl Phosphate and α,σ-Difluorophosphonate Substituents as Inhibitors of Riboflavin Synthase and Lumazine Synthase, *J. Org. Chem.* **69**, 601-612 (2004).
190. B. D. Gehm, A. S. Levenson, H. Liu, E.-J. Lee, B. M. Amundsen, M. Cushman, V. C. Jordan, J. L. Jameson, "Estrogenic Effects of Resveratrol in Breast Cancer Cells Expressing Mutant and Wild-type Estrogen Receptors: Role of AF-1 and AF-2," *J. Steroid Biochem. Mol. Biol.* **88**, 223-234 (2004).
191. M. A. Silvestri, M. Nagarajan, E. De Clercq, C. Pannecouque, and M. Cushman, "Design, Synthesis, Anti-HIV Activities, and Metabolic Stabilities of Alkenyldiarylmethane (ADAM) Non-nucleoside Reverse Transcriptase Inhibitors," *J. Med. Chem.* **47**, 3149-3162 (2004).
192. A. Morrell, S. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "Synthesis of Nitrated Indenoisoquinolines as Topoisomerase I Inhibitors," *Bioorg. Med. Chem. Lett.* **14**, 3659-3663 (2004).
193. M. Koch, C. Breithaupt, S. Gerhardt, I. Haase, S. Weber, M. Cushman, R. Huber, A. Bacher, and M. Fischer, "Structural Basis of Charge Transfer Complex Formation by Riboflavin Bound to 6,7-Dimethyl-8-ribityllumazine Synthase," *Eur. J. Biochem.* **271**, 3208-3214 (2004).
194. X. Xiao, S. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Cytotoxic 11-Aminoalkenylindenoisoquinoline and 11-Diaminoalkenylindenoisoquinoline Topoisomerase I Inhibitors," *Bioorg. Med. Chem.* **12**, 5147-5160 (2004).
195. X. Xiao, P. E. Fanwick, and M. Cushman, "Synthesis, Crystal Structure and Conversion of the Polycyclic Tris-anhydrotetramer of *o*-Aminobenzaldehyde to $Cu(TAAB)^{2+}$, *Synthetic Communications* **34**, 3901-3907 (2004).
196. X. Xiao, S,. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "A Novel Autoxidative Cleavage Reaction of 9-Fluoredenes Discovered During the Synthesis of a Potential DNA-Threading Agent," *J. Org. Chem.* **69**, 7495-7501 (2004).
197. J. Chen, T. Sambaiah, B. Illarionov, M. Fischer, A. Bacher, and M. Cushman, "Design, Synthesis, and Evaluation of Acyclic *C*-Nucleoside and *N*-Methylated Derivatives of the Ribitylaminopyrimidine Substrate of Lumazine Synthase as Potential Enzyme Inhibitors and Mechanistic Probes," *J. Org. Chem.* **69**, 6996-7003 (2004).
198. A. B. Edsall, A. K. Mohanakrishnan, D. Yang, P. E. Fanwick, E. Hamel, A. D. Hanson, G. Agoston, and M. Cushman, "Effect of Altering the Electronics of 2-Methoxyestradiol on Cell Proliferation, on Cytotoxicity in Human Cancer Cell Cultures, and on Tubulin Polymerization," *J. Med. Chem.* **47**, 5126-5139 (2004).
199. M. Nagarajan, A. Morrell, B. C. Fort, M. R. Meckley, S. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "Synthesis and Anticancer Activity of Simplified Indenoisoquinoline Topoisomerase I Inhibitors Lacking Substitutions on the Aromatic Rings, *J. Med. Chem.* **47**, 5651-5661 (2004).

200. J. Chen, B. Illarionov, A. Bacher, M. Fischer, I. Haase, G. Georg, Q. Ye, Z. Ma, and M. Cushman, "A High-Throughput Screen Utilizing the Fluorescence of Riboflavin for Identification of Lumazine Synthase Inhibitors," *Anal. Biochem.* **338**, 124-130 (2005).
201. S. Antony, G. Kohlhagen, K. Agama, M. Jayaraman, S. Cao, F. Durrani, Y. M. Rustum, M. Cushman, and Y, Pommier, "Cellular Topoisomerase I Inhibition and Antiproliferative Activity by MJ-III-65 (NSC 706744), an Indenoisoquinoline Topoisomerase I Poison," *Mol. Pharmacol.* **67**, 523-530 (2005).
202. B. L. Staker, M. D. Feese, M. Cushman, Y. Pommier, D. Zembower, L. Stewart, and A. B. Burgin, "Structures of Three Classes of Anticancer Agents Bound to the Human Topoisomerase I-DNA Covalent Complex, " *J. Med. Chem.* **48**, 2336-2345 (2005).
203. E. Morgunova, W. Meining, B. Illarionov, I. Haase, G. Jin, A. Bacher, M. Cushman, M. Fischer, and R. Ladenstein, "Crystal Structure of Lumazine Synthase from Mycobacterium tuberculosis as a Target for Rational Drug Design: Binding Mode of a New Class of Purinetrione Inhibitor," *Biochemistry* **44**, 2746-2758 (2005).
204. X. Xiao, Z.-H Miao, S. Antony, Y. Pommier, and M. Cushman, "Dihydroindenoisoquinolines Function as Prodrugs of Indenoisoquinolines," *Bioorg. Med. Chem. Lett.* **15**, 2795-2798 (2005).
205. X. Xiao, S. Antony, Y. Pommier, and M. Cushman, "On the Binding of Indeno[1,2-*c*]isoquinolines in the DNA-Topoisomerase I Cleavage Complex," *J. Med. Chem.* **48**, 3231-3238 (2005).
206. A. Ioanoviciu, S. Antony, Y. Pommier, B. L. Staker, L. Stewart, and M. Cushman, "Synthesis and Mechanism of Action Studies of a Series of Norindenoisoquinoline Topoisomerase I Poisons Reveal an Inhibitor with a Flipped Orientation in the Ternary DNA-Enzyme-Inhibitor Complex As Determined by X-Ray Crystallographic Analysis," *J. Med. Chem.* **48**, 4803-4814 (2005).
207. H. Y. Kim, C. Patkar, R. Warrier, R. Kuhn, and M. Cushman, "Design, Synthesis, and Evaluation of Dioxane-Based Antiviral Agents Targeted Against the Sindbis Virus Capsid Protein," *Bioorg. Med. Chem. Lett.* **15**, 3207-3211 (2005).
208. X. Xiao and M. Cushman, "An Ab Initio Quantum Mechanics Calculation that Correlates with Ligand Orientation and DNA Cleavage Site Selectivity in Camptothecin-DNA-Topoisomerase I Ternary Cleavage Complexes," *J. Amer. Chem. Soc.* **127**, 9960-9961 (2005).
209. X. Xiao and M. Cushman, "A Facile Method to Transform *trans*-4-Carboxy-3,4-dihydro-3-phenyl-1(*2H*)-isoquinolines to Indeno[1,2-*c*]isoquinolines," *J. Org. Chem.* **70**, 6496-6498 (2005).
210. X. Xiao and M. Cushman, "The Effect of E-ring Modifications in Camptothecin on Topoisomerase I Inhibition: A Quantum Mechanics Treatment," *J. Org. Chem.* **70**, 9584-9587 (2005).
211. B.-L. Deng, T. L. Hartman, R. W. Buckheit, Jr., C. Pannecouque, E. De Clercq, P. E. Fanwick, and M. Cushman, "Synthesis, Anti-HIV Activity, and Metabolic Stability of New Alkenyldiarylmethane HIV-1 Non-Nucleoside Reverse Transcriptase Inhibitors," *J. Med. Chem.* **48**, 6140-6155 (2005).
212. M. Cushman, G. Jin, B. Illarionov, M. Fischer, R. Ladenstein, and A. Bacher, "Design, Synthesis, and Biochemical Evaluation of 1,5,6,7,-Tetrahydro-6,7-dioxo-9-D-Ribitylaminolumazines Bearing Alkyl Phosphate Substituents as Inhibitors of Lumazine Synthase and Riboflavin Synthase," *J. Org. Chem.* **70**, 8162-8170 (2005).
213. A. Ramsperger, M. Augustin, A.-K. Schott, S. Gerhardt, T. Krojer, W. Eisenreich, B. Illarionov, M. Cushman, A. Bacher, R. Huber, and M. Fischer, "Crystal Structure of an Archaeal Pentameric Riboflavin Synthase Complex with a Substrate Analog Inhibitor:

Stereochemical Implications," *J. Biol. Chem.* **281**, 1224-1232 (2006).

214. C. Marchand, S. Antony, K. W. Kohn, M. Cushman, A. Ioanoviciu, B. L. Staker, A. B. Burgin, L. Stewart, and Y. Pommier, "A Novel Norindeniosoquinoline Structure Reveals a Common Interfacial Inhibitor Paradigm for Ternary Trapping of the Topoisomerase I-DNA Covalent Complex," *Mol. Cancer Ther.* **5**, 287-295 (2006).
215. A. Morrell, S. Antony, G. Kohlhagen, Y. Pommier. and M. Cushman, "Synthesis of Benz[*d*]indeno[1,2-*b*]pyran-5,11-diones: Versatile Intermediates for the Design and Synthesis of Topoisomerase I Inhibitors," *Bioorg. Med. Chem. Lett.* **16**, 1846-1849 (2006).
216. X. Xiao, S. Antony, Y. Pommier, and M. Cushman, "Total Synthesis and Biological Evaluation of 22-Hydroxyacuminatine," *J. Med. Chem.* **49**, 1408-1412 (2006).
217. H. Y. Kim, A. Talukdar, and M. Cushman, "Regioselective Synthesis of *N*-β-Hydroxyethylaziridines by the Ring Opening Reaction of Epoxides with Aziridine Generated in situ," *Org. Lett.* **8**, 1085-1087 (2006).
218. B.-L. Deng, M. D. Cullen, Z. Zhao, T. L. Hartman, R. W. Buckheit, Jr., C. Pannecouque, E. De Clercq, P. E. Fanwick, and M. Cushman, "Synthesis and Anti-HIV Activity of New Alkenyldiarylmethane (ADAM) Non-nucleoside Reverse Transcriptase Inhibitors Incorporating Benzoxazolone and Benzisoxazole Rings," *Bioorg. Med. Chem.* **14**, 2366-2374 (2006).
219. N. O. Anadu, V. J. Davisson, and M. Cushman, "Synthesis and Anticancer Activity of Brefeldin A Ester Derivatives," *J. Med. Chem.* **49**, 3897-3905 (2006).
220. A. Morrell, M. Jayaraman, M. Nagarajan, B. M. Fox, M. R. Meckley, A. Ioanoviciu, Y. Pommier, S. Antony, M. Hollingshead, and M. Cushman, "Evaluation of Indenoisoquinoline Topoisomerase I Inhibitors Using a Hollow Fiber Assay," *Bioorg. Med. Chem. Lett.* **16**, 4395-4399 (2006).
221. S. Antony, K. K. Agama, Z.-H. Miao, M. Hollingshead, S. L. Holbeck, M. H. Wright, L. Varticovski, M. Nagarajan, A. Morrell, M. Cushman, and Y. Pommier, "Bisindenoisoquinoline Bis-1,3-{(5,6-dihydro-5,11-diketo-11*H*-indeno[1,2-*c*]isoquinoline)-6-propylamino}propane bis(trifluoroacetate) (NSC 727357), a DNA Intercalator and Topoisomerase Inhibitor with Antitumor Activity," *Mol. Pharmacol.* **70**, 1109-1120 (2006).
222. M. Nagarajan, A. Morrell, S. Antony, G. Kohlhagen, K. Agama, Y. Pommier, P. A. Ragazzon, N. C. Garbett, J. B. Chaires, M. Hollingshead, and M. Cushman, " Synthesis and Biological Evaluation of Bisindenoisoquinolines as Topoisomerase I Inhibitors," *J. Med. Chem.* **49**, 5129-5140 (2006).
223. B.-L. Deng, T. L. Hartman, R. W. Buckheit, Jr., C. Pannecouque, E. De Clercq, and M. Cushman, "Replacement of the Metabolically Labile Methyl Esters in the Alkenyldiarylmethane (ADAM) Series of Non-nucleoside Reverse Transcriptase Inhibitors (NNRTIs) with Isoxazolone, Isoxazole, Oxazolone, or Cyano Substituents," *J. Med. Chem.* **49**, 5316-5323 (2006).
224. X. Xiao, A. Morrell, P. E. Fanwick, and M. Cushman, "On the Mechanism of Conversion of 4-Carboxy-3,4-dihydro-3-phenyl-1(2*H*)-isoquinolones to Indeno[1,2-c]isoquinolines by Thionyl Chloride," *Tetrahedron* **62**, 9705-9712 (2006).
225. E. Hamel, B. W. Day, J. H. Miller, M. K. Jung, P. T. Northcote, A. K. Ghosh, D. P. Curran, M. Cushman, K. C. Nicolaou, I. Paterson, and E. J. Sorensen, "Synergistic Effects of Peloruside A and Laulimalide with Taxoid Site Drugs, but Not with Each Other, on Tubulin Assembly," *Mol. Pharmacol.* **70**, 1555-1564 (2006).
226. M. Nagarajan, A. Morrell, A. Ioanoviciu, S. Antony, G. Kohlhagen. M. Hollingshead, Y. Pommier, and M. Cushman, "Synthesis and Evaluation of Indenoisoquinoline Topoisomerase I Inhibitors Substituted with Nitrogen Heterocycles," *J. Med. Chem.* **49**, 6283-6289 (2006).

227. A. Morrell, S. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "A Systematic Study of Nitrated Indenoisoquinolines Reveals a Potent Topoisomerase I Inhibitor," *J. Med. Chem.* **49**, 7740-7753 (2006).
228. E. Morgunova, B. Illarionov, T. Sambaiah, I. Haase, A. Bacher, M. Cushman, M. Fischer, M., R. Ladenstein, "Structural and Thermodynamic Insights into the Binding Mode of Five Novel Inhibitors of Lumazine Synthase from *Mycobacterium tuberculosis*," *FEBS J.* **273**, 4790-4804 (2006**)**.
229. A. Maiti, M. Cuendet, T. Kondratyuk, V. L. Croy, J. M. Pezzuto, and M. Cushman, "Synthesis and Cancer Chemopreventive Activity of Zapotin, a Natural Product from *Casimiroa edulis*," *J. Med. Chem.* **50**, 350-355 (2007).
230. C. Y. Lee, B. Illarionov, Y.-E. Woo, K. Kemter, R.-R. Kim, S. Eberhardt, M. Cushman, W. Eisenreich, M. Fischer, and A. Bacher, "Ligand Binding Properties of the *N*-Terminal Domain of Riboflavin Synthase from *Escherichia coli*," *J. Biochem. Mol. Biol.* **40**, 239-246 (2007).
231. A. Morrell, M. S. Placzek, J. D. Steffen, S. Antony, K. Agama, Y. Pommier, and M. Cushman, "Investigation of the Lactam Side Chain Length Necessary for Optimal Indenoisoquinoline Topoisomerase I Inhibition and Cytotoxicity in Human Cancer Cell Cultures," *J. Med. Chem.* **50**, 2040-2048 (2007).
232. H. Y. Kim, R. J. Kuhn, C. Patkar, R. Warrier, and M. Cushman, "Synthesis of Dioxane-Based Antiviral Agents and Evaluation of Their Biological Activities as Inhibitors of Sindbis Virus Replication," *Bioorg. Med. Chem.* **15**, 2667-2679 (2007).
233. Y. Zhang, B. Illarionov, A. Bacher, M. Fischer, G. I. Georg, Q.-Z. Ye, D. Vander Velde, P. E. Fanwick, Y. Song, and M. Cushman, "A Novel Lumazine Synthase Inhibitor Derived from Oxidation of 1,3,6,8-Tetrahydroxy-2,7-naphthyridine to a Tetraazaperylenehexaone Derivative," *J. Org. Chem.* **72**, 2769-2776 (2007).
234. J. Kaiser, B. Illarionov, F. Rohdich, W. Eisenreich, S. Saller, J. Van den Brulle, M. Cushman, A. Bacher, and M. Fischer, "A High Throughput Screening Platform for Inhibitors of the Riboflavin Biosynthesis Pathway," *Anal. Biochem.* **365**, 52-61 (2007).
235. A. Maiti, M. Cuendet, V. L. Croy, D. C. Endringer, J. M. Pezzuto, and M. Cushman, "Synthesis and Biological Evaluation of (±)-Abyssinone II and its Analogues as Aromatase Inhibitors for Chemoprevention of Breast Cancer," *J. Med. Chem.* **50**, 2799-2806 (2007).
236. T. Sakamoto, M. D. Cullen, T. L. Hartman, K. M. Watson, R. W. Buckheit, C. Pannecouque, E. De Clercq, and M. Cushman, "Synthesis and Anti-HIV Activity of New Metabolically Stable Alkenyldiarylmethane Non-Nucleoside Reverse Transcriptase Inhibitors Incorporating *N*-Methoxy Imidoyl Halide and 1,2,4-Oxadiazole Systems," *J. Med. Chem.* **50**, 3314-3321 (2007).
237. E. Morgunova, S. Saller, I. Haase, M. Cushman, A. Bacher, M. Fischer and R. Ladenstein, "Lumazine Synthase from *Candida albicans* as an Anti-Fungal Target Enzyme: Structural and Biochemical Basis for Drug Design," *J. Biol. Chem.* **282**, 17231-17241 (2007).
238. A. Morrell, M. Placzek, S. Parmley, S. Antony, T. Dexheimer, Y. Pommier and M. Cushman, "Optimization of the Indenone Ring of Indenoisoquinoline Topoisomerase I Inhibitors," *J. Med. Chem.* **50**, 4388-4404 (2007).
239. A. Morrell, S. Antony, G. Kohlhagen, Y. Pommier, and M. Cushman, "Nitrated Indenoisoquinolines as Topoisomerase I Inhibitors: A Systematic Study and Optimization", *J. Med. Chem.* **50**, 4419-4430 (2007).
240. A. Talukdar, B. Illarionov, A. Bacher, M. Fischer, and M. Cushman, "Synthesis and Enzyme Inhibitory Activity of the *S*-Nucleoside Analogue of the Ribitylaminopyrimidine

Substrate of Lumazine Synthase and Product of Riboflavin Synthase," *J. Org. Chem.* **72**, 7167-7175 (2007).

241. Y. Zhang, G. Jin, B. Illarionov, A. Bacher, M. Fischer, and M. Cushman, "A New Series of 3-Alkyl Phosphate Derivatives of 4,5,6,7-Tetrahydro-1-D-ribityl-1*H*-pyrazolo[3,4-*d*]pyrimidinedione as Inhibitors of Lumazine Synthase: Design, Synthesis, and Biological Evaluation," *J. Org. Chem.* **72**, 7176-7184 (2007).
242. M. D. Cullen, B.-L. Deng, T. L. Hartman, K. M. Watson, R. W. Buckheit, Jr., C. Pannecouque, E. De Clercq, and M. Cushman, "Synthesis and Biological Evaluation of Alkenyldiarylmethane HIV-1 Non-Nucleoside Reverse Transcriptase Inhibitors that Possess Increased Hydrolytic Stability." *J. Med. Chem.* **50**, 4854-4867 (2007).
243. A. B. Edsall, G. E. Agoston, A. M. Treston, S. M. Plum, R. H. McClanahan, T.-S. Lu, W. Song, and M. Cushman, "Synthesis and In Vivo Antitumor Evaluation of 2-Methoxyestradiol 3-Phosphate, 17-Phosphate, and 3,17-Diphosphate," *J. Med. Chem.* **50**, 6700-6705 (2007).
244. S. Antony, K. K. Agama, Z.-H. Miao, K. Takagi, M. H. Wright, A. I. Robles, L. Varticovski, M. Nagarajan, A. Morrell, M., Cushman, and Y. Pommier, "Novel Indenoisoquinolines NSC 725776 and NSC 724998 Produce Persistent Topoisomerase I Cleavage Complexes and Overcome Multidrug Resistance," *Cancer Res.* **67**, 10397-10405 (2007).
245. M. D. Cullen, T. Sarkar, E. Hamel, T. L. Hartman, K. M. Watson, R. W. Buckheit, Jr., C. Pannecouque, E. De Clercq, and M. Cushman, "Inhibition of Tubulin Polymerization by Select Alkenyldiarylmethanes," *Bioorg. Med. Chem. Lett.* **18**, 469-473 (2008).
246. M. D. Cullen, Y.-F. Cheung, M. D. Houslay, T. L. Hartman, K. M. Watson, R. W. Buckheit, Jr., C. Pannecouque, E. De Clercq, and M. Cushman, "Investigation of the Alkenyldiarylmethane Non-nucleoside Reverse Transcriptase Inhibitors as Potential cAMP Phosphodiesterase-4B2 Inhibitors," *Bioorg. Med. Chem. Lett.* **18**, 1530-1533 (2008).
247. M. D. Cullen, D. Miles, A. Rothwell, C. Bonham, K. V. Wood and M. Cushman, "Hydrolysis of Thioesters in an Ion Trap," *Rapid Commun. Mass Spectrom.* **22**, 1094-1098 (2008).
248. Y. Zhang, B. Illarionov, E. Morgunova, G. Jin, A. Bacher, M. Fischer, R. Ladenstein, and M. Cushman, "A New Series of *N*-[2,4-Dioxo-6-D-ribitylamino-1,2,3,4-tetrahydropyrimidin-5-yl]-oxalamic Acid Derivatives as Inhibitors of Lumazine Synthase and Riboflavin Synthase: Design, Synthesis, Biochemical Evaluation, Crystallography, and Mechanistic Implications," *J. Org. Chem.* **73**, 2715-2724 (2008).
249. Z. L. Fang, Y. Song, T. Sarkar, E. Hamel, W. E. Fogler, G. E. Agoston, P. E. Fanwick, and M. Cushman, "Stereoselective Synthesis of 3,3-Diarylacrylonitriles as Tubulin Polymerization Inhibitors," *J. Org. Chem.* **73**, 4241-4244 (2008).
250. M. A. Cinelli, A. Morrell, T. S. Dexheimer, E. S. Scher, Y. Pommier, and M. Cushman, "Design, Synthesis, and Biological Evaluation of 14-Substituted Aromathecins as Topoisomerase I Inhibitors," *J. Med. Chem.* **51**, 4609-4619 (2008).
251. Z. Li, M. Khaliq, Z. Zhou, C. B. Post, R. J. Kuhn, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Antiviral Agents Targeting Flavivirus Envelope Proteins," *J. Med. Chem.* **51**, 4660-4671 (2008).
252. Y. L. Song and M. Cushman, "The Binding Orientation of a Norindenoisoquinoline in the Topoisomerase I-DNA Cleavage Complex Is Primarily Governed by π-π Stacking Interactions," *J. Phys. Chem. B* **112**, 9484-9489 (2008).
253. M. Cuendet, C. P. Oteham, A. Maiti, B. A. Craig, M. Cushman, R. C. Moon and J. M. Pezzuto, "Zapotin Prevents Mouse Skin Tumorigenesis During the Stages of Initiation and Promotion," *Anticancer Res.* **28**, 3705-3709 (2008).

