

## JON DOUGLAS RAINIER: CURRICULUM VITAE

### **A. Education**

B. S. Chemistry, March, 1985, University of California, Irvine, California

M.S. Chemistry, September, 1990, California State University, Long Beach, California

Thesis Title: "A New Tartrate Derived Chiral Auxiliary"

Thesis Advisor: Professor Kensaku Nakayama

Ph. D. Organic Chemistry, October, 1993, University of California, Riverside, California

Dissertation Title: (Chapter 1) "Quinone Methides as Electrophilic Sinks: The Addition of Nucleophiles to and the Reductive Cyclization of Para-Quinone Methides and (Chapter 2) Efforts Toward the Synthesis of the C-Glycoside of Daunomycin and Studies of Tetracyclic Quinone Methides Related to the Anthracyclines."

Dissertation Advisor: Professor Steven R. Angle

Postdoctoral Fellow, 1993-1996, University of Pennsylvania, Philadelphia, Pennsylvania.

Research Area: Synthetic efforts towards the bioactive indole terpenes

Penitrem D and Emindole SA.

Sponsor: Professor Amos B. Smith, III

### **B. Employment**

July, 2021 Adjunct Professor, Department of Ophthalmology, Moran Eye Center, University of Utah, Salt Lake City, UT

July, 2006 Professor, Department of Chemistry, University of Utah, Salt Lake City, UT

July, 2002 Associate Professor, Department of Chemistry, University of Utah, Salt Lake City, UT

June, 2002 Associate Professor, Department of Chemistry, University of Arizona, Tucson, AZ

1996-2002 Assistant Professor, Department of Chemistry, University of Arizona, Tucson, AZ

1993-1996 National Institutes of Health Postdoctoral Fellow, University of Pennsylvania, Philadelphia, Pennsylvania with Professor Amos B. Smith, III

1985-1988 Quality Assurance Technician, HITCO, Gardena, California, Supervisor: Gilles Pronovost

### **C. Awards and Honors**

2019 Center for Science and Math Education (CSME) Faculty Associate

2018 UPSTEM Faculty Fellow, University of Utah

2015 Mortar Board Recognition, University of Utah

2013 Distinguished Teaching Award, University of Utah

2012 Ronald W. Parry Teaching Award, University of Utah  
2011 Student's Choice Teaching Award, University of Utah  
2008 Boehringer Ingelheim Lecturer, Ottawa University  
2001 Gencorp Foundation Technology Award for Excellence in Chemical Synthesis  
2001 Novartis Lecturer, Yale University  
2000-2004 National Science Foundation Career Award  
1998-2002 National Institutes of Health (Institute of General Medical Sciences) First Award  
1998 Research Corporation Research Innovation Award  
1993-1995 National Institutes of Health (National Cancer Institute) Postdoctoral Fellowship, Department of Chemistry, University of Pennsylvania, Philadelphia, PA  
1990 Outstanding Teaching Assistant Award, University of California, Riverside, CA  
1992-1993 Graduate Dean's Dissertation Research Grant, University of California, Riverside, CA

**C. COURSES TAUGHT 2002-2022 (\*New course or a major overhaul of the curriculum in an established course)**

Chem 2310 (1<sup>st</sup> Semester Organic Chemistry)  
Chem 2311 (Honors Organic Chemistry, 1<sup>st</sup> Semester)  
Chem 2320 (2<sup>nd</sup> Semester Organic Chemistry)  
Chem 2321 (Honors Organic Chemistry, 2<sup>nd</sup> Semester)  
Chem 2325 (2<sup>nd</sup> Semester Organic Chemistry Laboratory)\*  
Chem 5510 (Laboratory Safety)\*  
Chem 5570 (Research Ethics)\*  
Chem 5710 (Undergraduate Advanced Organic Chemistry Laboratory)\*  
Chem 7200 (Graduate Chemical Synthesis I)  
Chem 7210 (Graduate Chemical Synthesis II)  
Chem 7250 (Graduate Physical Organic Chemistry II)  
Chem 7270 (Graduate Organic Spectroscopy I)  
SCI 3900 (Being Human in STEM)\*

**D. SERVICE ACTIVITIES**

**Outreach**

- Secretary, Southern Section of the American Chemical Society, 1996-1997
- Organizer, Symposium on Natural Products, 14<sup>th</sup> Annual Rocky Mountain

Regional Meeting of the American Chemical Society, March 15-18, 1998

- Program Chair, 14th Annual Rocky Mountain Regional Meeting of the American Chemical Society, March 15-18, 1998
- Chair-elect, Southern Section of the American Chemical Society, 1998
- Chair, Southern Section of the American Chemical Society, 1999
- Council Member, Sam Hughes School Boy Scouts, 2001-2002
- co-Editor (with Professor Masahiro Hirama, Tohoku University), Tetrahedron Symposium in Print entitled: “The Synthesis of Fused Polycyclic Ethers”
- Co-Organizer (with Professor Fred West, University of Alberta), Symposium on “The Synthesis of Polycyclic Ethers”, 225<sup>th</sup> meeting of the American Chemical Society, New Orleans, LA
- Vice-Chair, 53<sup>rd</sup> Gordon Research Conference on Natural Products, Tilton School, Tilton, New Hampshire
- Chair, 54<sup>th</sup> Gordon Research Conference on Natural Products, Tilton School, Tilton, New Hampshire
- Local Chair, 39<sup>th</sup> National Organic Chemistry Symposium, Salt Lake City, UT
- Co-Organizer (with Professor Fred West, University of Alberta and Professor Masahiro Hirama, Tohoku University), Symposium on “The Synthesis of Polycyclic Ethers”, 2005 Pacificchem Meeting, Honolulu, Hawaii
- Coach, Firebirds Soccer: 2004-2011
- Co-Organizer (with Professor Raymond Andersen, University of British Columbia and Professor Michio Murata, Osaka University), Symposium on “Marine Natural Products, Synthesis, Bioactivity and Ecology”, 2010 Pacificchem Meeting, Honolulu, Hawaii
- Member of the Board, SYAC Swimming: 2011-2012
- Co-Instructor, SCI 3900 “Being Human in STEM”: 2019

### **Citizenship**

#### a. Intramural

Departmental Committees

1996-1997 Graduate recruiting committee

Marvel Symposium Committee

Graduate Recruiting Committee

Library Committee

1998-1999 Graduate Recruiting Committee

Library Committee

1999-2000 Graduate Recruiting Committee  
Library Committee  
2000-2001 Graduate Recruiting Committee  
Library Committee  
2001-2002 Graduate Recruiting Committee  
Library Committee  
TA Evaluation Committee  
Chemistry Annex Committee  
2001-2003 Graduate Admission Committee  
Faculty Recruiting Committee  
2001-2005 Graduate Admissions Committee (Chair)  
National Organic Chemistry Symposium Committee (Local Chair)  
2001-2006 Advisory Committee (Organic Representative)  
2001-2007 Graduate Education Committee  
2007-2008