254. T.-Y. Yu, R. D. O'Connor, A. C. Sivertsen, C. Chiauzzi; B. Poliks, M. Fischer, A. Bacher, I. Hasse, and M. Cushman, J. Schaefer,"^{15}N{^{31}P} REDOR NMR Studies of the Binding of Phosphonate Reaction Intermediate Analogues to *Saccharomyces cerevisiae* Lumazine Synthase," *Biochemistry* **47**, 13942-13951 (2008).
255. R. P. Bakshi, D. Sang, A. Morrell, M. Cushman, and T. A. Shapiro, "Activity of Indenoisoquinolines against African Trypanosomes," *Antimicrob. Agents Chemother.* **53**, 123-128 (2009).
256. Y. Pommier and M. Cushman, "The Indenoisoquinoline Non-Camptothecin Topoisomerase I Inhibitors: Update and Perspectives." *Mol. Cancer Ther.* **8**, 1008-1014 (2009).
257. B.-L. Deng, Y. Zhao, T. L. Hartman, K. Watson, R. W. Buckheit Jr., C. Pannecouque, E. De Clercq, and M. Cushman, "Synthesis of Alkenyldiarylmethanes (ADAMs) Containing Benzo[*d*]isoxazole and Oxazolidin-2-one Rings, a New Series of Potent Non-nucleoside HIV-1 Reverse Transcriptase Inhibitors," *Eur. J. Med. Chem.* **44**, 1210-1214 (2009).
258. A. Maiti, M. Sturdy, L. Marler, S. D. Pegan, A. Mesecar, J. M. Pezzuto, and M. Cushman, "Synthesis of Casimiroin and Optimization of Its Quinone Reductase 2 and Aromatase Inhibitory Activity," *J. Med. Chem.* **52**, 1873-1884 (2009).
259. Y. Zhao, A. Bacher, B. Illarionov, M. Fischer, G. Georg, Q.-Z. Ye, P. E. Fanwick, S. G. Franzblau, B. Wan, and M. Cushman, "Discovery and Development of the Covalent Hydrates of Trifluoromethylated Pyrazoles as Riboflavin Synthase Inhibitors with Antibiotic Activity Against *Mycobacterium tuberculosis*," *J. Org. Chem.* **74**, 5297-5303 (2009).
260. A. Talukdar, M. Breen, A. Bacher, B. Illarionov, M. Fischer, G. Georg, Q.-Z. Ye, and M. Cushman, "Discovery and Development of a Small Molecule Library with Lumazine Synthase Inhibitory Activity," *J. Org. Chem.* **74**, 5123-5134 (2009).
261. M. A. Cinelli, B. Cordero, T. S. Dexheimer, Y. Pommier, and M. Cushman, "Synthesis and Biological Evaluation of 14-(Aminoalkyl-aminomethyl)aromathecins as Topoisomerase I Inhibitors: Investigating the Hypothesis of Shared Structure-Activity Relationships," *Bioorg. Med. Chem.* **17**, 7145-7155 (2009).
262. M. D. Cullen, W. C. Ho, J. D. Bauman, K. Das, E. Arnold, T. Hartman, K. M. Watson, R. W. Buckheit, C. Pannecouque, E. De Clercq, and M. Cushman, "Crystallographic Study of a Novel Subnanomolar Inhibitor Provides Insight on the Binding Interactions of Alkenyldiarylmethanes with Human Immunodeficiency Virus-1 Reverse Transcriptase," *J. Med. Chem.* **52**, 6467-6473 (2009).
263. Z. Fang, G. E. Agoston, G. Ladouceur, A. Treston, L. Wang, and M. Cushman, "Structure Elucidation by Synthesis of Four Metabolites of the Antitumor Drug ENMD-1198 Detected in Human Plasma Samples," *Tetrahedron* **65**, 10535-10543 (2009).
264. Y. Song, A. Shao, T. S. Dexheimer, E. S. Scher, Y. Pommier, and M. Cushman, "Structure-Based Design, Synthesis, and Biological Studies of New Anticancer Norindenoisoquinoline Topoisomerase I Inhibitors," *J. Med. Chem.* **53**, 1979-1989 (2010).
265. R.-R. Kim, B. Illarionov, M. Joshi, M. Cushman, C. Y. Lee, W. Eisenreich, M. Fischer, and A. Bacher, "Mechanistic Insights on Riboflavin Synthase Inspired by Selective Binding of the 6,7-Dimethyl-8-ribityllumazine Exomethylene Anion," *J. Amer. Chem. Soc.* **132**, 2983-2990 (2010).
266. A. Talukdar, E. Morgunova, J. Duan, W. Meining, N. Foloppe, L. Nilsson, A. Bacher, B. Illarionov, M. Fischer, R. Ladenstein, and M. Cushman, "Virtual Screening, Selection

and Development of a Benzindolone Structural Scaffold for Inhibition of Lumazine Synthase," *Bioorg. Med. Chem.* **18**, 3518-3534 (2010).

267. B. Sun, J. Hoshino, K. Jermihov, L. Marler, J. M. Pezzuto, A. D. Mesecar, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Resveratrol Analogues as Aromatase and Quinone Reductase 2 Inhibitors for Chemoprevention of Cancer," *Bioorg. Med. Chem.* **18**, 5352-5366 (2010).
268. A. S. Mayhoub, A. Talukdar, and M. Cushman, "An Oxidation of Benzyl Methyl Ethers with NBS that Selectively Affords Either Aromatic Aldehydes or Aromatic Methyl Esters," *J. Org. Chem.* **75**, 3507-3510 (2010).
269. J. Hoshino, E.-J. Park, T. P. Kondratyuk, L. Marler, J. M. Pezzuto, R. B. van Breemen, S. Mo, Y. Li, and M. Cushman "Selective Synthesis and Biological Evaluation of Sulfate-Conjugated Resveratrol Metabolites," *J. Med. Chem.* **53**, 5033-5043 (2010).
270. P. V. N. Reddy, B. Banerjee, and M. Cushman "Efficient Total Synthesis of Ammosamide B," *Org. Lett.* **12**, 3112-3114 (2010).
271. M. A. Cinelli, A. E. Morrell, T. S. Dexheimer, K. Agama, S. Agrawal, Y. Pommier, and M. Cushman, "The Structure–activity Relationships of A-Ring-substituted Aromathecin Topoisomerase I Inhibitors Strongly Support a Camptothecin-like Binding Mode," *Bioorg. Med. Chem.* **18**, 5535-5552 (2010).
272. E. Morgunova, B. Illarionov, S. Sallar, A. Popov, T. Sambaiah, A. Bacher, M. Cushman, M. Fischer, and R. Ladenstein "Structural Study and Thermodynamic Characterization of Inhibitor Binding to Lumazine Synthase from *Bacillus anthracis*," *Acta Crystallogr.*, **D66**, 1001-1011 (2010).
273. L. Marler, M. Conda-Sheridan, M. A. Cinelli, A. E. Morrell, M. Cushman, L. Chen, K. Huang, R. van Breemen, and J. M. Pezzuto "Cancer Chemopreventive Potential of Aromathecins and Phenazines, Novel Natural Product Derivatives," *Anticancer Res.* **30**, 4873-4882 (2010).
274. E. Kiselev, T. S. Dexheimer, Y. Pommier, and M. Cushman "Design, Synthesis, and Evaluation of Dibenzo[*c,h*][1,6]naphthyridines as Topoisomerase I Inhibitors and Potential Anticancer Agents," *J. Med. Chem.* **53**, 8716-8726 (2010).
275. M. Conda-Sheridan, L. Marler, E.-J. Park, T. P. Kondratyuk, K. Jermihov, A. D. Mesicar, J. M. Pezzuto, R. N. Asolkar, W. Fenical, and M. Cushman "Potential Chemopreventive Agents Based on the Structure of the Lead Compound 2-Bromo-1-hydroxyphenazine, Isolated from *Streptomyces* Species, Strain CNS284," *J. Med. Chem.* **53**, 8688-8699 (2010).
276. E.-J. Park, T. P. Kondratyuk, A. Morrell, E. Kiselev, M. Conda-Sheridan, M. Cushman, S. Ahn, Y. Cho, J. J. White, R. B. van Breemen, and J. M. Pezzuto, "Induction of Retinoid X Receptor Activity and Consequent Up-regulation of $p21^{WAF1/CIP1}$ by Indenoisoquinolines in MCF7 Cells," *Cancer Prev. Res.* **4**, 592-607 (2011).
277. A. S. Mayhoub, M. Khaliq, R. J. Kuhn, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Thiazoles Targeting Flavivirus Envelope Proteins," *J. Med. Chem.* **54**, 1704-1714 (2011).
278. T. P. Kondratyuk, E.-J. Park, L. E. Marler, S. Ahn, Y. Yuan, Y. Choi, R. B. van Breemen, B. Sun, J. Hoshino, M. Cushman, K. C. Jermihov, A. D. Mesecar, C. J. Grubbs, and J. M. Pezzuto, "Resveratrol Derivatives as Promising Chemopreventive Agents with Improved Potency and Selectivity," *Mol. Nutr. Food Res.* **55**, 1249-1265 (2011).
279. K. E. Peterson, M. A. Cinelli, A. E. Morrell, A. Mehta, T. S. Dexheimer, K. Agama, S. Antony, Y. Pommier, and M. Cushman, "Alcohol-, Diol-, and Carbohydrate-Substituted Indenoisoquinolines as Topoisomerase I Inhibitors: Investigating the Relationships

Involving Stereochemistry, Hydrogen Bonding, and Biological Activity," *J. Med. Chem.* **54**, 4937-4953 (2011).

280. A. S. Mayhoub, M. Khaliq, C. Botting, Z. Li, R. J. Kuhn, and M. Cushman, "An Investigation of Phenylthiazole Antiflaviviral Agents," *Bioorg. Med. Chem.* **19**, 3845-3854 (2011).
281. A. S. Mayhoub, E. Kiselev, and M. Cushman, "An Unexpected Synthesis of 3,5-Diaryl-1,2,4-thiadiazoles from Thiobenzamides and Methyl Bromocyanoacetate," *Tetrahedron Lett.* **52**, 4941-4943 (2011).
282. E. Kiselev, S. DeGuire, A. Morrell, K. Agama, T. S. Dexheimer, Y. Pommier, and M. Cushman, "7-Azaindenoisoquinolines as Topoisomerase I Inhibitors and Potential Anticancer Agents," *J. Med. Chem.* **54**, 6106-6116 (2011).
283. W. J. Lu, C. Xu, Z. Pei, A. S. A. Mayhoub, M. Cushman, and D. A. Flockhart, "The Tamoxifen Metabolite Norendoxifen is a Potent and Selective Inhibitor of Aromatase (CYP19) and a Potential Lead Compound for Novel Therapeutic Agents," *Breast Cancer Res. Treat.* **133**, 99-109 (2012).
284. E.-J. Park, E. Kiselev, M. Conda-Sheridan, M. Cushman, and J. M. Pezzuto, "Induction of Apoptosis by 3-Amino-6-(3-aminopropyl)-5,6-dihydro-5,11-dioxo-11*H*-indeno[1,2-*c*]isoquinoline via Modulation of MAPKs (p38 and Jun N-terminal Kinase) and c-Myc in HL-60 Human Leukemia Cells," *J. Nat. Prod.* **75**, 378-384 (2012).
285. A. S. Mayhoub, L. Marler, T. Kondratyuk, E.-J. Park, J. M. Pezzuto, and M. Cushman, "Optimizing Thiadiazole Analogues of Resveratrol Versus Three Chemopreventive Targets," *Bioorg. Med. Chem.* **20**, 510-520 (2012).
286. P. V. N. Reddy, K. C. Jensen, A. D. Mesecar, P. E. Fanwick, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Potent Quinoline and Pyrroloquinoline Ammosamide Analogues as Inhibitors of Quinone Reductase 2, "*J. Med. Chem.* **55**, 367-377 (2012).
287. E. Kiselev, K. Agama, Y. Pommier, and M. Cushman, "Azaindenoisoquinolines as Topoisomerase I Inhibitors and Potential Anticancer Agents: A Systematic Study of Structure-Activity Relationships," *J. Med. Chem.* **55**, 1682-1697 (2012).
288. A. S. Mayhoub, L. Marler, T. P. Kondratyuk, E.-J. Park, J. M. Pezzuto, and M. Cushman, "Optimization of the Aromatase Inhibitory Activities of Pyridylthiazole Analogues of Resveratrol," *Bioorg. Med. Chem.* **20**, 2427-2434 (2012).
289. T. X. Nguyen, A. Morrell, M. Conda-Sheridan, C. Marchand, K. Agama, A. Bermingham, A. G. Stephen, A. Chergui, A. Naumova, R. Fisher, B. O'Keefe, Y. Pommier, and M. Cushman, "Synthesis and Biological Evaluation of the First Dual Tyrosyl-DNA Phosphodiesterase I (Tdp1)−Topoisomerase I (Top1) Inhibitors," *J. Med. Chem.* **55**, 4457-4478 (2012).
290. E. Kiselev, N. Empey, K. Agama, Y. Pommier, and M. Cushman, "Dibenzo[*c,h*][1,5]naphthyridinediones as Topoisomerase I Inhibitors" Design, Synthesis, and Biological Evaluation," *J. Org. Chem.* **77**, 5167-5172 (2012).
291. A. Talukdar, Y. Zhao, W. Lv, A. Bacher, B. Illarionov, M. Fischer, and M. Cushman, "*O*-Nucleoside, *S*-Nucleoside, and *N*-Nucleoside Probes of Lumazine Synthase and Riboflavin Synthase," *J. Org. Chem.* **77**, 6239-6261 (2012).
292. L. Chen, M. Conda-Sheridan, P. V. N. Reddy, A. Morrell, E.-J. Park, T. P. Kondratyuk, J. M. Pezzuto, R. B. van Breemen, and M. Cushman, "Identification, Synthesis, and Biological Evaluation of the Metabolites of 3-Amino-6-(3'-aminopropyl)-5*H*-indeno[1,2-*c*]isoquinoline-5,11-dione (AM6-36), a Promising Rexinoid Lead Compound for the

Development of Cancer Chemotherapeutic and Chemopreventive Agents," *J. Med. Chem.* **55**, 5965-5981 (2012).

293. D. Sun, J. G. Hurdle, R. E. Lee, R. E. Lee, M. Cushman, and J. M. Pezzuto, "Evaluation of Flavonoid and Resveratrol Chemical Libraries Reveals Abyssinone II as a Promising Antibacterial Lead," ChemMedChem **7**, 1541-1545 (2012).
294. R. Balana-Fouce, C. Prada, J. Requena, M. Cushman, Y. Pommier, R. Álvarez-Velilla, J. Escudero-Martínez, E. Calvo-Álvarez, Y. Pérez-Pertejo, and R. Reguera "Indotecan (LMP400) and AM13-55: Two Novel Indenoisoquinolines Show Potential for Treating Visceral Leishmaniasis," *Antimicrob. Agents Chemother.* **56**, 5264-5270 (2012).
295. A. S. Mayhoub, L. Marler, T. P. Kondratyuk, E.-J. Park, J. M. Pezzuto, and M. Cushman[§], "Optimization of Thiazole Analogues of Resveratrol for Induction of NAD(P)H:quinone Reductase 1 (QR1)," *Bioorg. Med. Chem.* **20**, 7030-7039 (2012).
296. G. Mancini, I. D'Annessa, A. Coletta, G. Chillemi, Y. Pommier, M. Cushman, and A. Desideri, "Binding of an Indenoisoquinoline to the Topoisomerase-DNA Complex Induces Reduction of Linker Mobility and Strengthening of Protein-DNA Interaction," PloS ONE 7(12): e51354. doi:10.1371/journal.pone.0051354 (http://dx.plos.org/10.1371/journal.pone.0051354).
297. M. A. Cinelli, P. V. N. Reddy, P.-C. Lv, J.-H. Liang, L. Chen, K. Agama, Y. Pommier, R. B. van Breemen, and M. Cushman, "Identification, Synthesis, and Biological Evaluation of Metabolites of the Experimental Cancer Treatment Drugs Indotecan (LMP400) and Indimitecan (LMP 776) and Investigation of Isomerically Hydroxylated Indenoisoquinoline Analogues as Topoisomerase I Poisons," *J. Med. Chem.* **55**, 10844-10862 (2012).
298. J.-H. Liang, K. An, W. Lv, M. Cushman, H. Wang, and Y.-C. Xu, "Synthesis, Antibacterial Activity and Docking of 14-Membered 9-*O*-(3-Arylalkyl)oxime 11,12-Cyclic Carbonate Ketolides," *Eur. J. Med. Chem.* **59**, 54-63 (2013).
299. J.-H. Liang, W. X.-L. Li, K. An, M. Cushman, H. Wang, and Y.-C. Xu, "Synthesis and Antibacterial Activity of 9-Oxime Ether Non-ketolides, and Novel Binding Mode of Alkylides," *Bioorg. Med. Chem. Lett.* **23**, 1387-1393 (2013).
300. M. Conda-Sheridan, P. V. Narasimha Reddy, A. Morrell, B. T. Cobb, C. Marchand, K. Agama, A. Chergui, A. Renaud, A. G. Stephen, L. K. Bindu, Y. Pommier, and M. Cushman, "Synthesis and Biological Evaluation of Indenoisoquinolines That Inhibit Both Tyrosyl-DNA Phosphodiesterase I (Tdp1) and Topoisomerase I (Top1)," *J. Med. Chem.* **56**, 182-200 (2013).
301. M. Conda-Sheridan, E.-J. Park, D. E. Beck, P. V. N. Reddy, T. X. Nguyen, B. Hu, L. Chen, J. L. White, R. B. van Breemen, J. M. Pezzuto, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Indenoisoquinoline Rexinoids with Chemopreventive Potential," *J. Med. Chem.* **56**, 2581-2605 (2013).
302. W. Lv, J. Liu, D. Lu, D. A. Flockhart, and M. Cushman, "Synthesis of Mixed (*E*,*Z*)- , (*E*)- , and (*Z*)- Norendoxifen with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," *J. Med. Chem.* **56**, 4611-4618 (2013).
303. J. Liu, P. J. Flockhart, D. Lu, W. Lv, J. Lu, X. Han, M. Cushman, and D. A. Flockhart, "Inhibition of Cytochrome P450 Isoforms by the E- and Z-Isomers of Norendoxifen," *Drug Metab. Dispos.* **41**, 1715-1720 (2013).
304. A. Coletta, S. Castelli, G. Chillemi, N. Sanna, M. Cushman, Y. Pommier, and A. Desideri, "Solvent Dependency of the UV-Vis Spectrum of Indenoisoquinolines: Role of Keto-oxygens as Polarity Interaction Probes", *PLoS ONE* 8(9): e73881.

doi:10.1371/journal.pone.0073881 (2013).
(http://dx.plos.org/10.1371/journal.pone.0073881

305. J. López-Sagaseta, C. Dulberger, A. McFedries, M. Cushman, A. Saghatelian, and E. Adams, "MAIT Recognition of a Stimulatory Bacterial Antigen Bound to MR1," *J. Immunol.* **191**, 5268-5277 (2013).
306. W. Lv, B. Banerjee, K. Molland, M. N. Seleem, A. Ghafoor, M. I. Hamed, B. Wan, S. G. Franzblau, A. D. Mesecar, and M. Cushman, "Synthesis of 3-(3-Aryl-pyrrolidin-1-yl)-5-aryl-1,2,4-triazines that Have Antibacterial Activity and Also Inhibit Inorganic Pyrophosphatase," *Bioorg. Med. Chem.* **22**, 406-418 (2014).
307. E. Kiselev, D. Sooryakumar, K. Agama, M. Cushman, and Y. Pommier, "Optimization of the Lactam Side Chain of 7-Azaindenoisoquinoline Topoisomerase I Inhibitors and Mechanism of Action Studies on Cancer Cells," *J. Med. Chem.* **57**, 1289-1298 (2014).
308. D. E. Beck, K. Agama, C. Marchand, A. Chergui, Y. Pommier, and M. Cushman, "Synthesis and Biological Evaluation of New Carbohydrate-Substituted Indenoisoquinoline Topoisomerase I Inhibitors and Improved Synthesis of the Experimental Anticancer Agents Indotecan (LMP400) and Indimitecan (LMP776)," *J. Med. Chem.* **57**, 1495-1512 (2014).
309. H. Mohammad, A. Mayhoub, A. Ghafoor, M. Soofi, R. A. Alajlouni, M. Cushman, and M. N. Seleem, "Discovery and Characterization of Potent Thiazoles versus Methicillin- and Vancomycin-Resistant *Staphylococcus aureus*," *J. Med. Chem.* **57**, 1609-1615 (2014).
310. J. Li, P. Li, J. N. Fletcher, W. Lv, Y. Deng, M. A. Vincent, J. P. Slack, T. S. McCluskey, Z. Jia, M. Cushman, A. D. Kinghorn, "In Vitro Evaluation of Potential Bitterness-Masking Terpenoids from the Canada Goldenrod (*Solidago canadensis*)," *J. Nat. Prod.* **57**, 1937-1743 (2014).
311. P.-C. Lv, K. Agama, C. Marchand, Y. Pommier, M. Cushman, "Design, Synthesis, and Biological Evaluation of *O*-2-Modified Indenoisoquinolines as Dual Topoisomerase I-Tyrosyl-DNA Phosphodiesterase I Inhibitors, "*J. Med. Chem.* **57**, 4324-4336 (2014).
312. M. Cushman, G. I. Georg, U. Holzgrabe, and S. Wang, "Absolute Quantitative ^{1}H-NMR Spectroscopy for Compound Purity Determination," *J. Med. Chem.* **57**, 9219 (2014).
313. H. Mohammed, A. S. Mayhoub, M. Cushman, and M. N. Seleem, "Anti-biofilm Activity and Synergism of Novel Thiazole Compounds with Glycopeptide Antibiotics against Multidrug-Resistant Staphylococci," *J. Antibiot.* **68**, 259-266 (2015).
314. H. Mohamed, P. V. N. Reddy, D. Monteleone, M. Cushman, and M. N. Seleem, "Synthesis and Antibacterial Evaluation of a Novel Series of Synthetic Phenylthiazole Compounds against Methicillin-resistant *Staphylococcus aureus* (MRSA), *Eur. J. Med. Chem.* **94**, 306-316 (2015).
315. W. Lv, J. Liu, T. C. Skaar, D. A. Flockhart, and M. Cushman, "Design and Synthesis of Norendoxifen Analogues with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," *J. Med. Chem.* **58**, 2623-2648 (2015).
316. T. X. Nguyen, M. Abdelmalak, C. Marchand, K. Agama, Y. Pommier, and M. Cushman, "Synthesis and Biological Evaluation of Nitrated 7-, 8-, 9-, and 10-Hydroxyindenoisoquinolines as Potential Dual Topoisomerase I (Top1) − Tyrosyl-DNA Phosphodiesterase I (TDP1) Inhibitors," *J. Med. Chem.* **58**, 3188-3103 (2015).
317. J. Roy, T. X. Nguyen, A. K. Kanduluru, C. Venkatesh, W. Lv., P. V. N. Reddy, P. S. Low, and M. Cushman, "DUPA Conjugation of a Cytotoxic Indenoisoquinoline Topoisomerase I Inhibitor for Selective Prostate Cancer Cell Targeting," *J. Med. Chem.* **58**, 3094-3103 (2015).

318. D. E. Beck, M. Abdelmalek, W. Lv, P. V. N. Reddy, G. S. Tender, E. O'Neill, K. Agama, C. Marchand, Y. Pommier, and M. Cushman, "Discovery of Potent Indenoisoquinoline Topoisomerase I Poisons Lacking the 3-Nitro Toxicophore," *J. Med. Chem.* **58**, 3997-4015 (2015).
319. X. Han, W. Lv, S.-Y- Guo, M. Cushman, and J.-H. Liang, "Synthesis and Structure-Activity Relationships of Novel 9-Oxime Acylides with Improved Bactericidal Activity," *Bioorg. Med. Chem.* **23**, 6437-6453 (2015).
320. H. Mohammad, P. V. N. Reddy, D. Monteleone, A. S. Mayhoub, M. Cushman, G. K. Hammac, M. N. Seleem, "Antibacterial Characterization of Novel Synthetic Thiazole Compounds against Methicillin-Resistant *Staphylococcus pseudintermedius*, *PLoS ONE*, **10** (2015). 10.1371/journal.pone.0130385, June 18, 2015. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130385
321. H. Mohammad, M. Cushman, and M. N. Seleem, "Antibacterial Evaluation of Synthetic Phenylthiazole Compounds *In Vitro* and *In Vivo* against a Methicillin-Resistant *Staphylococcus aureus* (MRSA) Murine Skin Infection Model. PLoS ONE **10** (2015) e0130385. doi:10.1371/journal.pone.0142321 November 4, 2015. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0142321
322. Z. L. Chelsky, P. Yue, T. P. Kondratyuk, D. Paladino, J. M. Pezzuto, M. Cushman, and J. Turkson, "A Resveratrol Analogue Promotes ERK-^{MAPK}-Dependent Stat3 Serine and Tyrosine Phosphorylation Alterations and Antitumor Effects In Vitro against Human Tumor Cells, *Mol. Pharm.* **88**, 524-533 (2015).
323. W. Lv, J. Liu, T. C. Skaar, E. O'Neill, G. Yu, D. A. Flockhart, and M. Cushman, "Synthesis of Triphenylethylene Bisphenols as Aromatase Inhibitors that Also Modulate Estrogen Receptors," *J. Med. Chem.* **59**, 157-170 (2016).
324. D. E. Beck, W. Lv, M. Abdelmalak, C. B. Plescia, K. Agama, C. Marchand, Y. Pommier, and M. Cushman, "Synthesis and Biological Evaluation of new Fluorinated and Chlorinated Indenoisoquinoline Topoisomerase I Inhibitors," *Bioorg. Med. Chem.* **24**, 1469-1479 (2016).
325. D. E. Beck, P. V. N. Reddy, W. Lv, M. Abdelmalak, G. S. Tender, S. Lopez, K. Agama, C. Marchand, Y. Pommier, and M. Cushman, "Investigation of the Structure-Activity Relationships of Aza-A-Ring Indenoisoquinoline Topoisomerase I Poisons," *J. Med. Chem.* **59**, 3840-3853 (2016).
326. P.-C Lv, M. S. A. Elsayed, K. Agama, C. Marchand, Yves Pommier, and M. Cushman, "Design, Synthesis, and Biological Evaluation of Potential Prodrugs Related to the Experimental Anticancer Agent Indotecan (LMP400)," *J. Med. Chem.* **59**, 4890-4899 (2016).
327. A. Hoshi, T. Sakamoto, J. Takayama, M. Xuan, M. Okazaki, T. Hartman, R. Buckheit Jr., C. Pannecouque, and M. Cushman, "Systematic Evaluation of Methyl Ester Bioisosteres in the Context of Developing Alkenyldiarylmethanes (ADAMs) as Non-nucleoside Reverse Transcriptase Inhibitors (NNRTIs) for anti-HIV-1 Chemotherapy," *Bioorg. Med. Chem.* **24**, 3006-3022 (2016).
328. L.-M. Zhao, H.-S. Jin, J. Liu, T. Skaar, J. Ipe, W. Lv, D. A. Flockhart, and M. Cushman "A New Suzuki Synthesis of Triphenylethylenes that Inhibit Aromatase and Bind to Estrogen Receptors α and β," *Bioorg. Med. Chem.* **24**, 5400-5409 (2016).
329. M. S. A. Elsayed, M. Zeller, and M. Cushman "Synthesis of Indolo[4,3-*bc*]phenanthridine-6,11(2*H*,12*H*)-diones Using the Schiff Base–Homophthalic Anhydride Cyclization Reaction," Syn. Commun. **46**, 1902-1908 (2016).
330. M. Haroon, W. Younis, L. Chen, C. E. Peters, J. Pogliano, K. Pogliano, B. Cooper, J. Zhang, A. Mayhoub, E. Oldfield, M. Cushman, and M. Seleem "Phenylthiazole

Antibacterial Agents Targeting Cell Wall Synthesis Exhibit Potent Activity In Vitro and In Vivo against Vancomycin-resistant Enterococci," *J. Med. Chem.* **60**, 2425-2438 (2017).

331. J.-C. Tian, X. Han, W. Lv, Y.-X. Li, H, Wang, B.-Z. Fan, M. Cushman, J.-H. Liang "Design, Synthesis, and Structure-Bactericidal Activity Relationships of Novel 9-Oxime Ketolides and Reductive Epimers of Acylides," *Bioorg. Med. Chem. Lett.* **27**, 1513-1524 (2017).
332. P. Wang, M. S. A. Elsayed, C. B. Plescia, A. Ravji, C. E. Redon, E. Kiselev, C. Marchand, O. Zeleznik, K. Agama, Y. Pommier, and M. Cushman "Synthesis and Biological Evaluation of the First Triple Inhibitors of Human Topoisomerase 1, Tyrosyl−DNA Phosphodiesterase 1 (Tdp1), and Tyrosyl−DNA Phosphodiesterase 2 (Tdp2)," *J. Med. Chem.* **60**, 3275-3288 (2017).
333. J. H. Liang, L. Yang, S. Wu, S.-S. Liu, M. Cushman, J. Tian, N.-M. Li, Q.-H. Yang, H.-O. Zhang, Y.-J. Qui, L. Xiang, C.-X. Ma, X.-M. Li, and H. Qing "Discovery of Efficient Stimulators for Adult Hippocampal Neurogenesis Based on Scaffolds in Dragon's Blood," *Eur. J. Med. Chem.* **136**, 382-392 (2017).
334. M. S. A. Elsayed, Y. Su, P. Wang, T Sethi, K. Agama, A. Ravji, C. E. Redon, E. Kiselev, K. A. Horzmann, J. L. Freeman, Y. Pommier, and M. Cushman "Design and Synthesis of Chlorinated and Fluorinated 7-Azaindenoisoquinolines as Potent Cytotoxic Anticancer Agents That Inhibit, Topoisomerase I,*" J. Med. Chem*. **60**, 5364-5376 (2017).
335. M. S. A. Elsayed, S. Chang, and M. Cushman, "Ligand-free, Palladacycle-facilitated Suzuki Coupling of Hindered 2-Arylbenzothiazole Derivatives Yields Potent and Selective COX-2 Inhibitors, *Org. Biomol. Chem.* **16**, 108-118 (2018).
336. L. Marzi, K. Agama, J. Murai, S. Difilippantonio, A. James, S. Sharan, D. Beck, M. Cushman, and Y. Pommier, "Novel Fluoroindenoisoquinoline Non-Camptothecin Topoisomerase I Inhibitors, *Mol. Cancer Ther*. **17**, 1694-1704 (2018).
337. H.-M. Lee, E. P. Clark, M. B. Kuijer, M. Cushman, Y. Pommier, and B. D. Philpot, "Characterization and Structure-Activity Relationships of Indenoisoquinoline-Derived Topoisomerase I Inhibitors in Unsilencing the Dormant *Ube3a* Gene Associated with Angelman Syndrome," *Mol. Autism* **9**, 45 (2018) https://doi.org/10.1186/s13229-018-0228-2
338. N. Nenortas, M. Cinelli, A. Morrell, M. Cushman, and T. Shapiro, "Activity of Aromathecins against African Trypanosomes," *Antimicrob. Agents Chemother.* **62**: e00786-18. https://doi.org/10.1128/AAC.00786-18.
339. M. S. A. Elsayed, B. Griggs, and M. Cushman, "Synthesis of Benzo[1,6]naphthyridinones Using the Catellani Reaction," *Organic Lett.* **20**, 5228-5232 (2018).
340. T.-c. Hsieh, J. Zhang, D. J. Bennett, J. M. Pezzuto, M. Cushman, and J. M. Wu, "The Effects of Resveratrol and Its Analogues on the Sirt5-GLS Axis-Mediated Glutamine Metabolic Reprogramming in Cancer Cells," in *Resveratrol: State-of-the-Art Science and Health Applications; Actionable Targets and Mechanisms of Resveratrol*, J. M. Wu and T.-c. Hsieh, Eds., World Scientific, Singapore, 2019, 159-182.
341. M. S. A. Elsayed, J. J. Nielsen, S. Park, J. Park, Q Liu, C. H. Kim, Y. Pommier, K. Agama, P. S. Low, and M. Cushman, "Application of Sequential Palladium Catalysis for the Discovery of Janus Kinase Inhibitors in the Benzo[*c*]pyrrolo[2,3-*h*][1,6]naphthyridin-5-one (BPN) Series," *J. Med. Chem.* **61**, 10440-10462 (2018).

342. Y. Pommier, M. Cushman, and J. H. Doroshow, "Novel Clinical Indenoisoquinoline Topoisomerase I Inhibitors: a Twist Around the Camptothecins," *Oncotarget* **9**, 37386-37288 (2018).
343. C.-X. Ma, W. Lv, Y.-X. Li, B.-Z. Fan, X. Han, F.-S. Kong, J.-C. Tian, M. Cushman, and J.-H. Liang, "Design, Synthesis and Structure-Activity Relationships of Novel Macrolones: Hybrids of 2-Fluoro 9-Oxime Ketolides and Carbamoyl Quinolones with Highly Improved Activity against Resistant Pathogens," *Eur. J. Med. Chem.* **169**, 1-20 (2019).
344. X.-M. Li, W. Lv, S.-Y. Guo, Y.-X. Li, B.-Z. Fan, M. Cushman, F.-S. Kong, J. Zhang, and J.-H. Liang "Synthesis and Structure-Bactericidal Activity Relationships of Non-ketolides: 9-Oxime Clarithromycin 11,12-Cyclic Carbonate Featured with Three-To-Eight-Length Spacers at 3-OH," *Eur. J. Med. Chem.* **171**, 235-254 (2019).
345. K.-B. Wang, M. S. A. Elsayed, G. Wu, N. Deng, M. Cushman, and D. Yang, "Indenoisoquinoline Topoisomerase Inhibitors Strongly Bind and Stabilize the *MYC* Promoter G-Quadruplex and Downregulate *MYC*, *J, Am. Chem. Soc.* **141**, 11059-11070 (2019).

Intellectual Property Disclosures (since 2007):

1. "Anti-trypanosomal activity of topoisomerase IB-targeting indenoisoquinolines", Mark S. Cushman, Andrew Morrell, Dongpei Sang, Rahul Bakshi, and Theresa Shapiro, June 12, 2007.
2. "Hydrolytically Stable Alkenyldiarylmethane Non-nucleoside Reverse Transcriptase Inhibitors," Mark S. Cushman and Matthew Cullen, March 1, 2007.
3. "14-Substituted Aromathecin Topoisomerase I Inhibitors," Mark S. Cushman, Maris Cinelli, Andrew Morrell, and Yves Pommier, April 17, 2008.
4. "Riboflavin Synthase Inhibitors as Potential Antitubercular Agents," Mark S. Cushman, Yanlei Zhang, Markus Fischer, and Adelbert Bacher, April 8, 2009.
5. "Discovery of a Novel Indenoisoquinoline Inducer of the Retinoid X Receptor Response Element (RXRE)," Mark S. Cushman, John M. Pezzuto, Eun-Jung Park, and Andrew Morrell, June 2, 2009.
6. "Casimiroin-Based Aromatase and QR2 Inhibitors," Mark S. Cushman, John M. Pezzuto, and Arup Maiti, January 21, 2009.
7. "New Antitumor Norindenoisoquinoline Topoisomerase I Inhibitors," Mark S. Cushman, Yunlong Song, and Yves Pommier, August 11, 2009.
8. "Substituted Dibenzo[*c,h*]naphthyridinediones, 11-Chlorodibenzo[*c,h*]naphthyridinones and Dibenzo[*c,h*]naphthyridines as Topoisomerase I Inhibitors and Potential Anticancer Agents," Mark S. Cushman, Evgeny Kiselev, and Yves Pommier, June 10, 2010.
9. "Indenoisoquinoline Topoisomerase I Inhibitors Substituted with Carbohydrates," Mark S. Cushman, Katherine Peterson, Maris Cinelli, Andrew Morrell, and Yves Pommier, October 22, 2010.
10. " Potential Chemopreventive Agents Based on the Structure of the Lead Compound 2-Bromo-1-hydroxyphenazine, Isolated from *Streptomyces* sp., Strain CNS284," Mark S. Cushman and Martin Conda-Sheridan, November 1, 2010.
11. "Preparation of Phenylthiazole Derivatives as Antiviral Agents," Abdelrahman Salah Mayhoub, Mansoora Khaliq, Richard Kuhn, and Mark S. Cushman, February 4, 2011.
12. "Preparation of Azole Derivatives as Cancer Chemopreventive Agents," Abdelrahman Salah Mayhoub, John M. Pezzuto, and Mark S. Cushman, April 1, 2011.

13. "Synthesis and Use of Dual Tyrosyl-DNA Phosphodiesterase I (Tdp1)-Topoisomerase I (Top1) Inhibitors", Mark S. Cushman and Nguyen Trung, March 8, 2012.
14. "Dibenzo[*c,h*][1,5]naphthyridinediones as Topoisomerase I Inhibitors: Design, Synthesis, and Biological Evaluation," Mark S. Cushman and Evgeny Kiselev, March 21, 2012.
15. "A Novel Synthesis of the Anticancer Drugs Indotecan (LMP400) and Indotecan (LMP776)," Mark S. Cushman, June 6, 2012.
16. "Antimicrobial activity of novel substituted thiazoles against methicillin-resistant *Staphylococcus aureus* (MRSA)", Mark S. Cushman, Abdelrahman S. Mayhoub, and Seleem N. Mohamed, September 25, 2012.
17. "Indenoisoquinoline Rexinoids with Chemopreventive Potential," Mark S. Cushman, Martin Conda-Sheridan, and John M. Pezzuto, January 7, 2013.
18. "Synthesis and Antibacterial Activity of 3-(3-Aryl-pyrrolidin-1-yl)-5-aryl-1,2,4-triazine Inorganic Pyrophosphatase Inhibitors," Mark S. Cushman, Wei Lv, and Andrew D. Mesecar, March 12, 2013.
19. "Synthesis of Mixed (*E,Z*)-, (*E*)-, and (*Z*)-Norendoxifen with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," Mark S. Cushman, David A. Flockhart, and Wei Lv," March 12, 2013.
20. "Design and Synthesis of Norendoxifen Analogues with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," Mark S. Cushman, David A. Flockhart, and Wei Lv," August 7, 2013.
21. "Design, Synthesis, and Biological Evaluation of *O*-2-Modified Indenoisoquinolines as Dual Topoisomerase I (Top1)-Tyrosyl-DNA Phosphodiesterase I (TDP1) Inhibitors," Mark S. Cushman, Yves Pommier, and Peng-Cheng Lv, February 25, 2014.
22. "Synthesis and Biological Evaluation of Nitrated 7-, 8-, 9-, and 10-Hydroxyindenoisoquinolines as Potential Dual Topoisomerase I (Top1) − Tyrosyl-DNA Phosphodiesterase I (TDP1) Inhibitors," Mark S. Cushman, Trung Xuan Nguyen, and Yves Pommier, January 24, 2015.
23. "Bioisosteric Replacement and S.A.R. Development Yield Potent Topoisomerase I Inhibitors with Improved Safety Potential," Daniel E. Beck, Wei Lv, Keli Agama, Christophe Marchand, Yves Pommier, and Mark S. Cushman, June 1, 2015.
24. Synthesis of Triphenylethylene Bisphenols as Aromatase Inhibitors that Also Modulate Estrogen Receptors," Mark S. Cushman and Wei Lv, August 13, 2015.
25. "Design, Synthesis, and Biological Evaluation of Potential Prodrugs Related to the Experimental Anticancer Agent Indotecan (LMP400)," Mark S. Cushman and Pengcheng Lv, October 12, 2015.
26. "Investigation of the Structure-Activity Relationships of Aza-A-Ring Indenoisoquinoline Topoisomerase I Poisons, Mark Cushman, Daniel Beck, and Yves Pommier, PRF Disclosure Number D2016-0013, January 25, 2016.
27. "Pyrimidinephenylthiazoles as Antimicrobials," Mark S. Cushman, Abdelrahman S. Mayhoub, and Mohamed Seleem, PRF Track Code 2016-CUSH-67515, April 8, 2016.
28. "Alkenyldiarylmethanes (ADAMs) as Non-nucleoside Reverse Transcriptase Inhibitors (NNRTIs) for anti-HIV-1 Chemotherapy," Mark Cushman and Takeshi Sakamoto, Purdue Reference Number 67411-01, USPTO application number 62/308,249, June 1, 2016.
29. "Synthesis and Biological Evaluation of the First Triple Inhibitors of Human Topoisomerase 1, Tyrosyl-DNA Phosphodiesterase 1 (Tdp1), and Tyrosyl-DNA Phosphodiesterase 2 (Tdp2)," Mark S. Cushman, Keli Agama, Mohamed Elsayed,

Evgeny Kiselev, Christophe Marchand, Caroline Plescia, Ping Wang, and Olga Zeleznik, PRF Disclosure Number D2016-0272, October 13, 2016.

30. "G-protein Biased Delta Opioid Receptor Agonists for Treatment of Alcohol Use Disorders and Co-morbid Disorders," Mark S. Cushman, Markus Lill, Richard M. van Rijn, Robert J. Cassell, Amr H. M. M. Abdullah, and Mohamed S. A. Elsayed, PRF Disclosure Number D2017-67884, April 10, 2017.
31. "Application of Sequential Palladium Catalysis for the Discovery of Janus kinase Inhibitors," Mark S. Cushman and Mohamed S.A. Elsayed, PRF Disclosure Number D2017-0365, October 19, 2017.
32. "Indenoisoquinoline Topoisomerase Inhibitors Strongly Bind and Stabilize the MYC Promoter G-Quadruplex and Downregulate MYC," PRF Disclosure Number D2019-0084, March 11, 2019.

Provisional Patent Applications:

1. Mark S. Cushman, Agustin Casimiro-Garcia, and William G. Rice, United States Provisional Patent Application, "Alkenyldiarylmethane (ADAM) Non-nucleoside HIV-1 Reverse Transcriptase Inhibitors (NNRTIs)," January 16, 1998, Purdue Reference P-97066.00, U.S. patent application serial number 60/071,700, European Serial Number 99902293.2-2103, Purdue Reference P-97066.00.JP (Japan), U.S. Utility Application No. 09/581,927.
2. Mark S. Cushman, Ankush Argade, Rudiger Haugwitz, and Rajesh Devraj, United States Provisional Patent Application, "Brefeldin A Derivatives," December 18, 1997, Purdue Reference P-97056.00, U.S. Provisional Patent Application Number 60/068,030.
3. Mark S. Cushman, Y. Pommier, M. Jayaraman, and P. Nagafuji, "Novel Indenoisoquinolines as Antineoplastic Agents," October 30, 1998, Purdue Reference P-98043.00.US, U.S. Provisional Patent Application Number 60/104,226, International Publication Number WO00/21537, PCT International Application Number PCT/US99/23900.
4. Mark S. Cushman and Ernest Hamel, "B-Homoestra-1,3,5(10)-trienes as Modulators of Tubulin Polymerization," October 26, 1999, Purdue Reference E-230,99/0, U.S. Provisional Patent Application Number 60/161,533, Purdue Reference P-99083.P1.US, Purdue Reference P-99083.00.WO. International Publication Number WO 01/30803 A1. October 10, 2000, International Patent Application No. PCT/US00/28273.
5. Mark S. Cushman and O.M. Zack Howard, "Inhibition of Rantes/CCR1 Mediated Chemotaxis by Novel Cosalane Compounds," November 29, 1999, PUR-130-PROV (7024-1063), P-99093.P1.US, U.S. Provisional Patent Application Serial Number 60/167,864.
6. Mark S. Cushman, Thota Sambaiah, Adelbert Bacher, and Markus J. Fischer, "Design, Synthesis, and Evaluation of 9-D-Ribitylamino-1,3,7-Trihydro-2,6,8-Purinetriones Bearing Alkyl Phosphate and α,α-Difluorophosphonate Substituents as Inhibitors of Riboflavin Synthase and Lumazine Synthase," November 10, 2003, P-03140.P1.US, U.S. Provisional Patent Application Serial Number 60/518,765.
7. Mark S. Cushman, Andrew E. Morrell, and Yves Pommier, "Synthesis of Nitrated Indenoisoquinolines," May 20, 2004, U.S. Provisional Patent Application P-04074.P1.US, Serial Number 60,568,987, Purdue Reference Number 64174.P1, Barnes & Thornburg Attorney Docket Number 3220-75284.
8. Mark S. Cushman and Andrew E. Morrell, "Synthesis of Indenoisoquinolines," May 9, 2005, U.S. Provisional Patent Application, Serial Number 11/125,723, Purdue Reference Number 64074.US, Barnes & Thornburg Attorney Docket Number 3220-77873.
9. Mark S. Cushman, Andrew E. Morrell, and Yves Pommier, "Process for Preparing Indenoisoquinolines," May 21, 2004, U.S. Provisional Patent Application Number P-04074.P1.US, Serial Number 60/572,852, Purdue Reference Number 64074.P2, Attorney

Docket Number 3220-75284. This application is supplemental to the one listed directly above.

10. Mark S. Cushman and Bo-Liang Deng, "Alkenyldiarylmethanes, Fused Analogs and Synthesis Thereof," October 25, 2005, U.S. Provisional Patent Application, Purdue Reference Number 64408.P1.US, Barnes & Thornburg Attorney Docket Number 3220-78445.
11. Mark S. Cushman and Andrew E. Morrell, "*N*-Substituted Indenoisoquinolines and Synthesis Thereof," November 14, 2005, U.S. Provisional Patent Application, Purdue Reference Number 64473.P1.US, Barnes & Thornburg Attorney Docket Number 3220-79121.
12. Mark S. Cushman and Bo-Liang Deng, "Alkenyldiarylmethanes, Fused Analogs, and Syntheses Thereof," November 25, 2005, U.S. Provisional Patent Application, Serial Number 60/729.838, Purdue Reference Number 64408.P1.US, Barnes & Thornburg Attorney Docket Number 3220-78445.
13. Mark S. Cushman, John M. Pezzuto, and Arup Maiti, "Chemotherapeutic Flavanoids, and Synthesis Thereof," December 15, 2006, Purdue Reference Number 64691.P1.US, Barnes & Thornburg Attorney Docket Number 3220-201177.
14. Mark S. Cushman, Takeshi Sakamoto, Matthew D. Cullen, "Hydrolytically Stable Alkenyldiarylmethane Non—Nucleoside Reverse Transcriptase Inhibitors," March 29, 2007, Purdue Reference Number 64813.P1.US., Barnes & Thornburg Docket Number 3220-201893.
15. Mark S. Cushman, John M. Pezzuto, and Arup Maiti, "Chemotherapeutic Flavonoids, and Syntheses Thereof," December 12, 2007, Purdue Reference Number 64681.00.WO, PCT International Serial No.: PCT/US2007/087283, Barnes & Thornburg Docket Number 3220-204578.
16. Mark S. Cushman, Maris A. Cinelli, Andrew E. Morrell, and Yves G. Pommier, "Oxobenzindolizinoquinolines and Uses Thereof," May 15, 2008, Purdue Reference Number 65107.P1.US, U.S. Provisional Patent Application No. 61/053,338, Barnes & Thornburg Docket Number 3220-205459.
17. Mark S. Cushman, Arup Maiti, and John M. Pezzuto, "Casimiroin, Analogs Thereof, and Methods for Treating Cancer", Provisional Patent Application No. 61/153807, filed February 20, 2009.
18. Mark S. Cushman, Yanlei Zheng, Markus Fischer, and Adelbert Bacher, "Riboflavin Synthase Inhibitors as Potential Antitubercular Agents," U.S. Provisional Patent Application No. 61/187,464, filed June 16, 2009.
19. Mark S. Cushman, John M. Pezzuto, and B. Sun, "Substituted Stilbenes, Syntheses Thereof, and Methods of Use in the Treatment and/or Prevention of Cancer". U.S. Provisional Patent Application No. 61/266,195, filed December 3, 2009.
20. Mark S. Cushman and Arup Maiti, "Casimiroin, Analogs Thereof, and Methods for Treating Cancer", Provisional Patent Application No. 61/305,582, filed February 18, 2010.
21. Mark S. Cushman and Yunlong Song, "Substituted Norindenoisoquinolines, Synthesis Thereof, and Methods of their Use," PCT International Application serial no. PCT/US2011/022732, filed January 27, 2011.
22. Mark S. Cushman and Abdelrahman S. Mayhoub, "Antiviral Thiazoles," United States Provisional Patent Application 61/441,786, filed February 11, 2011.
23. Mark S. Cushman and Evgeny Kiselev, "Substituted Dibenzonaphthyridines, Pharmaceutical Uses Thereof and Processes Therefor," Provisional Patent Application WO 2012/024437 A1, filed August 17, 2011 and published February 23, 2012.
24. Mark S. Cushman and Evgeny Kiselev, "Dibenzo[*c,h*][1,5]naphthyridinediones as Topoisomerase I Inhibitors: Design, Synthesis, and Biological Evaluation," filed May 11, 2012.

25. Mark S. Cushman and Katherine E. Peterson, "Alcohol-, Diol-, and Carbohydrate-Substituted Indenoisoquinolines as Topoisomerase I Inhibitors," PCT/US12/39365, filed May 24, 2012.
26. Mark S. Cushman, Mohamed Seleem, and Abdelrahman S. Mayhoub, "Antimicrobial Activity of Novel Substituted Thiazoles against Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Application No. 61/720,659, filed October 31, 2012, PRF Reference Number 2013-CUSH-66348-02, Application Number 14/069,089, filing date October 31, 2013.
27. Mark S. Cushman and Martin M. Conda-Sheridan, "Design, Synthesis, and Biological Evaluation of Indenoisoquinoline Rexinoids with Chemopreventive Potential," Application No. 61/771,544, filed March 1, 2013.
28. Mark S. Cushman, Trung X. Nguyen, and Philip S. Low, "DUPA-Indenoisoquinoline Conjugates", PRF Reference Number 2013-CUSH-66410-01, Application Number: 61/900,800, Filing Date: November 6, 2013.
29. Mark S. Cushman, Evgeny Kiselev, and Andrew Morrell, "Azaindenoisoquinoline Topoisomerase I Inhibitors," PRF Reference Number: 66042-01, Application Number: 14/199,754, Filing Date: March 6, 2014.
30. Mark S. Cushman, Yves Pommier, and Peng-Cheng Lv, "Design, Synthesis, and Biological Evaluation of O-2-Modified Indenoisoquinolines as Dual Topoisomerase I (Top1)-Tyrosyl-DNA-Phosphodiesterase I (TDP1) Inhibitors," PRF Reference Number: 66782-01, Application Number: 61/985,748, Filing Date: April 29, 2014.
31. Mark S. Cushman, "Improved Preparation of 7-Aza-5,6-dihydro-6-(3-bromopropyl)-9-methoxy-3-nitro-5,11-dioxo-11*H*-indeno[1,2-*c*]isoquinoline," PRF Reference Number 65926-03, Application Serial Number 62/054,097, Filing Date: September 23, 2014.
32. Mark S. Cushman, Wei Lv, and Li-Ming Zhao, "Synthesis of Triphenylethylene Bisphenols as Aromatase Inhibitors that Also Modulate Estrogen Receptors," PRF Reference Number 67271001, Application Serial Number 62/259,448, Filing Date: November 24, 2015.
33. Mark S. Cushman and Pengcheng Lv, "Prodrugs of Anticancer Agents Indotecan and Indimitecan," PRF Reference Number 67321-01, Application Serial Number 62/291,292, Filing Date: February 4, 2016.
34. Mark S. Cushman and Yves G. Pommier, "Azaindenoisoquinoline Compounds and Uses Thereof," PRF Reference Number 67685-01, Application Serial Number 62/437,777, Filing Date: December 22, 2016.
35. Mark S. Cushman, Abdelrahman Mayhoub, and Mohammed Seleem, "Phenylthiazoles and Uses Thereof," PRG Reference Number 67515-01, Application Serial Number 62/502,843, Filing Date: May 8, 2017.
36. Mark S. Cushman and Mohamed S. A. Elsayed, "Janus Kinase Inhibitors and Uses Thereof," application serial number 62/579327, Filing Date: October 31, 2017.

Patent Applications:

1. "New Anti-HIV Compounds Belonging to Aurintricarboxylic Acid", U. S. Patent Application US 431,568, 15 Apr 1990, Appl. 03 Nov. 1989, NITS Order No. PAT-APPL-7-431 568. A foreign filing of this patent has also been completed.
2. "Stilbene Derivatives as Anticancer Agents", U. S. Patent Application US 887,725, May 21, 1992.
3. "1,2-Dihydroellipticines with Activity Against CNS Specific Cancer Cell Lines", U. S. Patent Application Serial No. 07/956,903, October 2, 1992.
4. "Cosalane and Related Compounds Having Activity Against AIDS and AIDS-Related Infections," U.S. Patent Application Serial No. 08/029,415, filed March 10, 1993.

5. "Compounds with Activity Against AIDS and Related Infections," International Patent Application No. PCT/US94/01429, September 15, 1994. Published as WIPO Publication No. WO 94/20519.
6. Robert J. D'Amato, Mark Cushman, Rudiger D. Haugwitz, and Ravi K. Varma, "Estrogenic Compounds as Antiangiogenic Agents," U.S. Patent Application Serial No. 09-154,322, September 16, 1998.
7. Adelbert Bacher, Mark S. Cushman, Klaus Kis, Jeffrey Mihalic, Donglai Yang, Farahnaz Mavandadi, and Karl B. Kugelbrey, "Inhibitoren der Biosynthese von Vitamin B2 und Verfahren zu ihrer Herstellung," German Patent Application No. 199 03 736.1, January 28, 1999.
8. Mark S. Cushman, Ankush B. Argade, Rudiger D. Haugwitz, and Rajesh Devraj, "Brefeldin A Derivatives," International Patent Application No. PCT/US98/27000, December 18, 1998.
9. Adelbert Bacher, Mark S. Cushman, Klaus Kis, Jeffrey Mihalic, Donglai Yang, Farahnaz Mavandadi, and Karl B. Kugelbrey, "Inhibitoren der Biosynthese von Vitamin B2 und Verfahren zu ihrer Herstellung," International Patent Application No. PCT/EP2000/00638, January 27, 2000.
10. Mark S. Cushman, Pamela M. Nagafuji, Muthusamy Jayaraman, Yves G. Pommier, Preparation of Diketoindenoisoquinolines as Antineoplastic Agents," International Patent Application WO 99-US23900 19991014 (2000), European Patent Application No 12043/00.
11. Mark S. Cushman, Agustin Casimiro-Garcia, and William G. Rice, "Preparation of Alkenyldiarylmethanes as Non-Nucleoside Reverse Transcriptase Inhibitors," International Patent Application Serial Number PCT/US99/00916. International filings include P-97066.00.EP, P-97066.00.CA, and P-97066.00.JP, Application No. 2,317,942 (Japan) (2000).
12. Mark S. Cushman, Ankush B. Argade, Rudiger D. Haugwitz, and Rajesh Devraj, "Preparation of Brefeldin A Derivatives for Use as Anticancer Agents," International Patent Application PCT/US98/27000 (2000).
13. Mark S. Cushman, Pamela M. Nagafuji, Muthusamy Jayaraman, and Yves Pommier, "Novel Indenoisoquinolines as Antineoplastic Agents," International Patent Application WO 00/21537 (2000), European Patent Application No. E-030-1999/0-EP-05.
14. Mark Cushman and O. M. Zack Howard, "Cosalane Compounds and Methods for their Use," P99.93.00.US, 7024/PUR-130 (2000), Application Number 09/726,101.
15. Mark S. Cushman, Pamela M. Nagafuji, Muthusamy Jayaraman, and Yves Pommier, "Novel Indenoisoquinolines as Antineoplastic Agents," US Patent Application No. 09/807,340 (2001).
16. Ernest Hamel and Mark S. Cushman, "B-Homoestra-1,3,5(10)-trienes as Modulators of Tubulin Polymerization," International Publication Number WO 01/30803 A1, International Publication Date May 3, 2001, International Patent Application No. PCT/US00/28273.
17. Mark Cushman and Zack Howard, "Cosalane Compounds and Methods for their Use," U.S. Patent Application No. 09/771,769, January 29, 2001.
18. Mark Cushman, Ankush Argade, Rudiger D. Haugwitz, and Rajesh Devraj, "Brefeldin A Derivatives," U.S. Patent Application No. 09/581,773, February 26, 2001.
19. Mark S. Cushman and O.M. Zack Howard, "Cosalane Compounds and Methods for their Use," U.S. Patent Application Publication No. US 2003/0212045 A1, November 13, 2003.
20. Mark S. Cushman, Agustin Casimiro-Gracia, and William G. Rice, "Alkenyldiarylmethane Non-Nucleoside Reverse Transcriptase Inhibitors," U.S. Patent Application Publication No. US 2003/0220315 A1, November 27, 2003.
21. Mark S. Cushman, Yves Pommier, Pamela Nagafuji, and Muthusamy Jayaraman, "Novel Indenoisoquinolines as Antineoplastic Agents," European Patent Application No. 99 970323.4-2101, September 14, 2005.
22. Mark S. Cushman, Andrew Morrell, Yves G. Pommier (USA). "Synthesis of Indenoisoquinolines as Anticancer Agents." U.S. Pat. Appl. Publ. (2006), 16 pp.

CODEN: USXXCO US 2006025595 A1 20060202 Patent written in English. Application: US 2005-125723 20050509. Priority: US 2004-568987 20040507; US 2004-572852 20040520. CAN 144:192127 AN 2006:103559 CAPLUS (Copyright (C) 2006 ACS on SciFinder (R)

23. Mark S. Cushman, Alexandra S. Ioanoviciu, and Yves G. Pommier (USA). PCT Int. Appl. (2005), 46 pp. "Synthesis of Indenoisoquinoliniums for Cancer Treatment." CODEN: PIXXD2 WO 2005089294 A2 20050929 Designated States W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW. Designated States RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, ML, MR, NE, SN, TD, TG. Patent written in English. Application: WO 2005-US8491 20050315. Priority: US 2004-553837 20040317. CAN 143:347062 AN 2005:1049795 CAPLUS (Copyright (C) 2006 ACS on SciFinder (R)
24. Mark S. Cushman and Bo-Liang Deng, "Alkenyldiarylmethanes, Fused Analogs and Syntheses Thereof," PCT International Serial No. PCT/US2006/025392, June 29, 2006.
25. Mark S. Cushman, Andrew E. Morrell, and Yves, G. Pommier (USA). Synthesis of Indenoisoquinolines as Anticancer Agents. U.S. Pat. Appl. Publ. (2006), 16 pp. CODEN: USXXCO US 2006025595 A1 20060202 Patent written in English. Application: US 2005-125723 20050509. Priority: US 2004-568987 20040507; US 2004-572852 20040520. CAN 144:192127 AN 2006:103559 CAPLUS (Copyright (C) 2007 ACS on SciFinder (R))
26. Mark S. Cushman, Andrew E. Morrell, Muthukaman Nagarajan, and Yves. G. Pommier (Purdue Research Foundation, USA; Department of Health and Human Services). Preparation of N-substituted indenoisoquinolines having topoisomerase I inhibitory activity. PCT Int. Appl. (2007), 80pp. CODEN: PIXXD2 WO 2007059008 A2 20070524 Designated States W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG. Designated States RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, ML, MR, NE, SN, TD, TG. Patent written in English. Application: WO 2006-US43933 20061113. Priority: US 2005-736471 20051114; US 2006-808699 20060526. CAN 147:9812 AN 2007:563304 CAPLUS (Copyright (C) 2007 ACS on SciFinder (R))
27. Preparation of alkenyldiarylmethanes and fused analogs as inhibitors of HIV-I reverse transcriptase. Cushman, Mark S.; Deng, Bo-Liang. (Purdue Research Foundation, USA). PCT Int. Appl. (2007), 72pp. CODEN: PIXXD2 WO 2007005531 A2 20070111 Designated States W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ,

TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC. Designated States RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, ML, MR, NE, SN, TD, TG. Patent written in English. Application: WO 2006-US25392 20060629. Priority: US 2005-695570 20050630; US 2005-729838 20051025. CAN 146:142635 AN 2007:38159 CAPLUS (Copyright (C) 2007 ACS on SciFinder (R)

28. Mark S. Cushman, Andrew E. Morrell, Muthukaman Nagarajan, and Yves. G. Pommier (Purdue Research Foundation, USA; Department of Health and Human Services). *N*-Substituted Indenoisoquinolines and Synthesis Thereof. U.S. Patent Application US 2008/0318995 A1, December 25, 2008.
29. Novel Indenoisoquinolines as Antineoplastic Agents. Cushman, M. S.; Nagafuji, P. M.; Jayaraman, M.; Pommier, Y. G. European Patent Application Number 09000858.2, filed January 22, 2009.
30. Mark S. Cushman, Maris A. Cinelli, Andrew E. Morrell, and Yves G. Pommier, "Oxobenzindolizinoquinolines and Uses Thereof," International filing date May 14, 2009, International publication date November 19, 2009, International Publication Number WO 2009 140467 A1, PCT International Serial Number PCT/US/043905.
31. Cushman, M. S.; Song, Y. "Substituted Norindenoisoquinolines, Synthesis Thereof, and Methods of Use," International Patent Application WO2011094416 A1, published August 4, 2011.
32. Mark S. Cushman, Andrew E. Morrell, Muthukaman Nagarajan, Yves G. Pommier, Keli K. Agama, and Smitha Antony "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," United States Patent Application No. US 2012/0101119A1, April 26, 2012.
32. Mark S. Cushman, "Indenoisoquinoline Topoisomerase I Inhibitors Substituted with Carbohydrates," International Patent Application PCT/US2012/039365, May 25, 2012.
33. Mark S. Cushman and Yunlong Song, "Substituted Norindenoisoquinolines, Syntheses Thereof, and Methods of Use," Purdue Reference Number 654100.00.US, United States Patent Application US 13/575,505, November 29, 2012. United States Patent Application Publication No. US 2012/0302563 A1, November 29, 2012.
34. Mark S. Cushman, Trung X. Nguyen, and Martin Conda-Sheridan, "Synthesis of Dual Tyrosyl-DNA Phosphodiesterase I (Tdp1)-Topoisomerase I (Top1) Inhibitors," United States Patent Application Number US 2013/0345252 A1, December 26, 2013.
35. Mark S. Cushman, Mohamed Seleem, and Abderrahman S. Mayhoub, "Antimicrobial Substituted Thiazoles and Methods of Use," United States Patent Application Number US 2014/0121249 A1, May 1, 2014.
36. Mark S. Cushman, Philip S. Low, and Trung X. Nguyen, "DUPA-Indenoisoquinoline Conjugates," International Patent Application Number PCT/US2014/064127, PRF Reference Number 2013-CUSH-66410-02, November 5, 2014.
37. Mark S. Cushman, Andrew E. Morrell, Muthukaman Nagarajan, Yves George Pommier, Smitha Antony, Keli Agama, and Daniel E. Beck, "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," United States Patent Application Number 14/687,530, PFR Reference Number 64473-16, April 15, 2015.
38. Mark S. Cushman, Yves George Pommier, Peng-Cheng Lv, Christophe Marchand, and Keli Agama, "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," United States Patent Application Number 14/698,335, PFR Reference Number 2014-CUSH-66782-02, April 28, 2015.
39. Mark S. Cushman and Trung X. Nguyen, "Synthesis and Biological Evaluation of the First Dual Tyrosyl-DNA Phosphodiesterase (TDP1)-Topoisomerase I (Top1) Inhibitors,"

United States Patent Application Number 14/868,701, PRF Reference Number 66149-05, Filing Date: September 29, 2015.

40. Mark S. Cushman, Andrew E. Morrell, Muthukaman Nagarajan, Yves G. Pommier, Keli Agama, and Daniel E. Beck, "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," United States Patent Application Number 14/687,530, PRF Reference Number 64473-16, April 15, 2015.
41. Mark S. Cushman and Daniel E. Beck, "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," United Stated Patent Application Number 15/139,986, PRF Reference Number 64473-18, Filing Date April 27, 2016.
42. Mark S. Cushman and Daniel E. Beck, "Alcohol-, Diol-, and Carbohydrate-substituted Indenoisoquinolines as Topoisomerase I Inhibitors," United States Patent Application Number 15/144,311, PRF Reference Number 65707-04, Filing Date May 2, 2016.
43. Mark S. Cushman, Wei Lv, and Li-Ming Zhou, "Synthesis of Triphenylethylene Bisphenols as Aromatase Inhibitors that Also Modulate Estrogen Receptors," United States Patent Application Number 15/358,886, PRF Reference Number 67271-03, Filing Date November 22, 2016.
44. Mark S. Cushman, Andrew E. Morrell, Muthukaman Nagarajan, Yves Pommier, Keli Agama, and Smitha Antony, "A Process for Preparing *N*-Substituted Indenoisoquinolines", European Patent Application EP 3,112,349 A2, Purdue OTC Ref: 64473-20, Publication Date January 4, 2017.
45. Mark S. Cushman and Pengcheng Lv, "Prodrugs of Anticancer Agents Indotecan and Indimitecan," International Patent Application Number PCT/US17/16331, PRF Reference Number No. 67321-02, February 3, 2017.
46. Mark S. Cushman and Takeshi Sakamoto, "Alkenyldiarylmethanes as Non-Nucleoside Reverse Transcriptase Inhibitors for Anti-HIV-1 Chemotherapy," PRF Reference Number 67411, United States Patent Application Number 15/459,041, Purdue OTC Ref: 67411-02, March 15, 2017.
47. Mark S. Cushman, Ping Wang, and Yves George Pommier, and Mohamed S. A. Elsayed, "Azaindenoisoquinoline Compounds and Uses Thereof," PCT/US17/67206, PRF Reference Number 67685-02, December 19, 2017.
48. Mark S. Cushman and Mohamed S. A. Elsayed, "Janus Kinase Inhibitors and Uses Thereof," U. S. utility patent application, assigned application number 16/175,915, PRF reference number 68109-02, October 31, 2018.

Patents:

1. Haugwitz, R. D.; Nayaranan, V. L.; Cushman, M.; Jurayj, J. "1,2-Dihydroellipticines with Activity Against CNS Specific Cancer Cell Lines", U. S. Patent 5,272,146, issued December 21, 1993.
2. Cushman, M.; Haugwitz, R. D.; Jurayj, J.; Narayanan, V. L. "1,2-Dihydroellipticines with Activity Against CNS Specific Cancer", U. S. Patent 5,441,941, issued August 15, 1995.
3. Cushman, M. S.; Hamel, E. "Stilbene Derivatives as Anticancer Agents", U.S. Patent 5,430,062, issued July 4, 1995.
4. Cushman, M.; Haugwitz, R. D. ; Golebiewski, W. M. "Cosalane and Related Compounds Having Activity Against AIDS and AIDS-Related Infections", U. S. Patent 5,439,899, issued August 8, 1995.

5. Cushman, M. "Preparation of Bis(carboxyphenyl)alkenes and their Steroid Conjugates as Compounds Active Against AIDS and Related Infections", WO 1994020519 A1.
6. "Brefeldin A Derivatives," International Patent Serial No. PCT/US98/27000, October 5, 1999.
7. Cushman, M.; Argade, A. B.; Haugwitz, R. D.; Devraj, R. "Brefeldin A Derivatives", U. S. Patent 6,362,218, issued March 26, 2002.
8. Cushman, M, Nagafugi, P.; Jayaraman, M.; Pommier, Y. G. "Indenoisoquinolines as Antineoplastic Agents," U. S. Patent 6,509,344, issued January 21, 2003.
9. Cushman, M.; Howard, O. M. Z. "Cosalane Compounds and Methods for Their Use," U. S. Patent 6,562,805, issued May 13, 2003.
10. Cushman, M.; Casimiro-Garcia, A.; Rice, W. G. "Alkenyldiarylmethane Non-Nucleoside HIV-1 Reverse Transcriptase Inhibitors," U. S. Patent 6,569,897 B1, issued May 27, 2003.
11. Cushman, M,; Nagafugi, P.; Jayaraman, M.; Pommier, Y. G. "Novel Indenoisoquinolines as Antineoplastic Agents," Australian Patent 765135, issued January 8, 2004.
12. Hamel, E.; Cushman, M. S. "B-Homoestra-1,3,5(10)-trienes as Modulators of Tubulin Polymerization," U. S. Patent Number 6,696,436, issued February 24, 2004.
13. Cushman, M. S.; Pommier, Y. G. "Preparation of Indeno and Isoindoloisoquinolone Derivatives as Cytotoxic Agents," Patent Number WO2004100891 issued May 10, 2004.
14. Cushman, M. S.; Howard, O. M. Z. Mark S. Cushman and O. M. Zack Howard, "Cosalane Compounds and Methods for their Use," U. S. Patent Number 7,122,533 issued October 17, 2006.
15. Cushman, M. S.; Pommier, Y. G. "Cytotoxic Indeno and Isoindoloisoquinolones", U. S. Patent 7,312,228, issued December 25, 2007.
16. Cushman, M. S.; Morrell, A. E.; Pommier, Y. G. "Synthesis of Indenoisoquinolines," U. S. Patent Number 7,495,100 B2, issued February 24, 2009.
17. Cushman, M. S.; Nagafuji, P. M.; Jayaraman, M.; Pommier, Y. G. "Novel Indenoisoquinolines as Antineoplastic Agents," European Patent Number 1,123,099, issued March 3, 2009.
18. Cushman, M. S.; Ioanoviciu, A. S.; and Pommier, Y. "Synthesis of Indenoisoquinoliniums and Methods of Use," U.S. patent 7,781,445, issued August 24, 2010.
19. Cushman, M. S.; Nagafuji, P.; Jayaraman, M.; and Pommier, Y. "Novel Indenoisoquinolines as Antineoplastic Agents," Canadian Patent 2,347,100, issued December 4, 2010.
20. Cushman, M. S.; Morrell, A. E.; Nagarajan, M.; Pommier, Y.; Agama, K.; Antony, S. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," U. S. Patent Number 8,053,443, issued November 8, 2011.
21. Cushman, M. S.; Morrell, A.; Nagarajan, M. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof, Japanese Patent 5412113, issued November 15, 2013.
22. Cushman, M. S.; Kiselev, E.; Morrell, A. E. "Azaindenoisoquinoline Topoisomerase I Inhibitors," U. S. Patent Number 8,686,146 B2, issued April 1, 2014.
23. Cushman, M. S.; Morrell, A. E.; Nagarajan, M.; Pommier, Y.; Agama, K. K.; Antony, S. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," U. S. Patent Number 8,829,022 B2, issued September 9, 2014.
24. Cushman, M. S.; Morrell, A.; Pommier, E. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof, Japanese Patent 5567157, issued June 27, 2014.

25. Cushman, M. S.; Nguyen, T. X.; Conda-Sheridan, M.; Pommier, Y. "Synthesis and Use of Dual Tyrosyl-DNA Phosphodiesterase I (TDP1)-Topoisomerase I (TOP1) Inhibitors," U. S. Patent Number 8,912,213 B2, Issued December 16, 2014.
26. Cushman, M. S.; Pezzuto, J. M.; and Maiti, A. "Chemotherapeutic Flavanoids and Syntheses Thereof," U. S. Patent Number 8,946,287 B2, issued February 3, 2015.
27. Cushman, M. S.; Kiselev, E.; Morrell, A. E.; Pommier, Y. G. "Azaindenoisoquinoline Topoisomerase I Inhibitors," U. S. Patent Number 9,034,870 B2, issued May 19, 2015.
28. Cushman, M.; Kiselev, E. "Substituted Dibenzonaphthyridines, Pharmaceutical Uses Thereof and Processes Therefor," U. S. Patent Number 9,073,920, issued July 7, 2015.
29. Cushman, M. S.; Nguyen, T. X.; Conda-Sheridan, M. M.; Pommier, Y. G. "Synthesis and Use of Dual Tyrosyl I-DNA Phosphodiesterase I (TDP1)-Topoisomerase I (Top1) Inhibitors," U. S. Patent Number 9,175,002, issued November 3, 2015.
30. Cushman, M. S.; Song, Y. "Substituted Norindenoisoquinolines, Syntheses Thereof, and Methods of Use," U. S. Patent Number 9,206,193 B2, issued December 8, 2015.
31. Cushman, M. S.; Morrell, A. E.; Nagarajan, M.; Pommier, Y. G.; Antony, S.; Beck, D. E. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," U. S. Patent Number 9,217,010, issued December 22, 2015.
32. Cushman, M. S. and Pommier, Y. G., "Alcohol-, Diol-, and Carbohydrate-Substituted Indenoisoquinolines and Topoisomerase I Inhibitors," U. S. Patent Number 9,328,073 B2, issued May 3, 2016.
33. Cushman, M. S., Seleem, M., and Mayhoub, A. S., "Antimicrobial Substituted Thiazoles and Methods of Use," U. S. Patent Number 9,353,072 B2, issued May 31, 2016.
34. Cushman, M. S., Morrell, A. E., Nagarajan, M., Pommier, Y. G., Antony, S., Agama, K. K., Beck, D. B. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," U. S. Patent Number 9,388,211 B2, issued July 12, 2016.
35. Cushman, M. S, Pommier, Y.G., Lu, P.-C., Marchand, C., Agama, K. "*N*-Substituted Indenoisoquinolines and Syntheses Thereof," U. S. Patent Number 9,399,660 B2, issued July 26, 2016.
36. Cushman, M. S.; Nguyen, T. X; Conda-Sheridan, M. M.; Pommier, Y. G. "Synthesis and Use of Dual Tyrosyl-DNA Phosphodiesterase I (TDP1)-Topoisomerase I (TOP1) Inhibitors", U. S. Patent Number 9,402,842 B2, issued August 2, 2016.
37. Cushman, M. S.; Beck, D. "Alcohol-, Diol-, and Carbohydrate-Substituted Indenoisoquinolines as Topoisomerase I Inhibitors: U. S. Patent Number 9,682,990 B2, issued June 20, 2017.
38. Cushman, M. S.; Beck, D. E. "N-Substituted Indenoisoquinolines and Syntheses Thereof," U. S. Patent Number 9,796,753 B2, issued October 24, 2017.
39. Cushman, M. S.; Seleem, M.; Mayboub, A. S. "Antimicrobial Substituted Thiazoles and Methods of Use," U. S. Patent Number 9,801,861 B2, issued October 31, 2017.
40. Cushman, M.S. and Elsayed, M. S. A., "Janus Kinase Inhibitors and Uses Thereof," U.S. Patent Number 10,399,979, issued September 3, 2019.

Licensed Inventions:

1. "Stilbene Derivatives as Anticancer Agents," Research Corporation, 1995. To date (2007), Purdue has received a total of $460,588.10 from this invention.
2. "Indenoisoquinoline Topoisomerase I Inhibitors" licensed to Linus Pharma, Inc., October 28, 2009.

3. "Azaindenoisoquinoline Topoisomerase I Inhibitors," licensed to Merrimack Pharmaceuticals. This was a commercial evaluation license from June 26, 2014 to September 26, 2016.

Contributed Papers at Meetings:

1. "The Condensation of Schiff Bases with Succinic Anhydride," 158th American Chemical Society National Meeting, New York, N.Y., September 10, 1969.
2. "The Synthesis of *trans*-3'-Methylnicotine," 162nd American Chemical Society National Meeting, Washington, D.C., September 13, 1971.
3. "A Convergent Synthesis of *cis*- and *trans*-13-Methyltetrahydroprotoberberines," 173rd American Chemical Society National Meeting, New Orleans, Louisiana, March 25, 1977.
4. "A Total Synthesis of Corydaline," 10th Annual Graduate Student Meeting in Medicinal Chemistry, Lake Hope State Park, Ohio, June 4, 1977.
5. "A Total Synthesis of Nitidine Chloride," 174th American Chemical Society National Meeting, Chicago, Illinois, August 31, 1977.
6. "A Stereoselective Oxidation by Thionyl Chloride Leading to the Indeno-[1,2-*c*]isoquinoline System," 176th American Chemical Society National Meeting, Miami, Florida, September 13, 1978.
7. "New Protoberberine and Benzophenanthridine Alkaloid Syntheses," 20th Annual Meeting of the American Society of Pharmacognosy, Purdue University, August 3, 1979.
8. "Total Synthesis of Chelidonine," International Research Congress on Natural Products as Medicinal Agents, Strasbourg, France, July 7, 1980.
9. "Synthesis of New Riboflavin Antimetabolites," 13th Annual Graduate Student Meeting in Medicinal Chemistry, Purdue University, July 17, 1980.
10. "Total Synthesis of Chelidonine," 179th American Chemical Society National Meeting, Houston, Texas, March 24, 1980.
11. "Total Synthesis of Chelidonine," 13th Annual Graduate Student Meeting in Medicinal Chemistry, Purdue University, July 17, 1980.
12. "The Absolute Configurations of the 13-Methyltetrahydroprotoberberine Alkaloids," 28th Congress, International Union of Pure and Applied Chemistry, Vancouver, British Columbia, Canada, August 18, 1981.
13. "Synthesis of Isoquinoline Analogs of the Anticancer Agent Nitidine Chloride," 15th Annual Graduate Student Meeting in Medicinal Chemistry, The Ohio State University, Columbus, Ohio, June 26, 1982.
14. "The Total Synthesis of Methyl Corydalate," 16th Annual Graduate Student Meeting in Medicinal Chemistry, The University of Michigan, Ann Arbor, Michigan, June 27th, 1983.
15. "Potential Antitumor Agents II: Synthesis of Isoquinoline Analogs of Fagaronine," 16th Annual Graduate Student Meeting in Medicinal Chemistry, The University of Michigan, Ann Arbor, Michigan, June 28th, 1983.
16. "Total Synthesis of (±)-Epicorynoline, (±)-Corynoline, and (±)-6-Oxocorynoline," 18th American Chemical Society National Meeting, Seattle, Washington, March 21, 1983.
17. "Potential Antitumor Agents III: New Encounters in the Synthesis of a Phenylisoquinoline Analog of Fagaronine," 17th Annual Graduate Student Meeting in Medicinal Chemistry, State University of New York at Buffalo, Buffalo, New York, June 25, 1984.
18. "Synthesis and Antitumor Activity of Structural Analogs of the Anticancer Benzophenanthridine Alkaloid Fagaronine Chloride," 189th National Meeting of the American Chemical Society, Miami Beach, Florida, May 2, 1985.
19. "A Study of the Biosynthesis of Benzo(*c*)phenanthridines from Protoberberines," 19th Great Lakes Regional Meeting of the American Chemical Society, West Lafayette, Indiana, June 10, 1985.
20. "Synthesis of some Hypothetical Intermediates in the Biosynthesis of Benzo[*c*]phenanthridines," 18th Annual Graduate Students Meeting in Medicinal Chemistry, West Lafayette, Indiana, June 17, 1985.

21. "Synthesis of Bis(trifluoromethylated) Pyrazine-containing Nitrogen Heterocycles from Hexafluorobiacetyl and Ortho Diamines. Stabilization of the Covalent Dihydrates of Pteridines and Pyrido[3,4-*b*]pyrazines by Trifluoromethyl Groups," 10th International Congress of Heterocyclic Chemistry, University of Waterloo, Ontario, Canada, August 12, 1986.
22. "Synthesis of Bis(trifluoromethylated) Pyrazine-containing Nitrogen Heterocycles from Hexafluorobiacetyl and Ortho Diamines. Stabilization of the Covalent Dihydrates of Pteridines and Pyrido[3,4-*b*]pyrazines by Trifluoromethyl Groups," 191st American Chemical Society National Meeting, New York City, New York, April 15, 1986.
23. "Model Studies for the Preparation of Riboflavin Synthase Inhibitors. Stabilization of the Covalent Hydrates of Pyrazine-containing Nitrogen Heterocycles by Trifluoromethyl Substituents," 8th International Symposium on Pteridines and Folic Acid Derivatives, Montreal, Quebec, Canada, June 10, 1986.
24. "Asymmetric Synthesis of (+)-Corynoline," 27th Annual Meeting of The American Society of Pharmacognosy, The University of Michigan, Ann Arbor, Michigan, July 30, 1986.
25. "Asymmetric Synthesis of (+)-Corynoline," 193rd American Chemical Society National Meeting, Denver, Colorado, April 8, 1987.
26. "Computer Assisted Molecular Design of Antisense Oligonucleotide-Intercalator Conjugates as Antiviral Agents," Gordon Conference on Chemotherapy of AIDS, Oxnard, California, March l5, 1988.
27. "Computer Assisted Molecular Design of Antisense Oligonucleotide-Intercalator Conjugates as Antiviral Agents," The Second International Conference on Antiviral Research, Williamsburg, Virginia, April 11, l988.
28. "Synthesis of 6-Trifluoromethyl-8-ribityllumazine **(1)** as a ^{19}F NMR Detecting Shift Probe for the Light Riboflavin Synthase of *Bacillus subtilis*," The 196th American Chemical Society National Meeting, Los Angeles, California, September 28, 1988.
29. "Design and Synthesis of Oligonucleotide-Intercalator Conjugates as Potential Anti-AIDS Agents," Conference on Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression: Therapeutic Implications," Rockville, Maryland, June 18, 1989.
30. "Synthesis of a Biologically Active End Group Modified Retro-Inverso Bombesin C-Terminal Nonapeptide," The 198th American Chemical Society National Meeting, Miami Beach, Florida, September 14, 1989.
31. "An Approach to the Synthesis of HIV Protease Inhibitors: Stereochemically Pure Peptide Substrate Analogs Containing [Phe-ψCH_2N-Pro] Linkages," Second International Conference on Drug Research in Immunologic and Infectious Diseases. Acquired Immune Deficiency Syndrome (AIDS), Washington, D.C., November 6, 1989.
32. "Synthesis and Liposome Encapsulation of Antisense Oligonucleotide-Intercalator Conjugates," Second International Conference on Drug Research in Immunologic and Infectious Diseases. Acquired Immune Deficiency Syndrome (AIDS), Washington, D.C., November 6, 1989.
33. "Synthesis and Evaluation of a Triphenylcarbinol Related to the Incorrectly Assumed Structure of Aurintricarboxylic Acid," Second International Conference on Drug Research in Immunologic and Infectious Diseases. Acquired Immune Deficiency Syndrome (AIDS), Washington, D.C., November 6, 1989.
34. "Synthesis and Evaluation of Hypothetical Intermediates in the Biosynthetic Conversion of Protoberberine to Benzo[*c*]phenanthridine Alkaloids," 1989 International Chemical Congress of Pacific Basin Societies, Honolulu, Hawaii, December 19, 1989.
35. "Inhibition of Reverse Transcription by Oligonucleotide-Intercalator Conjugates," Advances in Molecular Biology and Targeted Treatments for AIDS, Washington, D. C., May 15-18, 1990.
36. "Synthesis of Antisense Oligonucleotide-Intercalator Conjugates," Advances in Molecular Biology and Targeted Treatments for AIDS, Washington, D. C., May 15-18, 1990.
37. "An Approach to the Synthesis of HIV Protease Inhibitors: Stereochemically Pure Peptide Substrate Analogs Containing [Phe-ψCH_2N-Pro] Linkages," Advances in

Molecular Biology and Targeted Treatments for AIDS, Washington, D. C., May 15-18, 1990.

38. "Synthesis and Evaluation of a Triphenylcarbinol Related to the Incorrectly Assumed Structure of Aurintricarboxylic Acid," Advances in Molecular Biology and Targeted Treatments for AIDS, Washington, D. C., May 15-18, 1990.
39. "Liposome Encapsulation of Oligonucleotides," Advances in Molecular Biology and Targeted Treatments for AIDS, Washington, D. C., May 15-18, 1990.
40. "The Anti-AIDS Activity of Aurintricarboxylic Acid is Directly Correlated with its Molecular Weight," Third International Conference of Anticancer Research, October 16, 1990, Marathon, Greece.
41. "Anticancer Specificity of Some Ellipticinium Salts Against Human Brain Tumors *In Vitro*," Eighty-Third Annual Meeting of the American Association of Cancer Research, May 20-23, 1992, San Diego, California.
42. "Synthesis and Evaluation of Analogues of (Z)-1-(4-Methoxyphenyl)-2(3,4,5-trimethoxyphenyl)ethene as Potential Cytotoxic and Antimitotic Agents," Eighty-Third Annual Meeting of the American Association of Cancer Research, May 20-23, 1992, San Diego, California.
43. "Synthesis and Evaluation of a Series of Benzylanilines as Potential Cytotoxic and Antimitotic Agents Acting by Inhibition of Tubulin Polymerization," Eighty-Fourth Annual Meeting of the American Association for Cancer Researc, May 19-22, 1993, Orlando, Florida.
44. "^{19}F NMR Studies on the Mechanism of Riboflavin Synthase," Eleventh International Symposium on Flavins and Flavoproteins, July 27-31, 1993, Nagoya, Japan.
45. "^{19}F NMR Studies of Lumazine Protein from *Photobacterium phosphoreum*," Eleventh International Symposium on Flavins and Flavoproteins, July 27-31, 1993, Nagoya, Japan.
46. "Design and Synthesis of Ellipticinium Salts and 1,2-Dihydroellipticines with High Selectivities against Human CNS Cancers *In Vitro*, " 1994 Annual American Association for Cancer Research National Meeting, April 13, 1994, San Francisco, California.
47. "Mechanism of Anti-Human Immunodeficiency Virus (HIV) Action of Selected ATA Polymer Analogues," Eighth International Conference on Antiviral Research, December 15, 1994, Santa Fe, New Mexico.
48. "Synthesis and Biological Evaluation of Certain Alkenyldiarylmethanes (ADAMs) as Anti-HIV Agents which Act as Non-nucleoside Reverse Transcriptase Inhibitors," 25th National Medicinal Chemistry Symposium, June 19, 1996, Ann Arbor, Michigan.
49. "Synthesis, Antitubulin Activity, and Anticancer Activity of More Potent Analogs in the 2-Alkoxyestradiol Series," 213th American Chemical Society National Meeting, April 16, 1997, San Francisco, California.
50. "Design, Synthesis, and Biological Evaluation of New Alkenyldiarylmethanes (ADAMs) with Enhanced Potencies as Anti-HIV Agents," 215th American Chemical Society National Meeting, March 29, 1998, Dallas, Texas.
51. "Synthesis and Anti-HIV Activity of Cosalane Analogs Incorporating Nitrogen in the Alkenyl Linker Chain," 217th American Chemical Society National Meeting, March 22, 1999, Anaheim, California.
52. "Synthesis of New Analogs of Indenoisoquinoline: Potential Non-Camptothecin Topoisomerase I Poisons," 217th American Chemical Society National Meeting, March 21, 1999, Anaheim, California.
53. "Synthesis of Analogs of Cosalane," 217th American Chemical Society National Meeting, March 24, 1999, Anaheim, California.

54. "Novel Non-camptothecin Topoisomerase I Poisons: The Indenoisoquinolines," AACR-NCI-EORTC International Conference on Molecular Targets and Cancer Chemotherapeutics, November 16, 1999, Washington, D. C.
55. "Steroid Derivatives Interacting with Tubulin: from Colchicine-like to Paclitaxel-like Effects on Tubulin Polymerization," AACR-NCI-EORTC International Conference on Molecular Targets and Cancer Chemotherapeutics, November 16, 1999, Washington, D. C.
56. "Inhibition of RANTES/CCR1 Mediated Chemotaxis by Novel Cosalane Compounds," Seventh Annual Conference of the International Cytokine Society, Hilton Head Island, South Carolina, December 5, 1999.
57. "Novel Modifications to the Alkenyldiarylmethane (ADAM) Series of HIV-1 Reverse Transcriptase Inhibitors," 219th American Chemical Society National Meeting, San Francisco, March 26, 2000.
58. "Cleavage Complexes Induced by Novel Non-Camptothecin Inhibitors, the Indenoisoquinolines, in the Presence of Normal and Mutated Topoisomerase I from Camptothecin-Resistant Cell Lines," 91st Annual Meeting of the American Society for Cancer Research, San Francisco, April 3, 2000.
59. "Synthesis of Cosalane Amino Acid Conjugates for Enhanced Anti-HIV Activity and Oral Bioavailability," 221st National Meeting of the American Chemical Society, San Diego, April 1, 2001.
60. "Synthesis and Biological Evaluation of New Lavendustin A Analogs," 221st National Meeting of the American Chemical Society, San Diego, April 1, 2001.
61. "Solid Phase Synthesis of Alkenyldiarylmethanes Targeting HIV-1 Reverse Transcriptase," 221st National Meeting of the American Chemical Society, San Diego, April 1, 2001.
62. "Design, Synthesis, and Biological Evaluation of Diarylmethylenepiperidinecarboxylates as New Anti-HIV Agents," 221st National Meeting of the American Chemical Society, San Diego, April 1, 2001.
63. "Design and Synthesis of Brefeldin A Prodrugs with Enhanced Aqueous Solubilities," 34th Mid-Atlantic Graduate Student Symposium, Columbus, Ohio, June 28, 2001.
64. "Design and Synthesis of (+)-Brefeldin A Sulfide Prodrugs with Enhanced Aqueous Solubilities," 222nd ACS National Meeting, Chicago, Illinois, August 26, 2001.
65. "Design and Synthesis of Novel Non-Camptothecin Topoisomerase I Poisons," 222nd ACS National Meeting, Chicago, Illinois, August 26, 2001.
66. "Unexpected Aldol Type Addition Reaction of Diisopropylidene-D-Ribose Dithioacetal and Regioselective 1-*O*-Deacylation of Peracetylated Glycopyranosides by Mercuric Chloride and Mercuric Oxide," 222nd ACS National Meeting, Chicago, Illinois, August 27, 2001.
67. "Extension of the Polyanionic Cosalane Chromophore for Increasing Anti-HIV Potency," 222nd ACS National Meeting, Chicago, Illinois, August 26, 2001.
68. "A Hexacarboxylic Acid Variant of Cosalane Inhibits CCL5 and CXCL12 Mediated Cellular Activities," Abstract 2224, 2002 AACR Annual Meeting, San Francisco, April 8, 2002.
69. "The Synthesis of New Indenoisoquinolines: Cytotoxic Agents and Topoisomerase I Inhibitors," 36th Graduate Student Symposium in Medicinal Chemistry, Ann Arbor, Michigan, June 27, 2003.
70. AACR-NCI-EORTC International Conference. Molecular Targets and Cancer Therapeutics Proceedings, A260, pg.114. November 2003.

71. "Design, Synthesis, and Biological Evaluation of Novel Cytotoxic Aminoalkenylindenoisoquinoline Topoisomerase I Inhibitors," 227th American Chemical Society National Meeting, Anaheim, California, March 28, 2004.
72. "Synthesis of New Indenoisoquinoline: Cytotoxic Agents and Topoisomerase I Inhibitors," 227th American Chemical Society National Meeting, Anaheim, California, March 28, 2004.
73. "Synthesis and Evaluation of Ligands to Probe the Active Site of Lumazine Synthase," 227th American Chemical Society National Meeting, Anaheim, California, March 28, 2004.
74. "Exploring the Anticancer Activity of Brefeldin A," Mid-Atlantic Graduate Student Symposium in Medicinal Chemistry, Purdue University, West Lafayette, Indiana, June 17-19, 2004.
75. "Synthesis of New Indenoisoquinolines: Cytotoxic Agents and Topoisomerase I Inhibitors," Mid-Atlantic Graduate Student Symposium in Medicinal Chemistry, Purdue University, West Lafayette, Indiana, June 17-19, 2004.
76. "Design and Synthesis of Indenoisoquinoline Topoisomerase I Inhibitors," Mid-Atlantic Graduate Student Symposium in Medicinal Chemistry, Purdue University, West Lafayette, Indiana, June 17-19, 2004.
77. "Design, Synthesis, and Biological Evaluation of Novel Cytotoxic 11-Aminoalkenylindenoisoquinoline Topoisomerase I Inhibitors," Mid-Atlantic Graduate Student Symposium in Medicinal Chemistry, Purdue University, West Lafayette, Indiana, June 17-19, 2004.
78. "Quantum Mechanics Studies on the DNA Sequence Preference of Camptothecin," X. Xiao and M. Cushman, 229th American Chemical Society National Meeting, San Diego, California, March 15, 2005.
79. "Design, Synthesis and Metabolic Stabilities of Alkenyldiarylmethanes (ADAMs) Having Nonidentical Aromatic Substituents as NNRTIs." B-L. Deng and M. Cushman, 229th American Chemical Society National Meeting, San Diego, California, March 16, 2005.
80. "Design, Synthesis, and Evaluation of Dioxane Antiviral Agents Targeted Against the Hydrophobic Binding Pocket of Syndbis Virus Capsid Protein," H. Y. Kim, R. Warrier, C. Patkar, R. Kuhn, and M. Cushman, 229th American Chemical Society National Meeting, San Diego, California, March 16, 2005.
81. "New Indenoisoquinolinium Salts, *N*-6-Desalkylindenoisoquinolines, and 5,11-Diketoindenoisoquinolines: Design and Synthesis of Topoisomerase I Inhibitors as Anticancer Agents," A. S. Ioanoviciu, S. Antony, G. Kohlhagen, Y. Pommier, B. Staker, L. Stewart, and M. Cushman, 229th American Chemical Society National Meeting, San Diego, California, March 16, 2005.
82. "On the Binding of Indeno[1,2-*c*]isoquinolines in the DNA-topoisomerase I Cleavage Complex," X. Xiao, S. Antony, Y. Pommier, and M. Cushman, 229th American Chemical Society National Meeting, San Diego, California, March 16, 2005.
83. "Determining the Mechanisms of Action of Anticancer Natural Products," N. O. Anadu, Mark S. Cushman, and V. J Davisson, 230th American Chemical Society National Meeting, Washington, D. C., August 30, 2005.
84. "Bisindenoisoquinoline (NSC 727357): A Novel Inhibitor of Topoisomerases," Smitha Antony, Keli K. Agama, Ze-Hong Miao, Muthukaman Nagarajan, Mark Cushman, and Yves Pommier," AACR-NCI-EORTC 17th Symposium: Molecular Targets and Cancer Therapeutics, Drug Highlights, November 14, 2005.
85. "Cellular Topoisomerase I Inhibition and Antiproliferative Activity of Indenoisoquinolines Selected for Preclinical Development," Keli K. Agama, Smitha Antony, Ze-Hong Miao, Muthukaman Nagarajan, Mark Cushman, and Yves Pommier, AACR-NCI-EORTC 17th Symposium, International Conference on Molecular Targets and Cancer Therapeutics: Discovery, Biology, and Clinical Applications, Philadelphia,

PA, November 14, 2005.

86. "Design and Synthesis of Optimized Indenoisoquinolines as Topoisomerase I Inhibitors," S. M. Parmley, A. Morrell, M. Cushman, S. Antony, G. Kohlhagen, and Y. Pommier, 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006.
87. "Synthesis of Benz[*d*]indeno[1,2-*b*]pyran-5,11-diones: Versatile Intermediates for the Design and Synthesis of Topoisomerase I Inhibitors," Andrew Morrell, Smitha Antony, Glenda Kohlhagen, Yves Pommier, and Mark Cushman, 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006.
88. "A New Four-Frequency Transmission-Line Probe is Designed to Study Lumazine Synthase-Ligand Complex," Tsyr-Yan Dharma Yu, Justyne Wolak, Gregory Potter, Robert D. O'Connor, Mark Cushman, and Jabob Schaefer, 47th Experimental Nuclear Magnetic Resonance Conference, The Asilomar Conference Center, Pacific Grove, California, April 23, 2006.
89. "Histone γ-H2AX as a Pharmacodynamic Biomarker for the Indenoisoquinoline Topoisomerase I Inhibitors Selected for Preclinical Development," Smitha Antony, Keli A. Agama, Muthukaman Nagarajan, Mark Cushman, William M. Bonner, Yves Pommier, 97th AACR Annual Meeting, Washington, D.C., April 1, 2006.
90. "Discovery of Natural Products as Inhibitors of Carcinogenesis," John M. Pezzuto, William Fenical, Mark Cushman, Ching-Jer Chang, Bruce Craig, Richard Moon, Andy Mesecar, Richard B. van Breemen, and Harry H. Fong, 47th Annual Meeting of the American Association of Pharmacognosy, Arlington, Virginia, August 5, 2006.
91. "Delivery of Indenoisoquinoline Using Customized Releasable PEG Linkers," Cushman, M.; Pommier, Y. 4th NCI-EORTC International Meeting on Cancer Molecular Markers, from Discovery to Clinical Practice, Stone Mountain, Georgia, September 8, 2006.
92. "A Systematic Study of Nitrated Indenoisoquinolines Reveals a Potent Topoisomerase I Inhibitor," Andrew Morrell, Glenda Kohlhagen, Smitha Antony, Yves Pommier, and Mark Cushman, 232nd ACS National Meeting, San Francisco, CA, September 11, 2006.
93. "Multi-Gram Total Syntheses of Zapotin and (±)-Abyssinone II, Cancer Chemopreventive Natural Products," Arup Maiti, John M. Pezzuto, Muriel Cuendet, Tamara Kondratyuk, Vicki L. Croy, and Mark Cushman, 232nd ACS National Meeting, San Francisco, CA, September 10, 2006.
94. "Design, Synthesis, and Biochemical Evaluation of Ribitylaminopyrimidine Substrate Analogs of Lumazine Synthase as Potential Enzyme Inhibitors and Mechanistic Probes," Arindam Talukdar, Adelbert Bacher, Markus Fischer, Boris Illarionov, and Mark Cushman, 232nd ACS National Meeting, San Francisco, CA, September 10, 2006.
95. "Delivery of Indenoisoquinoline Using Customized Releasable PEG Linkers," Hong Zhao, Ying Gao, Charles D. Conover, Lee M. Greenberger, Ivan D. Horak, Yves Pommier, Melinda Hollingshead, Mark Cushman, and Andrew Morrell, 18th EORTC-NCI-AACR Symposium on "Molecular Targets and Cancer Therapeutics" Prague, Czech republic, 7-10 November 2006.
96. "Synthesis, SAR and Biological Evaluation of Racemic Abyssinone II and Analogues as Potential Aromatase Inhibitors for Prevention of Breast Cancer," Arup Maiti, Muriel Cuendet, Vicki L. Croy, Denise C Endringer, John M Pezzuto, and Mark Cushman, 233rd ACS National Meeting, Chicago, Illinois, March 25, 2007.
97. "Synthesis and Biological Evaluation of Alkenyldiarylmethane HIV-1 Non-Nucleoside Reverse Transcriptase Inhibitors that Possess Increased Hydrolytic Stability," Matthew D. Cullen, Erik De Clercq, Christophe Pannecouque, Tracy L. Hartman, Robert W. Buckheit Jr., Bo Liang Deng, and Mark Cushman, 233rd ACS National Meeting, Chicago,

Illinois, March 25, 2007.

98. "Synthesis and Anti-HIV Activity of New Metabolically Stable Alkenyldiarylmethane (ADAM) Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs) with *N*-Methoxy Imidoyl Halides," Takeshi Sakamoto, Matthew D. Cullen, and Mark Cushman, 127th Annual Meeting of the Pharmaceutical Society of Japan, Toyama City, March 28-30, 2007.
99. "Design, Synthesis and Evaluation of 1-(D-Ribityl)-1,7-dihydro-pyrazolo[3,4-d]pyrimidine-4,6-diones Bearing Alkyl Phosphate Substituents as Inhibitors of Lumazine Synthase," Yanlei Zhang, Adelbert Bacher, Markus Fisher, Boris Illarionov, and Mark Cushman, 233rd ACS National Meeting, Chicago, Illinois, March 25, 2007.
100. "Novel Indenoisoquinolines NSC 725776 and NSC 724998 Produce Persistent Topoisomerase I Cleavage Complexes and Overcome Multidrug Resistance," Yves, G. Pommier, Smitha Antony, Keli Agama, Ze-Hong Miao, Kazutaka Takugi, Susan Bates, Mollie H. Wright, Anna I Robbles, Lyuba Varticovski, Muthukaman Nagarajan, and Mark Cushman, AACR-NCI-EORTC International Conference, San Francisco, California, October 22, 2007.
101. "Pilot Toxicity Study of Indenoisoquinoline Analogs NSC-725776 and NSC-724998 in Beagle Dogs," Zahalka, E.; Seung, H.; Glaze, E.; Tomaszewski, J., Cushman, M.; Pommier, Y, Annual Meeting of the American Association for Cancer Research, April 14, 2007.
102. "3,3-Diarylacrylonitriles as Tubulin Polymerization Inhibitors for Cancer Chemotherapy," Zhenglai Fang and Mark Cushman, Ernest Hamel, and Gregory E. Agoston, 235th American Chemical Society National Meeting, New Orleans, Louisiana, April 6, 2008.
103. "Natural Product Cancer Chemopreventive Agents." John M. Pezzuto, Ching J. Chang, Bruce A. Craig, Mark Cushman, William Fenical, Harry H.S. Fong, Andrew Mesecar, Richard C. Moon, Richard B. van Breemen, Annual Meeting of the Phytochemical Society of North America, Washington State University, Pullman, Washington, June 27, 2008.
104. Ahn, S.; Cushman, M. S.; Pezzuto, J.M.; van Breemen, R.B. Studies of Intestinal Absorption and Serum Levels of Novel Chemopreventive Agents. 57th ASMS Conference on Mass Spectrometry Meeting, Philadelphia, Pennsylvania, May 31, 2009.
105. Li, J., Cushman, M., Pezzuto, J.M., van Breemen, R.B. *In Vitro* Metabolism of Zapotin from *Casimiroa edulis* in Human Liver Microsomes and Cryopreserved Human Hepatocytes. 56th ASMS Conference on Mass Spectrometry, Denver, CO; June 1, 2008.
106. "Discovery and Optimization of Antiviral Agents Targeting the Flavivirus Envelope Protein," Z. Li, M. Khaliq, Z. Zhou, C. B. Post, R. J. Kuhn, and M. Cushman, Great Lakes Regional Center of Excellence (GLRCE) Meeting, Hilton Head, South Carolina, November 7, 2008.
107. "Non-Camptothecin Topoisomerase I Inhibitors, the Indenoisoquinolines NSC 725776 and NSC 724998 Produce Persistent Topoisomerase I Cleavage Complexes and Overcome Multidrug Resistance and Limitations of Camptothecins," Pommier, Y., Agama, K., Antony, S., Robles, A. I., Varticovski, L., Nagarajan, M., Hollingshead, M., Parchment, R., Tomaszwewski, J., Doroshow, J., and Cushman, M. NCI Translates: the NCI Translational Science Meeting, Washington, D.C., November 9, 2008.
108. "Induction of RXR Transcriptional Activity and Apoptosis in HL-60 Human Leukemia Cells by Natural Product-based 3-amino-6-(3-aminopropyl)-5,6-dihydro-5,11-dioxo-11*H*-indeno[1,2-*c*]isoquinoline Dihydrochloride," Park, E.-J., Pezzuto, J.M., Morrell, A., and

Cushman, M. 50th Annual American Society of Pharmacognosy Meeting, Honolulu, Hawaii, June 27, 2009.

109. "Mechanism-Based Screening of Resveratrol Derivatives as Potential Cancer Chemopreventive Agents" Kondratyuk, T. P., Park, E.-J., Marler, L., Rostama, B., Pezzuto, J. M., and Cushman, M.. 50th Annual American Society of Pharmacognosy Meeting, Honolulu, Hawaii, June 27, 2009.
110. "The Indenoisoquinolines Non-Camptothecin Topoisomerase I Inhibitors: From the Bedside to the Bench to the Bedside," Pommier, Y.; Tomaszewski, J. E.; Doroshow, J. H.; Cushman, M. NCI Translates - The 2009 NCI Translational Science Meeting. November 5-7, 2009, Vienna, Virginia, November 5, 2009.
111. "Induction of RXR Transcriptional Activity and Consequent Up-regulation of p21 by 3-Amino-6-(3-aminopropyl)-5,6-dihydro-5,11-dioxo-11*H*-indeno[1,2-*c*]isoquinoline Dihydrochloride in MCF-7 Breast Cancer Cells", Park, E.-J.; Kondratyuk, T. P.; Morrell, A.; Kiselev, E.; Cushman, M.; and Pezzuto, J. M., American Association for Cancer Research Frontiers and Cancer Prevention Research, Houston, Texas, December 6, 2009.
112. "Aromatase Inhibition and Chemopreventive Potential of Novel Resveratrol Derivatives," Marler, L. E.; Cushman, M.; Sun, B.; Mesecar, A. D.; van Breemen, R. B.; Pezzuto, J. M., American Association for Cancer Research Frontiers and Cancer Prevention Research, Houston, Texas, December 6, 2009.
113. "Small Molecule Inhibitor of Dengue Envelope Protein," Khaliq, M.; Zhou, Z.; Suk, J.-e.; Li, Z.; Post, C. B.; Cushman, M.; Kuhn, R. J. Symposium on Vaccine Research: New Developments and Opportunities, The Burton Morgan Center for Entrepreneurship, Purdue University, October 8, 2009.
114. "Small Molecule Inhibitor of Dengue Envelope Protein," Khaliq, M.; Zhou, Z.; Suk, J.-e.; Li, Z.; Post, C. B.; Cushman, M.; Kuhn, R. J., Keystone Symposia on Molecular and Cellular Biology, Cell Biology of Virus Entry, Replication and Pathogenesis, Taos, New Mexico, February 16-21, 2010.
115. "LC-MS-MS Determination of Zapotin from *Casimiroa edulis* in Rat Serum and Tissues" Li, J.; Cushman, M.; Pezzuto, J. M.; van Breemen, R. B., 58th American Society for Mass Spectrometry Conference on Mass Spectrometry, Salt Lake City, Utah, May 23-27, 2010.
116. "In Vitro Hepatic Metabolism of 3-Amino-6-(3-aminopropyl)-5,6-dihydro-5,11-dioxo-11*H*-indeno[1,2-*c*] Isoquinoline Dihydrochloride, a Promising Cancer Chemoprevention Agent," Chen, L.; Li, J.; Cushman, M.; Pezzuto, J.; van Breemen, R. B., 58th American Society for Mass Spectrometry Conference on Mass Spectrometry, Salt Lake City, Utah, May 23-27, 2010.
117. "Aromatase Specificity of Casimiroin Analogs," Laura Marler, Arup Maiti, Mark Cushman, John Pezzuto, 2010 Joint Annual Meeting of the American Society of Pharmacognosy and the Phytochemical Society of North America, St. Petersburg Beach, Florida, July 10-14, 2010.
118. "Cancer Chemopreventive Potential of Marine-Derived Phenazines," Laura E. Marler, John M. Pezzuto, Ratnakar N. Asolkar, William Fenical, Martin Conda-Sheridan, Mark Cushman, Pacifichem 2010 Meeting, Honolulu, Hawaii, December 15-20, 2010.
119. "Discovery and Development of the Covalent Hydrates of Trifluoromethylated Pyrazoles as Riboflavin Synthase Inhibitors with Antitubercular Activity," Evgeny Kiselev, Thomas Dexheimer, Yves Pommier, and Mark Cushman, 240th National American Chemical Society Meeting, Boston, Massachuestts, August 22-26, 2010.

120. "Discovery and Development of the Covalent Hydrates of Trifluoromethylated Pyrazoles as Riboflavin Synthase Inhibitors with Antitubercular Activity," Arindam Talukdar, Adelbert Bacher, Boris Illarionov, Markus Fischer, Scott G. Franzblau, Baojie Wan, and Mark Cushman, 240th National American Chemical Society Meeting, Boston, Massachusetts, August 22-26, 2010.
121. "Cancer Chemopreventive Potential of Marine-Derived Phenazines," Laura E. Marler, John M. Pezzuto, Ratnaker N. Asolkar, William Fenical, Martin Conda-Sheridan, and Mark Cushman, The International Chemical Congress of Pacific Basin Societies (Pacifichem), Honolulu, Hawaii, December 15-20, 2010.
122. "Discovery and Lead Structure Optimization of a Non-secosteroid Binding Partner for the Vitamin D Receptor (20)", Jerry White, Mark S. Cushman, and Richard B. van Breemen, American Society for Mass Spectrometry Conference, Denver, Colorado, June 5-9, 2011.
123. "Human Metabolism of AM6-36, a Retinoid X Receptor-alpha Ligand, Lian Chen, Mark Cushman, John M. Pezzuto, and Richard B. van Breemen, American Chemical Society National Meeting, Denver, Colorado, June 5-9, 2011.
124. "7-Azaindenoisoquinolines: Topoisomerase I Inhibitors with Improved Water Solubility", Evgeny Kiselev, Sean DeGuire, Andrew Morrell, Keli Agama, Thomas Dexheimer, Yves Pommier and Mark Cushman, American Chemical Society National Meeting, Denver, Colorado, June 5-9, 2011.
125. "The Challenges and Promise of Cancer Chemoprevention: The Role of Natural Products", John M. Pezzuto, Mark Cushman, William Fenical, Andrew Mesecar, and Richard B. van Breemen, 3rd Brazilian Conference on Natural Products (BCNP), Ouro Preto, MG, Brazil, October 29-November 2, 2011.
126. "The Role of Natural Products in Cancer Chemoprevention", John M. Pezzuto, Mark Cushman, William Fenical, Andrew Mesecar, and Richard B. van Breemen, The 2nd Annual Conference of the American Council for Medicinally Active Plants, Huntsville, Alabama, July 17, 2011.
127. "Antimicrobial Evaluation of a Focused Naringenin and Resveratrol Chemical Library," Dianqing Sun, Julian G. Hurdle, Robin E. Lee, Li Shen, Tamara P. Kondratyuk, Richard E. Lee, Mark Cushman, and John M. Pezzuto, Phytochemical Society of North America 2011 Conference, Kona, Hawaii, December 15-20, 2011.
128. "Thiadiazole and Thiadiazole Derivatives of Resveratrol as Inducers of Quinone Reductase 1," Laura Marler, Abdelrahman Mayhoub, Mark Cushman, and John Pezzuto, Phytochemical Society of North America 2011 Conference, Kona, Hawaii, December 15-20, 2011.
129. "Resveratrol Derivative (*E*)-4-(3,5-Dimethoxystyryl)analine Is a Novel Inhibitor of Cancer Cell Invasion," Tamara P. Kondratyuk, Eun-Jung Park, Tyler Hirokawa, Ethyn Leong, Bis Sun, Mark Cushman, and John M. Pezzuto, Phytochemical Society of North America 2011 Conference, Kona, Hawaii, December 15-20, 2011.
130. "Suppression of 12-*O*-Tetradecanoylphorbol-13-acetate-induced Ornithine Decarboxylate Activity by Resveratrol Derivatives," Suaib Luqman, Tamara P. Kondratyuk, Juma Hoshino, Mark Cushman, John M. Pezzuto, Phytochemical Society of North America 2011 Conference, Kona, Hawaii, December 15-20, 2011.
131. "7-Azaindenoisoquinolines: Topoisomerase I Inhibitors with Improved Water Solubility," Evgeny Kiselev, Sean DeGuire, Andrew Morrell, Keli Agams, Thomas Dexheimer, Yves Pommier, and Mark Cushman, 242nd American Chemical Society National Meeting, Denver, Colorado, August 28-September 1, 2011.
132. "Indenoisoquinolines: A New Class of Rexinoids with Promising Chemopreventive

Potential," Martin Conda-Sheridan, P. V. Narasimha Reddy, Lian Chen, Eun-Jung Park, Tamara P. Kondratyuk, John M. Pezzuto, Richard van Breemen, and Mark Cushman, 242nd American Chemical Society National Meeting, Denver, Colorado, August 28-September 1, 2011.

133. "Optimization of Thiazole Analogues of Resveratrol for Induction of Quinone Reductase 1 (QR1)," Abdelrahman S. Mayhoub, Laura Marler, Tamara P. Kondratyuk, Eun-Jung Park, John M. Pezzuto, and Mark Cushman, 243rd American Chemical Society National Meeting, San Diego, California, March 25-29, 2012.
134. "A Structure-Activity Relationship Study of Azaindenoisoquinoline Topoisomerase I Inhibitors," Evgeny Kiselev, Keli Agama, Yves Pommier, and Mark Cushman, 243rd American Chemical Society National Meeting, San Diego, California, March 25-29, 2012.
135. "Characterization of the Anti-proliferative Effect of 6-(3-Aminopropyl)-9-methoxy-3-nitro-5*H*-indeno[1,2-*c*]isoquinoline-5,11(6*H*)-dione in Cultured PC-3 Cells," Eun-Jung Park, Andrew Morrell, Martin Conda-Sheridan, Mark Cushman, John M. Pezzuto, American Association for Cancer Research, Chicago, Illinois, April 2, 2012.
136. "A New Drug for an Old Bug: Antimicrobial Activity of Novel Substituted Thiazoles against Methicillin-Resistant *Staphylococcus aureus* (MRSA)," H. Mohammad, A.S. Mayhoub, A. Ghafoor, M. Soofi, R. A. Alajlouni, M. Cushman and M. N. Seleem, Conference of Research Workers in Animal Disease, Chicago, Illinois, December 2, 2012.
137. "Application of Raman Spectroscopy in Antimicrobial Drug Discovery Research," H. Mohammad, R. A. Alajlouni[1], A. I. M. Athamneh[2], A. S. Mayhoub[3], M. Cushman[3], R. S. Senger[2], M. N. Seleem[1], Conference of Research Workers in Animal Disease, Chicago, Illinois, December 2, 2012.
138. "Biological Evaluation of Resveratrol and Derivatives," John M. Pezzuto, Talysa Ogas, Tamara Kondratyuk, Clinton Grubbs, Bin Sun, Mark Cushman, and Richard van Breemen, Resveratrol 2012 – Second International Conference of Resveratrol and Health, Leichester, United Kingdom, December 5, 2012.
139. "Synthesis of Mixed (*E,Z*)-, (*E*)-, and (*Z*)-Norendoxifen with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," W. Lv, J. Liu,[2] D. Lu,[2] D. A. Flockhart,[2] and M. Cushman, The 30th Annual H. C. Brown Lectures – 2013, Purdue University, West Lafayette, Indiana, April 27, 2013.
140. "Synthesis of 3-(3-Aryl-pyrrolidin-1-yl)-5-aryl-1,2,4-triazine Inorganic Pyrophosphatase Inhibitors," W. Lv, B. Banerjee, K. L. Molland, M. N. Seleem, A. Ghafoor, B. Wan, S. G. Franzblau, A. D. Mesecar, and M. Cushman, The 30th Annual H. C. Brown Lectures – 2013, Purdue University, West Lafayette, Indiana, April 27, 2013.
141. "Synthesis and Biological Evaluation of New Carbohydrate-Substituted Indenoisoquinoline Topoisomerase I Inhibitors," Daniel E. Beck, Keli Agama, Christophe Marchand, Adel Chergui, Yves Pommier, and Mark Cushman, 6th Yao Yuan Biotech-Pharma Symposium, Illinois Institute of Technology, March 8, 2014.
142. "Design and Synthesis of Norendoxifen Analogues with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," Wei Lv, Jinzhong Liu, David A. Flockhart, and Mark Cushman, 247th American Chemical Society National Meeting, Dallas, Texas, March 16, 2014.
143. "DUPA Conjugation of Cytotoxic Indenoisoquinoline Topoisomerase I Inhibitors as a Method for Selectively Targeting Prostate Cancer Cells," Trung X. Nguyen, Jyoti Roy, Ananda K. Kanduluru, Philip S. Low, Mark Cushman,"247th American Chemical Society National Meeting, Dallas, Texas, March 19, 2014.

144. "Synthesis and Biological Evaluation of New Carbohydrate-Substituted Indenoisoqinoline Topoisomerase I Inhibitors and Improved Syntheses of the Experimental Anticancer Agents Lidotecan (LMP400) and Indimitecan (LMP776)," 247th American Chemical Society National Meeting, Dallas, Texas, March 19, 2014.
145. "Design and Synthesis of Norendoxifen Analogues with Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," Wei Lv, Jinzhong Liu, David A. Flockhart, and Mark Cushman, Health and Disease: Science, Culture and Policy Research Poster Session, Purdue University, March 31, 2014.
146. "DUPA Conjugation of Cytotoxic Indenoisoquinoline Topoisomerase I Inhibitors as a Method for Selectively Targeting Prostate Cancer Cells," Trung X. Nguyen, Jyoti Roy, Ananda K. Kanduluru, Philip S. Low, Mark Cushman, Health and Disease: Science, Culture and Policy Research Poster Session, Purdue University, March 31, 2014.
147. "Synthesis and Biological Evaluation of New Carbohydrate-Substituted Indenoisoqinoline Topoisomerase I Inhibitors and Improved Syntheses of the Experimental Anticancer Agents Indotecan (LMP400) and Indimitecan (LMP776)," Daniel E. Beck, Keli Agama, Christophe Marchand, Adel Chergui, Yves Pommier, and Mark Cushman, Health and Disease: Science, Culture and Policy Research Poster Session, Purdue University, March 31, 2014.
148. "DUPA Conjugation of Cytotoxic Indenoisoquinoline Topoisomerase I Inhibitors as a Method for Selectively Targeting Prostate Cancer Cells," Trung Nguyen, Jyoti Roy, Ananda Kanduluru, Philip Low, and Mark Cushman, Indiana University Melvin and Bren Simon Cancer Center's Cancer Research Day, Indianapolis, Indiana, May 29, 2014.
149. "A Novel Resveratrol Analogue Inhibits STAT3 Signaling and Induces Antitumor Cell Effects Against Human Glioma Cells," Zachary Chelsky, Tamara P. Kondratyuk, John Pezzuto, Mark Cushman, and James Turkson, Resveratrol 2014, 3rd International Conference of Resveratrol and Health, Waikoloa, Hawaii, November 30, 2014.
150. "Hydroxynorendoxifen, an Active Tamoxifen Metabolite, Possesses Dual Aromatase Inhibitory and Estrogen Receptor Modulatory Activities," J. Liu, D. Lu, J. Lu, W. Lv, M. Cushman, Z. Desta, and D. A. Flockhart, Annual Meeting of the American Society for Clinical Pharmacology and Therapeutics (ASCPT), Atlanta, Georgia, March 22, 2014.
151. "Synthesis and Biological Evaluation of New Carbohydrate-Substituted Indenoisoquinoline Topoisomerase I Inhibitors," Daniel E. Beck, Keli Agama, Christophe Marchand, Adel Chergui, Yves Pommier, and Mark Cushman, 247th American Chemical Society National Meeting, Dallas, Texas, March 19, 2014.
152. "Bioisosteric Replacement and S.A.R. Develepment Yield Potent Topoisomerase I Inhibitors with Improved Safety Potentia," Daniel E. Beck, Wei Lv, Christophe Marchand, Yves Pommier, and Mark Cushman, 44th National Organic Chemistry Symposium, University of Maryland at College Park, June 28, 2015.
153. "Targeting the Topoisomerase I Enzyme in Cancer Cells with Acquired Resistance to SN-38," Jan Stenvang, Niels Frank Jensen, Haatisha Jandu, Steen Knudsen, Keli Agama, Thomas Jensen, Anker Hansen, Peter Buhl Jensen, Yves Pommier, Mark Cushman, and Nils Brunner, AACR-NCI-EORTC International Conference on Molecular Targets and Cancer Therapeutics, Boston, November 5, 2015.
154. "Saving Fido – Unearthing a Novel Topical Antimicrobial for Treatment of Multidrug-resistant Staphylococcal Skin Infections in Companion Animals," H. Mohammad, A.S. Mayhoub, P.V.M. Reddy, M. Cushman and M. N. Seleem., Conference of Research Workers in Animal Diseases, Chicago, Illinois, December 7, 2015.

155. "Systematic Evaluation of Methyl Ester Bioisoteres in the Context of Developing Alkenyldiarylmethanes (ADAMs) as Non-nucleoside Reverse Transcriptase Inhibitor (NNRTIs) for anti-HIV-1 Chemotherapy," Ayako Hoshi, Takeshi Sakamoto, Jun Takayama, Meiyan Xuan, Mari Okazaki, Tracy L. Hartman, Robert W. Buckheit, Jr., Christophe Pannecouque, Mark Cushman, 136th Annual Meeting of the Pharmaceutical Society of Japan, Yokohama, March 28, 2016.
156. "Synthesis and Biological Evaluation of the First Triple Inhibitors of Human Topoisomerase 1, Tyrosyl-DNA Phosphodiesterase 1 (Tdp1), and Tyrosyl-DNA Phosphodiesterase 2 (Tdp2)," Ping Wang, Mohamed S. A. Elsayed, Caroline B. Plescia, Azhar Ravji, Christophe E. Redon, Evgeny Kiselev, Christophe Marchand, Olga Zeleznik, Keli Agama, Yves Pommier, and Mark Cushman, 253rd American Chemical Society National Meeting, San Francisco, April 2, 2017.
157. "Phase I Study of Indenoisoquinoline LMP776 in Adults with Relapsed Solid Tumors and Lymphomas," Shivaani Kummar, Jerry Collins, Nancy Moore, Lamin Juwara, Naoko Takebe, Richard Piekarz, Elad Sharon, Howard Streicher, Lyndsay Harris, Barbara Conley, Yves Pommier, Jerry Rubinstein, Mark Cushman, and Mary Quinn, 2017 ASCO Annual Meeting, June 2, 2017, Chicago, Illinois.
158. "Palladacycle-facilitated Ligand-free Suzuki Coupling of Hindered Aryl Bromides Yields Potent and Selective COX-2 Inhibitors," Mohamed S. A. El Sayed, Siran Chang, and Mark Cushman, 254th ACS National Meeting in Washington, DC, August 20, 2017.
159. "Indotecan (LMP400), Imidotecan (LMP776) and LMP744, a New Class of Non-camptothecin TOP1 Inhibitors Selective for Cancer Cells with Homologous Recombination Deficiencies and High SLFN11 Expression," L. Marzi, K. Agama, Z. W. Ohler, L. Szabove, S. Sharan, J. Murai, M. Al abo, M. Cushman, and Y. Pommier, AACR-NCI-EORTC International Conference on Molecular Targets and Cancer Therapeutics: Discovery, Biology, and Clinical Applications, Philadelphia, Pennsylvania, October 26, 2017.
170. "Indotecan (LMP400), Indimitecan (LMP776) and LMP744: A new class of non-camptothecin TOP1 inhibitors selective for cancer cells with homologous recombination deficiencies and high SLFN11 expression," Laetitia Marzi, Keli Agama, Z. Weaver Ohler, Ludmila Szabova, Shyam Sharan, Junko Murai, Muthana Al Abo, Mark Cushman and Yves Pommier, American Association for Cancer Research Annual Meeting, Chicago, Illinois, April 14, 2018.
171. "Indenoisoquinoline Topoisomerase I Inhibitors Target the DNA G-quadruplex Formed in the c-Myc Promoter and Cause MYC Downregulation," Kaibo Wang, Mohamed S. A. Elsayed, Guanhui Wu, Mark Cushman, Danzhou Yang, American Association for Cancer Research Annual Meeting, Chicago, Illinois, April 14, 2018.
172. "By-pass of Irinothecan Resistance by the Potent Topoisomerase I Inhibitor LMP400," Jan Stenvang, Niels Frank Jensen, Mark Cushman, Mark Rogers, and Nils Brünner, Conference on Response and Resistance in Cancer Therapy, University of Kent, Canterbury, UK, September 12, 2018.
173. "Indotecan (LMP400), Imidotecan (LMP776) and LMP744: A New Class of Non-camptothecin TOP1 Inhibitors Selective for Cancer Cells with Homoloous Recombination Deficiencies and High SLFN11 Expression," Yves Pommier, Laetitia Marzi, Zoe Waever Ohler, Ludmila Szabova, Shyam Sharan, Junko Murai, Mark Cushman, American Association for Cancer Research Annual Meeting, Chicago, Illinois, April 14, 2018.

Invited Lectures:

1. "A Novel Approach to the Total Synthesis of Certain Isoquinoline Alkaloids," Department of Chemistry, Indiana University-Purdue University, Fort Wayne, Indiana, April 5, 1977.
2. "New Alkaloid Syntheses," Department of Chemistry, Indiana University, Bloomington, Indiana, November 20, 1978.
3. "Synthesis of (±)-Thalictricavine, Berlambine, and (±)-Canadine from a Common Intermediate," Franklin College, Franklin, Indiana, November 27, 1979.
4. "Total Synthesis of Protoberberine and Benzophenathridine Alkaloids," Department of Chemistry, Northern Illinois University, March 26, 1981.
5. "Total Syntheses of Protoberberine and Benzophenanthridine Alkaloids," Department of Chemistry, University of Alberta, Edmonton, Canada, August 11, 1981.
6. "The Condensation of Schiff Bases with Homophthalic Anhydrides: A Method for the Total Synthesis of Protoberberine and Benzophenanthridine Alkaloids," Department of Chemistry, Munich Technical University, Garching, West Germany, December 15, 1983.
7. "Synthesis of Biologically Active Structural Analogs of the Anticancer Benzophenanthridine Alkaloids Nitidine Chloride and Fagaronine Chloride," The Medical Faculty, Palacky University, Olomouc, Czechoslovakia, June 8, 1984. This lecture was also presented at the Institute of Organic Chemistry and Biochemistry, Munich Technical University, Garching, West Germany, May 23, 1984.
8. "The Development of a Method for the Asymmetric Synthesis of Benzophenanthridine Alkaloids", Division of Medicinal Chemistry and Natural Products, College of Pharmacy, University of Iowa, Iowa City, Iowa, May 1, 1986.
9. "Mechanism Based Design and Synthesis of Fluorinated Riboflavin Synthase Inhibitors," Division of Toxicology, School of Pharmacy, University of California, San Francisco, California, December 30, l987.
10. "Prevention of the Cytopathic Effect of HIV in Cell Culture by ATA and Analogs," The Decision Network Meeting, National Cancer Institute, National Institutes of Health, Bethesda, Maryland, October 24, 1988.
11. "Anti-AIDS Drug Development," The 3rd Annual Meeting and Exposition of the American Association of Pharmaceutical Scientists, Orlando, Florida, November 2, 1988.
12. "An Overview of Anti-AIDS Drug Development," Department of Chemistry, Purdue University, West Lafayette, Indiana, November 22, 1988.
13. "An Overview of Anti-AIDS Drug Development," Department of Chemistry, The University of Akron, Akron, Ohio, December 6, 1988.
14. "Anti-AIDS Drug Development," Joliet Section of the American Chemical Society, Bradley, Illinois, May 9, 1989.
15. "Design and Synthesis of New Potential Anti-AIDS Agents," Chemex Pharmaceuticals, Inc., Denver, Colorado, May 22, 1989.
16. "Design and Synthesis of ATA Analogs as Potential Anti-AIDS Agents," Gilead Sciences Incorporated, Foster City, California, May 23, 1989.
17. "Anti-AIDS Drug Development," Abbott Labs, Abbott Park, Illinois, July 7, 1989.
18. "Synthesis of Fluorinated 8-Ribityllumazines as ^{19}F-NMR Detecting Shift Probes and Inhibitors of the Light Riboflavin Synthase of *Bacillus subtilis*," 9th International Symposium on Pteridines and Folic Acid Derivatives, Zurich, Switzerland, September 5, 1989.

19. "Anti-AIDS Drug Development Based on ATA," Department of Chemistry, Purdue University, West Lafayette, Indiana, October 11, 1990.
20. "Anti-AIDS Drug Development Based on ATA," Department of Medicinal Chemistry and Pharmacognosy, The University of Illinois at Chicago, Chicago, Illinois, February 15, 1991.
21. "Strategies for the Development of Anti-AIDS Agents," Annual Meeting of the American Association of Colleges of Pharmacy, Boston, Massachusetts, July 7, 1991.
22. "Design and Synthesis of Potential Anti-AIDS Agents," Lehrstuhl für Organische Chemie und Biochemie der Technischen Universität München, Garching, West Germany, August 1, 1991.
23. "Strategies for Anti-AIDS Drug Development," presented at a conference entitled "AIDS Drug Design: from Benchtop to Bedside", Indiana University School of Medicine, Indianapolis, Indiana, October 8, 1991.
24. "Design and Synthesis of a Diphenylmethane-Steroid Conjugate Which Prevents the Cytopathic Effect of HIV-1 in Cell Cultures," The NIH Decision Network Meeting, June 1, 1992.
25. "Design and Synthesis of Protein-Tyrosine Kinase Inhibitors as Potential Anticancer Agents," Lehrstuhl für Organische Chemie und Biochemie der Technischen Universität München, D-8046 Garching, Federal Republic of Germany, July 22, 1992.
26. "Strategies for the Development of anti-AIDS Agents," Department of Industrial and Physical Pharmacy, Purdue University, West Lafayette, Indiana, September 21, 1992.
27. "Design and Synthesis of Protein-Tyrosine Kinase Inhibitors as Potential Anticancer Agents", Department of Chemistry, University of Alberta, Edmonton, Alberta, Canada, October 5, 1992.
28. "Design and Synthesis of Protein-Tyrosine Kinase Inhibitors as Potential Anticancer Agents", Developmental Therapeutics Program, Division of Cancer Treatment, National Cancer Institute, Bethesda, Maryland 20892, October 19, 1992.
29. "Design and Synthesis of Protein-Tyrosine Kinase Inhibitors as Potential Anticancer Agents", Warner Lambert Parke-Davis Pharmaceutical Research, Ann Arbor, Michigan 49105, October 29, 1992.
30. "Inhibitors of Signal Transduction Pathways", The R. W. Johnson Pharmaceutical Research Institute, Raritan, New Jersey 98869, March 19, 1993.
31. "Design and Synthesis of Cosalane, a Novel Anti-HIV Agent", Lehrstühl für Organische Chemie und Biochemie, der Technischen Universität München, D-8046 Garching, Federal Republic of Germany, July 7, 1993.
32. "1. Design and Synthesis of Cosalane, a Novel Anti-HIV Agent. 2. Hydroxystilbenes as Inhibitors of Tyrosine Kinases", Procept, Inc., Cambridge, Massachusetts, July 23, 1993.
33. "Problems in the Scale-Up Resynthesis of Cosalane," National Cancer Institute, National Institutes of Health, Rockville, Maryland, August 12, 1993.
34. "Design and Synthesis of Cosalane, a Novel Anti-HIV Agent", Department of Chemistry, Notre Dame University, South Bend, Indiana, March 30, 1994.
35. "AIDS Research," Purdue University Student Health Center, West Lafayette, Indiane, April 19, 1994.
36. "Design, Synthesis, and Biological Evaluation of Cosalane, a Novel Anti-HIV Agent Which Inhibits Multiple Features of Virus Reproduction," Department of Pharmacology and Toxicology, Purdue University, West Lafayette, Indiana, October 12, 1994.

37. "Design, Synthesis, and Biological Evaluation of Cosalane, a Novel Anti-HIV Agent Which Inhibits Multiple Features of Virus Reproduction," Department of Chemistry, Purdue University, West Lafayette, Indiana, October 13, 1994.
38. "HIV Replication and Treatment Strategies," Committee for the Prevention of AIDS, Purdue University, West Lafayette, Indiana, December 6, 1994.
39. "New Anti-HIV Agents", Department of Chemistry, DePauw University, Greencastle, Indiana, February 23, 1995.
40. "New Anti-HIV Agents Which Inhibit Multiple Stages of the Viral Replication Cycle," 78th Canadian Society for Chemistry Conference and Exhibition, University of Guelph, Guelph, Canada, June 1, 1995.
41. "Design, Synthesis, and Biological Evaluation of Cosalane, a Novel Anti-HIV Agent which Inhibits Multiple Features of Virus Replication", Cytel Corporation, San Diego, California, July 10, 1995.
42. "Design, Synthesis, and Biological Evaluation of Cosalane, a Novel Anti-HIV Agent which Inhibits Multiple Features of Virus Replication", University of Missouri - Kansas City, August 17, 1995.
43. "Basic Science Research at Purdue University", Indiana University HIV/AIDS Research Consortium, Indiana State Department of Health, Indianapolis, Indiana, April 17, 1996.
44. " Synthesis and Biological Evaluation of Certain Alkenyldiarylmethanes (ADAMs) as Anti-HIV Agents which Act as Non-Nucleoside Reverse Transcriptase Inhibitors," University of Missouri - Kansas City, September 26, 1996.
45. "Recent Advances in the Chemotherapy of AIDS", West Lafayette Sagamore Lyons Club, West Lafayette, Indiana, April 28, 1997.
46. "I. Synthesis of Inhibitors of Tubulin Polymerization. II. Synthesis of Inhibitors of Lumazine Synthase and Riboflavin Synthase," Lehrstühl für Organische Chemie und Biochemie der Technischen Universität München, August 6, 1997, Munich, Germany.
47. "I. Synthesis of Inhibitors of Tubulin Polymerization. II. Synthesis of Inhibitors of Lumazine Synthase and Riboflavin Synthase," University of Missouri - Kansas City, September 26, 1997.
48. "Synthesis of ADAMs and Cosalane Analogs with Enhanced Potencies as Anti-HIV Agents," Cytel Corporation, San Diego, California, March 26, 1998.
49. "Design and Synthesis of Novel Anti-HIV Agents: Inhibitors of Viral Attachment and Reverse Transcription," Department of Chemistry, Ohio Northern University, Ada, Ohio. April 2, 1998.
50. "Design and Synthesis of Potential Anticancer Agents which Target Tubulin Polymerization, Topoisomerase I, and Protein Trafficking," Developmental Therapeutics Program, National Institutes of Health, Rockville, Maryland, August 14, 1998.
51. "Design and Synthesis of Potential Anticancer Agents which Target Tubulin Polymerization and Topoisomerase I," EntreMed, Inc., Rockville, Maryland, December 9, 1998.
52. "Investigation of the Binding of Fluorolumazines to the 1-MDa Capsid of Lumazine Synthase by $^{15}N\{^{19}F\}$ REDOR NMR, " University of Minnesota, Minneapolis, Minnesota, April 13, 1999.
53. "Bioseparations Engineering of Natural Products," Purdue Chromatography Workshop, Purdue University, West Lafayette, Indiana, October 11, 1999.
54. "Ligands for Probing the Active Site of Lumazine Synthase," Indiana University Northeast, Gary, Indiana, March 1, 2000.

55. "Metabolically Stable Analogs of Hypothetical Intermediates in the Reactions Catalyzed by Lumazine Synthase and Riboflavin Synthase," 32nd American Chemical Society Regional Meeting, Covington, Kentucky, May 18, 2000.
56. "Design, Synthesis, and Biological Evaluation of New Cosalanes," Tularik, Inc., South San Francisco, September 8, 2000.
57. "Design, Synthesis, and Biological Evaluation of New Anti-HIV Agents which Inhibit gp120-CD4 Binding and RANTES-Induced Chemotaxis," Munich Technical University, Garching, Germany, September 22, 2000.
58. "Metabolically Stable Analogs of Hypothetical Intermediates in the Reactions Catalyzed by Lumazine Synthase and Riboflavin Synthase," 3-Dimensional Pharmaceuticals, Inc., Exton, Pennsylvania, June 8, 2001.
59. "Discovery of the Indenoisoquinolines as Novel Topoisomerase I Inhibitors by COMPARE Analysis," National Institutes of Health, Bethesda, Maryland, July 16, 2001.
60. "A Novel Class of Topoisomerase I Inhibitors Discovered by COMPARE Analysis," EntreMed, Inc., Rockville, Maryland, July 17, 2001.
61. "The Utilization of COMPARE Algorithm in the Discovery of a Novel Class of Topoisomerase I Inhibitors," Munich Technical University, Garching, Germany, August 16, 2001.
62. "Metabolically Stable Analogs of Hypothetical Intermediates in the Reactions Catalyzed by Lumazine Synthase and Riboflavin Synthase," Hoffmann-La Roche, Inc., Nutley, New Jersey, June 27, 2002.
63. "Design, Synthesis, and Biological Evaluation of Indenoisoquinoline Topoisomerase I Inhibitors as Potential Anticancer Agents," National Institutes of Health, Rockville, Maryland, May 7, 2003.
64. "Ligands for Probing the Active Sites of Lumazine Synthase and Riboflavin Synthase," Department of Medicinal Chemistry, University of Kansas, Lawrence, Kansas, August 19, 2003.
65. "The Future Development of Indenoisoquinolines as Anticancer Agents at the National Cancer Institute," Developmental Therapeutics Program, National Cancer Institute, Rockville, Maryland, November 15, 2004.
66. "Design, Synthesis, Crystallography, and Biological Evaluation of Indenoisoquinoline Topoisomerase I Inhibitors as Anticancer Agents," Department of Pharmacology and Toxicology, Division of Medicinal and Natural Products Chemistry, The University of Arizona, Tuscon, Arizona, February 17, 2005.
67. "Total Synthesis of Zapotin and Abyssinone II, " Natural Inhibitors of Carcinogenesis PO11 CA48112 External Advisory Board Meeting, University of Illinois at Chicago, May 26, 2006.
68. "What Molecular Forces Could Possibly be Involved in Stabilizing the Topoisomerase I-DNA-Inhibitor Ternary Cleavage Complex and What do the Answers Tell us About How to Design More Effective Topoisomerase I Inhibitors?," 37th Great Lakes Regional American Chemical Society Meeting, Milwaukee, Wisconsin, May 31, 2006.
69. "Design and Synthesis of Indenoisoquinoline Topoisomerase I Inhibitors," Department of Chemistry and Biochemistry, Munich Technical University, July 12, 2006.
70. "Synthesis and Evaluation of Indenoisoquinoline Non-Camptothecin Topoisomerase I Inhibitors: an NCI Intra- and Extra-mural Partnership," National Institutes of Health, Center for Cancer Research Grand Rounds, Bethesda, Maryland, December 12, 2006.

71. "Molecular Modeling of Indenoisoquinoline-DNA-Topoisomerase I Ternary Complexes," Department of Chemistry, Virginia Polytechnic Institute, Blacksburg, Virginia, September 21, 2007.
72. "The Binding Orientation of a Norindenoisoquinoline in the Topoisomerase I-DNA Cleavage Complex Is Governed by π-π Stacking Interactions," Department of Chemistry, University of Alberta, Edmonton, Canada, October 1, 2007.
73. "Ligands for Probing the Active Sites of Lumazine Synthase and Riboflavin Synthase," Department of Medicinal and Natural Products Chemistry, University of Iowa, Iowa City, Iowa, March 24, 2009.
74. "Design and Synthesis of Indenoisoquinoline Topoisomerase I Inhibitors", an invited presentation at the American Chemical Society Symposium "Small Molecule Therapeutic Agents," 238th National Meeting of the American Chemical Society, Washington, D.C., August 18, 2009.
75. "From the Hood to the Hospital: How and Indenoisoquinoline Accident Turned into an Anticancer Drug," Symposium Recognizing Professor Yusuf Abul-Hajj, University of Minnesota, June 23, 2010.
76. "The 13th Webster-Sibilsky Lecture in Medicinal Chemistry in Recognition of Contributions to the Field of Medicinal Chemistry," University of Illinois at Chicago, March 16, 2012.
77. "From the Hood to the Hospital: How and Indenoisoquinoline Accident Turned into an Anticancer Drug," Division of Clinical Pharmacology, School of Medicine, Indiana University, Indianapolis, Indiana, September 3, 2013.
78. "The Story of the Discovery and Development of the Anticancer Drugs Indotecan and Indimitecan," University Place, West Lafayette, Indiana, May 6, 2014.
79. "From the Hood to the Hospital: How and Indenoisoquinoline Accident Turned into an Anticancer Drug," Sunnylife Pharma, Inc., Indianapolis, Indiana, December 12, 2014.
80. "Targeting Indenoisoquinoline Topoisomerase I Inhibitors to Cancer Cells," 249th ACS National Meeting, Symposium in Honor of Richard Gibbs, Denver, Colorado, March 23, 2015.
81. "How Our Topoisomerase I Inhibitor Project was Hijacked by JAK Kinases," Ole Gisvold Lectureship in Medicinal Chemistry, Department of Medicinal Chemistry, University of Minnesota, April 3, 2018.
82. "How Our Topoisomerase I Inhibitor Project Was Hijacked by the Janus Kinases", Department of Physiology and Pharmacology, Oregon Health Science University, Portland, Oregon, May 17, 2018.
83. "In Recognition of Those Who Deserve the Philip S. Portoghese Lectureship Award but Did Not Receive It," Philip S. Portoghese Lectureship, 256th ACS National Meeting, Boston, Massachusetts, August 21, 2018.
84. "How Do the Indenoisoquinoline Topoisomerase I Inhibitors Work and How Were They Discovered?", Gibson Oncology, LLC, Baltimore, Maryland, November 5, 2018.
85. "Patentable Microcrystalline Polymorphs of LMP400," Gibson Oncology, LLC, Fisher Island, Florida, March 4, 2019.

Research Grants and Contracts:

1. $133,049, National Institutes of Health, CA-19204, "New Benzophenanthridine and Protoberberine Syntheses," 1976-1979.

2. $6,650, American Cancer Society and the Indiana Elks, "Synthesis of Antileukemic Benzophenanthridine and Protoberberine Alkaloids," 1975-1977.
3. $8,940, David Ross Grant, "New Riboflavin Antimetabolites," 1978-1980.
4. $192,743, National Institutes of Health, CA-19204, "New Alkaloid Syntheses," 1979-1982.
5. $157,177, National Institutes of Health, CA-27517, "Synthesis of Streptonigrin," 1980-1983.
6. $13,200, David Ross Grant, "The Synthesis and Evaluation of Fluorinated Ribityllumazines as Potential Inhibitors of Riboflavin Synthase," 1982-1984.
7. DM 57,528, Fulbright Commission, "Synthesis and Biochemical Evaluation of Potential Riboflavin Synthase Inhibitors," 1983-1984.
8. $238,898, National Institutes of Health, GM-30932, "New Alkaloid Syntheses," 1982-1985.
9. $7600, Bioanalytical Systems, "New Alkaloid Syntheses," 1985-1986.
10. $13,200, David Ross Grant, "Design, Synthesis and Biological Evaluation of Potential Lumazine Synthase and Riboflavin Synthase Inhibitors,"1986-1988.
11. $729,057, National Institutes of Health, "Synthesis of Congeners and Prodrugs," NO1-CM-67699, 1986-1991.
12. $1,568,000, National Institutes of Health, AI-24289 "National Cooperative Drug Discovery Group for the Treatment of AIDS - Synthetic Approach, Co-PI with Dr. S.R. Byrn (PI) and Dr. H.L. Weith (Co-PI), 1987-1990.
13. $252,484, National Institutes of Health, CA47476, "Protein-tyrosine Kinase Inhibitors as Anticancer Agents," 1988-199l.
14. $386,797, National Institutes of Health, AI-25712 "Anti-HIV (AIDS) Agents Targeted to the RNA Template", Co-PI with Dr. S.R. Byrn (PI) and Dr. H.L. Weith (Co-PI), 1988-1990.
15. $496,992, National Institutes of Health, NO1-CM-87268, "Synthesis of Congeners and Prodrugs of Anti-AIDS Compounds," 1988-1991.
16. $15,960, David Ross Grant, "Synthesis of Phosphotyrosine-containing Peptides as Potential Inhibitors of Protein-tyrosine Kinases", 1990-1992.
17. $597,420, National Institutes of Health, NO1-CM-17513, "Synthesis of Congeners and Prodrugs of Anti-AIDS Compounds", 1991-1994.
18. $1,136,933, National Institutes of Health, NO1-CM-17512, "Synthesis of Congeners and Prodrugs," 1991-1996.
19. $19,800, Purdue Research Foundation Grant, "Design and Synthesis of Protein-Tyrosine Kinase Inhibitors Based on Natural Product Templates," 1992-1994.
20. $10,000, Indiana Elks, "Targeting DNA Cross-linking Agents to Specific Regions by Conjugation to Minor Groove Binders," 1995-1996.
21. $20,400, Purdue Research Foundation, "Targeting DNA Cross-linking Agents to Specific Regions by Conjugation to Minor Groove Binders," 1996-1997.
22. $568,592, National Institutes of Health, RO1-AI-36624, "Synthesis of New Anti-HIV Agents Related to Cosalane," 1995-1998.
23. $574,585, National Institutes of Health, RO1-GM-51469, "Ligands for Probing the Active Site of Lumazine Synthase," 1995-1999.
24. $1,013,191, National Institutes of Health, NO1-CM-67260, "Synthesis of Congeners and Prodrugs," 1998-2001.
25. $23,332, Purdue Research Foundation, "Design and Synthesis of Novel Non-nucleoside HIV-1 Reverse Transcriptase Inhibitors for the Treatment of AIDS," 1998-2000.

26. $566,395 (including cost sharing by Purdue totaling $216,000), National Institutes of Health, 1 S10 RR12025-01A1, "High Resolution Mass Spectrometer," 1998.
27. $505,113, National Institutes of Health, RO1-AI-43637, "Synthesis of New NNRTIs for the Treatment of AIDS," 1998-2001.
28. $50,000, Showalter Trust, "Design, Synthesis, and Biological Evaluation of Novel Protein-tyrosine Kinase Inhibitors and Potential Anticancer Agents," 1999-2000.
29. $25,292, Cancer Center Purdue Research Foundation Research Grant, "Design and Synthesis of Novel Protein-Tyrosine Kinase Inhibitors," 2000-2002.
30. $29,376 (total annual support) "Training in Drug and Carcinogen-DNA Interactions" training grant 5T32-09634, NIH, 2000-2002.
31. $924,221, National Institutes of Health, RO1 GM51469, "Ligands for Probing the Active Site of Lumazine Synthase," 2000-2004.
32. $873,170, National Institutes of Health, UO1 CA89566, "Novel Indenoisoquinoline Topoisomerase I Inhibitors," 2001-2005.
33. $25,000, EntreMed, Inc., "Design and Synthesis of 2-Methoxyestradiol Analogs," 2002-2003.
34. $50,000, EntreMed, Inc., "Design and Synthesis of 2-Methoxyestradiol Analogs," 2003-2004.
35. $806,868, National Institutes of Health, AI043637, "Synthesis of New NNRTIs for the Treatment of AIDS," 2003-2006.
36. $600,000, National Institutes of Health, 1 U54 AI57153-01, "Development of Anti-viral Strategies for Enveloped Viruses," 2003-2008. This is part of a larger grant application, involving 11 Midwestern universities, entitled "Bioterrorism: Molecular Analysis and Intervention", with Richard Kuhn at the PI and Mark Cushman as a Co-PI.
37. $971,544, National Institutes of Health, RO1 GM51469, "Ligands for Probing the Active Site of Lumazine Synthase," 2005-2009.
38. $6,845,355, National Institutes of Health, PO1 CA48112-13, "Natural Inhibitors of Carcinogenesis," 2005-2010. This is a large program project grant with John Pezzuto as the PI and Mark Cushman as one of the a co-PIs. The total cost for the Cushman subproject is $987,011.
39. $1,250,472, National Institutes of Health, U01 CA89566-05, "Novel Indenoisoquinoline Topoisomerase I Inhibitors," 2005-2010.
40. $209,614, EntreMed, "Design and Synthesis of Tubulin Polymerization Inhibitors," 2006-2008.
41. $20,000, American Chemical Society Division of Medicinal Chemistry Predoctoral Fellowship Program, "Synthesis of Indenoisoquinoline Topoisomerase I Inhibitors, Predoctoral Support for Andrew Morrell."
42. $108,980, EntreMed, "Synthesis of ENMDS-1198 Metabolites," 2007-2008.
43. $384,414, National Institutes of Health, U54 AI57153-05S1, "Development of Antiviral Strategies," 2008-2009. This is part of a larger grant application, involving 11 Midwestern universities, entitled "Bioterrorism: Molecular Analysis and Intervention", with Richard Kuhn at the PI and Mark Cushman as a Co-PI. The total cost for the Cushman subproject is $103,859.
44. $16,795, Purdue Research Foundation, "Synthesis and Biological Evaluation of Aromathecins and Luotonins as Topoisomerase I Poisons," 2009-2010.
45. $477,847, National Cancer Institute, NIH ARRA Award 3PO1CA04812-17S1, "Natural Inhibitors of Carcinogenesis," 2009-2010 (Mark Cushman Co-PI, John Pezzuto, PI).

46. $417,844, NIH-funded subcontract from the University of Illinois at Chicago, NIH ARRA Award 1376000511A5, "Novel Antibiotic Development for Biodefense", 2010-2012.
47. $16,795, Purdue PRF XR Research Grant, "Design and Synthesis of Azaindenoisoquinolines as Topoisomerase 1 Inhibitors. Experimental Evaluation of the TT-TT Stacking Hypothesis", 2010-2011.
48. $1,492,575, National Institutes of Health, U01 CA89566-10, "Novel Indenoisoquinoline Topoisomerase I Inhibitors," 2010-2015.
49. $16,065, Purdue PRF XR Research Grant, "Design and Synthesis of Norendoxifen Analogues with Dual Aromatase Inhibitory Activity and Estrogen Receptor Modulation Activity", 2012-2013.
50. $75,000, Showalter Grant Award, "“Development of Novel Antimicrobial Compounds Against Multidrug Resistance Bacterial Pathogens, Including Methicillin-Resistant Staphylococcus Aureus (MRSA)", 2012-2013.
51. $74,662, National Institute of Drug Abuse, RO3DA045897, "Development of G-protein biased delta opioid receptor agonist with analgesic potency," 2018-2019 (PI: Richard van Rijn, collaborator: Mark Cushman).
52. $10,000, MCMP Research Enhancement Award, "Discovery of novel δ opioid chemotypes with G-protein bias for treatment of alcohol use disorder," 2018-2019 (PI: Richard van Rijn, co-I, Mark Cushman).
53. $150,270, NIH Supplemental Award, 3R01CA177585-05S1, "Modulating c-Myc transcription by G-quadruplex-interactive small molecules," 2018-2019 (PI: Danzhou Yang).

Teaching:

During my tenure of service to Purdue University I have participated in teaching the following courses:

1. MDCH 204, Organic Chemistry I
2. MDCH 205, Organic Chemistry II
3. MDCH 407, Medicinal Chemistry and Pharmacognosy I
4. MDCH 408, Medicinal Chemistry and Pharmacognosy II
5. MDCH 553, Intermediate Organic Medicinal Chemistry
6. MDCH 600, Advanced Medicinal Chemistry
7. MCMP 422, Immunology and Chemotherapy
8. MCMP 570, Basic Principles of Chemical Action on Biological Systems
9. MCMP 442, Chemotherapy of Infectious and Neoplastic Diseases
10. MCMP 490, Remedial Organic Chemistry for Graduate Students
11. MCMP 690, Biological Targets for Drug Discovery
12. MCMP 625, Grant Writing
13. IUSM 610, Basic Principles of Pharmacology and Toxicology I
14. PHRM 840, Professional Program Laboratory III
15. PHRM 865, Integrated Pharmacotherapy V
16. MCMP 544, Drug Classes and Mechanisms
17. MCMP 495, Organic Synthesis Laboratory
18. MCMP 618, Molecular Targets: Cancer

Service:

1. To the Department:

a. Graduate Admissions Committee, 1977-1979, 1994-1999, 2011-2017, Chairman, 1978.

b. Chairman, Preliminary Examinations Committee, 1977-1979.

c. Graduate Students Advisory Committee, 1979-1999, 2011-present.

d. Member of Advisory Committees for the following students (in addition to my own students):

John Toth (M.S. 1977), Suzanne Evans (M.S. 1977), Paul Keller (M.S. 1979, Ph.D. 1981), John Grosso (Ph.D. 1980), Bruce Hathaway (Ph.D. 1980), David Ho (Ph.D. 1985), Merrick Almond (Ph.D. 1985), Robert Riggs (Ph.D. 1986), James Blodgett (Ph.D. 1986), Julie Stimmel (Ph.D. 1987), Sumon Sakolchai (Ph.D. 1987), Miland Narukar (Ph.D. 1988), Robert Oberlender (Ph.D. 1989), Mona Patel (Ph.D. 1989), Subas M. Sakya (Ph.D. 1991), Qun Dang (Ph.D. 1992), He-Sung Choi (Ph.D. 1992), Wu-Po Ma (Ph.D. 1992), Duy Nhu Nguyen (Ph.D. 1993), Scott Snyder (Ph.D. 1993), Jeffrey A. Moore (Ph.D. 1993), Felix A. Aviles-Garay (M.S. 1993), Joan Marie Dalla Riva Toma (Ph.D. 1993), James R. Gillig (M.S. 1994), Timm Knoerzer (Ph.D. 1994); Xi Chen (M.S., 1994); Suwanna Vangveravong (Ph.D. 1994); Kitaw Negash (Ph.D., 1994), Aaron P. Monte (Ph.D. 1995), Betsy Leverett (Ph.D. 1995), Norman P. Gerry (Ph.D. 1996), Hasik Youn (Ph.D. 1997), Mike Deras (Ph.D. 1997), Joseph Blair (Ph.D. 1997), Kenneth M. Gigstad (Ph.D. 1997), Lingling L. Rogers (Ph.D. 1998), Matthew A. Parker (Ph.D. 1998), Medina R. Gerasimov (M.S. 1998), Douglas Klewer (Ph.D. 1998), Sunkyung Lee (Ph.D. 1998), Amjad M. Qandil (Ph.D. 1998), Caterina Bissantz (M.S. 1999), Xiaoting Tang (M.S. 1999), Timothy Turner (Ph.D., 2000), Maneesh Pingle (Ph.D., 2000), Jason C. Thoen (Ph.D. 2001), Jerry B. Evarts, Jr. (Ph.D. 2001), Sandra Tobias (Ph.D., 2001), Hugo Garrido Hernandez (Ph.D., 2001), James J. Chambers (Ph.D., 2002), Eduardo Torres (Ph.D., 2004), Cristine M. Torres (Ph.D., 2004), Angel I. Morales-Ramos (Ph.D. 2004), Rebecca S. Myers (Ph.D., 2004), Tom McLean (Ph.D. 2005), Ravi Krishnamoorthy (Ph.D. 2006), Yajie Zhang (Ph.D. 2007), Ahmad M.S. El-Awa (Ph.D. 2007), James L. Donelson (Ph.D. 2007), Jianmin Zhang (University of Alberta) (Ph.D. 2007), Andrew Placzek (Ph.D., 2009), Soo Sung Kang (Ph.D. 2009), Kai Xi (Ph.D. 2009), Lisa Bonner (Ph.D. 2009), Chun-Xiao Xu (Ph.D, 2009), Brian Laing (Ph.D. 2010), Gurusankar Ramamorthy (Ph.D. 2010), Mansoora Khaliq (Ph.D. 2010), Jianfeng Li (Ph.D. 2011), Alia Huang Clark (Ph.D. 2011), Jaimeen Majmudar (2012), David Anderson (Ph.D. 2012), Katherine C. Jermihov (Ph.D. 2012), Carolyn G. Botting (M.S. 2012), Changho Han (Ph.D. 2013), Mark Riofski (Ph.D. 2013), Liza Shrestha (Ph.D. 2013), Christine Marian (Ph.D. 2013), Eric Jones (M.S. 2013), James Woods (Ph.D. 2014), Haroon Mohammad (Ph.D. 2016), Kyle Denton (Ph.D. 2017), Keith Viccaro (Ph.D. 2017), Dino Petrov Petrov (Ph.D. 2018).

e. Recruiting Committee for the Department Head, 1988.

f. Recruiting Committee for an Assistant Professor of Medicinal Chemistry, 1988.

g. Interim Director of the Mass Spectrometry Center, 1994-1998.

h. Recruiting Committee for the faculty position is mass spectrometry, 1994-1997.

i. Recruiting Committee for an Assistant Professor of Natural Products Chemistry, 1998-1999.

j. Recruiting Committee for an Assistant Professor of Cancer Pharmacology, 1998-1999.

k. Seminar Advisor for: Medina Gerasimov, 1998; Xiaoting Tang, 1998; Caterina Bissantz, 1999; Ibrahim Yaqub Hawash, 1999; Karla Cuevas-Licea, 2000; Brian Henricksen, 2001; Vishal C. Nashine, 2001; Priscilla Reyes, 2002; Sherine Abd-El-Mawla, 2003.

l. Recruiting Committee for an Assistant Professor in Drug Design and Synthesis, 2000-2001.

m. Graduate Student Recruiting Committee, Chairman, 2000-2007.
n. Graduate Course Task Force, 2002-2003.
o. Mentor for Michael Sauvel, a summer research student supported by the Purdue University Cancer Center.
p. Drug Discovery Faculty Position Recruiting and Screening Committee, 2009-2011.
q. Medicinal Chemistry Faculty Position Recruiting Committee, 2010-2011.
r. Graduate Admissions and Recruiting Committee, 2011-2018
s. Graduate Advisory Committee, 2011-
t. Medicinal Chemistry Faculty Recruiting Committee, 2011-2014
u. Cancer Therapeutics Faculty Recruiting Committee, 2011-2014
v. Chair of the MCMP Task Force to develop a new course for the B.S. degree in pharmaceutical sciences on drug classes and drug mechanisms, 2012. Wrote report that will serve as a basis of course approval.
w. Department Seminar Committee, 2014-
x. Chair, MCMP Faculty Recruiting Committee, 2014-2015
y. MCMP Department Head Search Committee, 2014.
z. Reviewer of nine grant proposals for the MCMP Research Enhancement Application, 2017.

2. To the School:

a. Secretary of the Graduate Research and Policy Committee, 1978-1983.
b. Academic Advisor for undergraduate students, 1975-2005.
c. Graduate Advisory Committee, 1978-2000.
d. Pharmacy School Grievance Committee, 1990-1991, 1995-1996, and 1999-2001.
e. Promotions Committee (Area), 2001.
f. Nuclear Pharmacy Faculty Search Committee, 2001-2002.
g. Graduate Course Task Force, 2002-2003.
h. Committee to Establish a Medicinal Chemistry Minor for Chemistry Majors, 2004.
i. Schools of Pharmacy, Nursing, and Health Sciences Grievance Committee, 2007-2009.
j. Instructional Technology Task Force, 2008-2009.
k. Member, Core Faculty to Develop an Infectious Disease Course, 2009-2011.
l. Task Force to Review Academic Standards for the Doctor of Pharmacy Program, 2010.
m. Pharmacy Faculty Council, 2010-2013
n. Faculty and Staff Self-Study Committee, 2010.
o. Participated in Faculty Roundtables at the Purdue University College of Pharmacy Orientation, August 21, 2012.
p. Area Promotions Committee, 2013.
q. Medicinal Chemistry and Molecular Pharmacology Department Head Search Committee, 2013-2014.
r. Medicinal Chemistry and Molecular Pharmacology Faculty Recruiting Committee (Chair) 2014-2015.
s. Interviewer of Pharm. D. applicants, 2014-2017.
t. Pharmacy Admissions Committee, 2017-2018.
u. Therapeutics Student Stress Committee, 2018-present.
v. College Nominations Committee, 2018-present.

3. To the University:

a. Fulbright Committee, 1984.
b. Faculty Associate, Purdue Grand Prix, 1986.

c. Cytotoxicity Assay Advisory Committee, 1988-1991
d. Graduate Council, 1994-1997.
e. Cancer Center Grants Review Committee 1994-1995
f. Chairman of the Campus-wide Mass Spectrometry Advisory Committee, 1996-1998
g. Purdue University Cancer Center Mass Spectrometry Core Director, 1994-1998
h. Cancer Center Grants Review Committee, 1998
i Department Head Review Committee, 1998
j. Faculty Scholars Review Committee, 1999
k. Academic Procedures Committee, Purdue Virology Program, 1999
l. University Senate, 2002-2003.
m. University Senate Nominating Committee, 2002-2003.
n. AIMS Focus Group, 2008-2011
o. Purdue Innovative Pilot Project Review Committee, 2012
p. Purdue Drug Discovery Building Investment Video (made 2012)
q. Purdue Drug Discovery Building Design Committee, 2011-2013
r. Reviewer for American Cancer Society junior investigator award, 2012.
s. Automated Synthesis Lab Chemistry Group, 2014.
t. Purdue Drug Discovery Faculty Recruiting Committee, 2012-2014.
u. New Purdue Drug Discovery Faculty Recruiting Committee, 2014-2015
v. Purdue Internal Grant Initiative Grant Review Committee, 2014- 2015
w. Committee to Review Distinguished Professor Appointments, 2014
x. Purdue Standing Committee on Research Integrity, 2016-2019
y. Committee to Review Distinguished Professor Appointments, 2018

4. To the Profession:

a. Program Project Site Visit, Yale University School of Medicine, New Haven, Connecticut, March 28-30, 1988.
b. NSF Proposal Evaluation, April 1, 1988.
c. Special Study Section for the Review of AIDS Proposals, National Institutes of Health, Bethesda, Maryland, April 27, 1988.
d. National Cooperative Drug Discovery Groups for the Treatment of AIDS Review Committee Meeting, National Institutes of Health, Bethesda, Maryland, June 27-30, 1988.
e. Special NCDDG Review Committee, National Institutes of Health, Washington, D. C., November 20-21, 1988.
f. The National Institute of Allergy and Infectious Diseases Ad Hoc Review of Competing Contract Proposals, Bethesda, Maryland, June 27-28, 1989.
g. Source Selection Meeting for RFP Nos. NIH-NIAID-89-14 (Analytical Chemistry of Chemicals and Pharmaceutical Products for Treatment of Infectious Diseases) and NIH-NIAID-AIDSP-89-13 (Resynthesis of Potential Therapeutic Agents for Treatment of Infectious Diseases), Bethesda, Maryland, September 28, 1989.
h. Review of NIH grant application 1 R13 CA55099 to fund a conference on "Antisense Strategies", March 27, 1991.
i. Member, NIH Medicinal Chemistry Study Section AHR-B1, April 7, 1994.
k. Member, Editorial Advisory Board, *The Journal of Organic Chemistry*, 1999-2004.
l. Member, Editorial Advisory Board, *The Journal of Medicinal Chemistry*, 2005-2010.
m. Member, NIH SBCA Study Section, June 22, 2005.
n. Presided at session entitled "New Strategies for Modern Medicinal Chemistry II", Regional American Chemical Society Meeting, Milwaukee, Wisconsin, May 31, 2006.
o. Member, NIH SBCA Study Section, June 7, 2010.
p. Member, ACS Medicinal Chemistry Predoctoral Fellowship Selection Committee, 2011.
r. Reviewer for American Cancer Society junior investigator award, 2012.
s. Associate Editor, *Journal of Medicinal Chemistry*, 2012-present.

Undergraduate Students Mentored Since 2002:

Marintha Rae Meckley, 2002
Samba Jarju, 2003
Michael Sauvel, 2003
Lauren Carlson, 2004
Brian Fort, 2004
Jamin Stefan, 2005
Seth Parmley, 2005
Michael Placzek, 2005
Meghan Breen, 2006
Nicholas Empey, 2007
Sean Deguire, 2007
Brenda E. Cordero Sanchez, 2007
Alexandria Reed, 2008
Erin Brown, 2009
Qingnuo Lin, 2011
Brooklyn Cobb, 2011
Rubayat Khan, 2012
Dennis Monteleone, 2012
Stephanie Pitman, 2013
Dennis Monteleone, 2013
Ge Yu, 2014
Yafan Su (International Visitor), 2016
Cassandra Etelamaki, 2016
Siran Chang, 2016
Xuewen Wang (International Visitor), 2017
Brittany Griggs, 2017-2018

Past and Present Graduate Students:

Frederick W. Dekow
1975-l977
M.S.
"Synthesis of Protoberberine Alkaloids"
Support: NIH

Harold S. Burlhis
1976-l978
M.S.
"Studies Toward the Synthesis of Yohimbines"
Support: NIH

S. Peter Foltis
1979-l98l
M.S.
"Chemical and Biological Studies of Malformin, a Metabolite of *Aspergillus niger*
Support: NIH

Diana Lee Darling
1977-l981
Ph.D.
"Fluorinated Analogs of Riboflavin: Potential Antimetabolites"
Support: NIH

Mary P. Koleck

1979-1983
Ph.D.
"Total Synthesis of Chelidonine"
Support: NIH

Prem Mohan
l981-1984
Ph.D.
"Total Synthesis and Antitumor Evaluation of Analogs of Nitidine Chloride and Fagaronine Chloride"
Support: NIH

Wai Cheong Wong
198l-1984
Ph.D.
"Total Synthesis of Corydalic Acid Methyl Ester"
Support: NIH

Jer-kang Chen
1983-1988
Ph.D.
"Asymmetric Synthesis of Benzophenanthridine Alkaloids"
Support: NIH and TA

Donald Patrick
1984-1988
Ph.D.
"Synthesis of Antisense Oligonucleotide-Intercalator Conjugates as Potential Anti-AIDS Agents"
Support: NIH

Eung-Seok Lee
1987-1992
Ph.D.
"Design and Synthesis of Potential Protein-tyrosine Kinase Inhibitors"
Support: NIH

Hemant Patel
1984-1989
Ph.D.
"Design and Synthesis of Fluorinated Ribityllumazines as Potential Riboflavin Synthase Inhibitors"
Support: David Ross Grant

Kshitij Thakkar
1991-1995
Ph.D.
"Part I. Synthesis and Protein-Tyrosine Kinase Inhibiting Activity of Polyhydroxylated Stilbene Analogues of Piceatannol. Part II. Study of Novel Oxidative Cyclization of 2'-Hydroxychalcones to 4,5-Dialkoxyaurones by Thallium(III) Nitrate."
Support: David Ross Grant

Sunglak Im
1991-1995
M.S.
"The Design and Synthesis of Intercalator-Oligonucleotide Conjugates: Potential Inhibitors of HIV Reverse Transcriptase"

Support: Departmental TA

Pamela Nagafuji
1992-1998
Ph.D.
"A New Method for the Synthesis of Fused Pyrrole Systems from Carbonyl Compounds and Amino Aldehydes"
Support: Microbiology Department TA, Indiana Elks, Purdue Research Foundation

Agustine Casimiro-Garcia
Ph.D.
1995-1999
"Synthesis of New Anti-HIV Agents Related to Cosalane"
Support: NIH

Jeffrey T. Mihalic
1995-1999
Ph.D.
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Mark Micklatcher
1997-2000
Ph.D.
"Synthesis of Alkenyldiarylmethanes as Non-nucleoside Inhibitors of HIV-1 Protease"
Support: Purdue Research Foundation grant.

Brian Fox
1998-2002
Ph.D.
"Design and Synthesis of Brefeldin A Sulfide Derivatives and Prodrug Candidates"
Support: NIH

Fanrong Mu
1998-2002
Ph.D.
"Design and Synthesis of Protein-tyrosine Kinase Inhibitors"
Support: PRF

Max Silvestri
1999-2004
Ph.D.
"Synthesis of Novel NNRTIs for the Treatment of AIDS"
Support: NIH

Allison Edsall
1999-2004
Ph.D.
"Design and Synthesis of 2-Methoxyestradiol Analogs and Potential Anticancer Agents"
Support: Walther Foundation and EntreMed, Inc.

Jinhua Chen
1999-2004
Ph.D.
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Nwanne O. Nene Anadu
2001-2006
Ph.D.
"Synthesis of Brefeldin A Derivatives and Affinity Columns"
Support: Indiana Elks, UNCF·Merck Science Initiative, Purdue University Cancer Center

Alexandra S. Ioanoviciu
2001-2005
Ph.D.
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Xiangshu Xiao
2001-2005
Ph.D.
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Andrew Morrell
2002-2007
Ph.D.
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support" NIH Training Grant, American Chemical Society Medicinal Chemistry Fellowship sponsored by Pfizer

Matthew D. Cullen
2003-2007
Ph.D.
"Non-nucleoside Reverse Transcriptase Inhibitors"
Support: NIH

Yanlei Zhang
2004-2007
M.S.
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Katie Peterson
2006-2007
M.S.
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Juma Yoshino
2006-2008
M.S.
"Synthesis of Chemopreventive Agents"
Support: NIH

Yujie (Jade) Zhao
2007-2009
M.S.
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Maris Cinelli
2007-2011
"Aromathecin Topoisomerase I Inhibitors"
Support: NIH

Evgeny Kiselev
2007-2012
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Martin Conda-Sheridan
2007-2012
"Synthesis of Chemopreventive Agents"
Support: NIH

Trung Nguyen
2009-2014
"Synthesis of Tyrosyl-DNA Phosphodiesterase I Inhibitors"
Support: NIH

Wei Lv
2009-2014
"Synthesis of *O*-Succinylbenzoyl-CoA Synthetase Inhibitors
Support: NIH

Daniel Beck
2011-2015
"Novel Topoisomerase I Inhibitors"
Support: NIH

Mohamed S. A. Elsayed
2014-present
"Novel Topoisomerase I Inhibitors"
Support: NIH

Elizaveta N. O'Neill
2014-2015
"Novel Norendoxifen Analogues for Breast Cancer Treatment"
Support: Fellowship

Past and Present Postdoctoral Students:

Dr. Leung Cheng
1977-1978
"Total Synthesis of Nitidine Chloride"
Support: NIH

Dr. Joseph Valko
1978-1979
"Total Synthesis of Chelidonine"
Support: NIH

Dr. T.C. Choong
1979-1980
"Total Synthesis of Chelidonine"

Support: NIH

Dr. Dinesh K. Dikshit
1979-1980
"Formation of the 5-Benzo[*d*]naphtho[2,3-*b*]pyran System During an Attempted Benzophenanthridine Synthesis"
Support: NIH

Dr. Jacob Mathew
1980-198l
"Studies on the Synthesis of Streptonigrin"
Support: NIH

Dr. Yash Pal Gupta
1980-198l
"Total Synthesis of Protoberberine and Benzophenanthridine Alkaloids"
Support: NIH

Dr. Kinuko Iwasa
1980-198l
"Total Synthesis of Protoberberine and Benzophenanthridine Alkaloids"
Support: NIH

Dr. Yu-Pin Wang
1982-1983
"Asymmetric Synthesis of Benzophenanthridine Alkaloids"
Support: NIH

Dr. Aziz Abbaspour
1982-1984
"Total Synthesis of Corynoline"
Support: NIH

Dr. Edmund Madaj
1985-1986
"Studies on the Mechanism of the Condensation Reaction of Schiff Bases with Cyclic Dicarboxylic Acid Anhydrides"
Support: NIH Grant and a grant from Bioanalytical Systems, Inc.

Dr. P. Chinnasamy
1986-1987
"Design and Synthesis of Potential Protein-tyrosine Kinase Inhibitors"
Support: NIH

Dr. Jurjus Jurayj
1986-1993
"Design and Synthesis of Potential Bombesin Antagonists"
"Dihydroellipticines with Selectivity Against CNS Cancer"
Support: NIH

Dr. Rupinder Grewal
1987-1988
"Design and Synthesis of Antisense Oligonucleotide-intercalator Conjugates as Potential Anti-AIDS Agents"
Support: NIH

Dr. Asit Chakraborti
1987-1989
"Design and Synthesis of Potential Protein-tyrosine Kinase Inhibitors"
Support: NIH

Dr. Suseela Kanamathareddy
1988-1990
"Design and Synthesis of Oligonucleotide Mimetics Based on the Aurintricarboxylic Acid Model"
Support: NIH

Dr. Jer-kang Chen
1988-1990
"Design and Synthesis of Oligonucleotide-Intercalator Conjungates as Potential Anti-AIDS Agents"
Support: NIH

Dr. Dhanapalan Nagarathnam
1988-1990
"Design and Synthesis of Protein-Tyrosine Kinase Inhibitors"
Support: NIH

Dr. Steve Chang
1988-1989
"Design and Synthesis of ATA Analogs as Anti-AIDS Agents"
Support: NIH

Dr. Young-Im Oh
1988-1991
"HIV Protease Inhibitors as Potential Anti-AIDS Agents"
Support: NIH

Dr. Carl Wild
1988-1989
"Fractionation of ATA and Correlation of Anti-AIDS Activity With Molecular Weight Distribution"
Support: NIH

Dr. Damodaragounder Gopal
1989-1990
"Design and Synthesis of Potential Protein-Tyrosine Kinase Inhibitors"
Support: NIH

Dr. Marek Golebiewski
1989-1994
"Design and Synthesis of ATA Monomer Analogs and Potential Anti-AIDS Agents"
Support: NIH

Dr. Hu-Ming He
1990-1996
"Design and Synthesis of Tubulin Polymerization Inhibitors"
Support: NIH

Dr. Marek Koneiczny
1990-1993
"Design and Synthesis of anti-HIV Agents"

Support: NIH

Dr. Helen Zhu
1991-1993
"Design and Synthesis of Flavonoid PTK Inhibitors"
Support: NIH

Dr. Robert Keyes
1992-1994
"Design and Synthesis of Phospholipids as Potential Anti-HIV Agents"
Support: NIH

Dr. Sharon Krisovitch
1993-1994
"Phospholipid Analogs of Cosalane"
Support: NIH

Dr. Elzbieta Hejchman
1994-1996
"Water-soluble Analogs of Ambrosin"
Support: NIH

Dr. Rajesh Devraj
1994-1996
"Dihydroellipticines with Selectivity Against CNS Cancer"
Support: NIH

Dr. Farahnaz Mavandadi
1995-1997
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Dr. Ankush Argade
1995-1997
"Addition of Thiols to Brefeldin A"
Support: NIH

Dr. Jeffrey A. Ruell
1995-1998
"Synthesis of New Anti-HIV Agents Related to Cosalane"
Support: NIH

Dr. Shabana Insaf
1997-1998
"Isolation and Structure Elucidation of a Cosalane Metabolite"
Support: NIH

Dr. Muthusamy Jayaraman
1997-2000
"Indenoisoquinoline Inhibitors of Topoisomerase I"
Support: NIH

Dr. Zhuqiang Wang
1997-1998
"2-Methoxyestradiol Analogs with Enhanced Potencies as Inhibitors of Tubulin Polymerization and Cancer Cell Growth"

Support: NIH

Dr. Jeffrey Vroman
1997-1999
"Addtion of Selenium Compounds to Brefeldin A"
Support: NIH

Dr. Gitendra Paul
1998-1999
"Synthesis of Cosalane Analogs"
Support: NIH

Dr. Arasambattu K. Mohanakrishnan
1998-1999
"Synthesis of 2-Methoxyestradiol Analogs"
Support: NIH

Dr. Donglai Yang
1998-1999
"Ligands for Probing the Active Site of Lumazine Synthase
Support: NIH

Dr. Guozhang Xu
1999-2001
"Synthesis of Non-Nucleoside Reverse Transcriptase Inhibitors"
Support: NIH

Dr. K. C. Santhosh
1999-2001
"Synthesis of New Anti-HIV Agents Related to Cosalane"
Support: NIH

Dr. Thota. Sambaiah
1999-2002
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Dr. Arunachalam Kannan
2000-2001
"Synthesis of New Anti-HIV Agents Related to Cosalane"
Support: NIH

Dr. Muthukaman Nagarajan
2001-2003
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Dr. Guangyi Jin
2001-2004
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Dr. Brian Grella
2004
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Dr. Ha Young Kim
2003-2005
"Development of Anti-viral Strategies for Enveloped Viruses"
Support: NIH

Dr. Bo-Liang Deng
2003-2005
"Alkenyldiarylmethane (ADAM) Non-nucleoside Reverse Transcriptase Inhbitors"
Support: NIH

Dr. Hongwu Zhao
2004-2006
"2-Methoxyestradiol Analogs"
Support: EntreMed

Dr. Arup Maiti
2005-2008
"Synthesis of Chemopreventive Agents"
Support: NIH

Dr. Arindam Talukdar
2005-present
"Ligands for Probing the Active Site of Lumazine Synthase"
Support: NIH

Dr. Yunlong Song
2006-2008
"Indenoisoquinoline Topoisomerase I Inhibitors"
Support: NIH

Dr. Ze Li
2006-2009
"Development of Anti-viral Strategies for Enveloped Viruses"
Support: NIH

Dr. Zhenglai Fang
2006-2009
"Design and Synthesis of Tubulin Polymerization Inhibitors"
Support: EntreMed

Dr. P. V. Narashima Reddy
2008-2014
"Synthesis of Chemopreventive Agents"
Support: NIH

Dr. Biplab Banerjee
2009-2012
"Synthesis of Ammosamides and OSB-CoA Synthetase Inhibitors"
Support: NIH

Dr. Vijaykumar Pawar
2010-2011
"Riboflavin Synthase Mechanism Probes"
Support: NIH

Dr. Peng-Cheng Lv
2010-2012
"Synthesis of LMP400 and LMP776 Metabolites"
Support: NIH

Dr. Ping Wang
2014-present
"Synthesis of Indenoisoquinoline Topoisomerase I Inhibitors
Support: NIH

Past and Present Visiting Professors Sponsored

Prof. Takeshi Sakamoto
2005-2006
"Design and Synthesis of Alkenyldiarylmethane Non-nucleoside Reverse Transcriptase Inhibitors"
Support: Josai University, Japan (Visiting Professor)

Prof. Zhi-Yu Shao
2007-2008
"Synthesis of Norindenoisoquinoline Topoisomerase I Inhibitors"
Institute of Biological Science and Biotechnology
Donghua University, China
Support: China Scholarship Council (Visiting Professor)

Bin Sun
2008-2009
Shandong University, China
Support: China Scholarship Council

Prof. Jian-Hua Liang
"Synthesis of Potential Indenoisoquinoline Metabolites of Indenoisoquinolines in Phase I Clinical Trials"
2010-2011
School of Life Science, Beijing Institute of Technology, China
Support: China Scholarship Council (Visiting Professor)

Prof. Li-Ming Zhao
"Synthesis of Norendoxifen Analogues for Treatment of Breast Cancer"
2013-2014
School of Chemistry and Chemical Engineering
Jiangsu Normal University
China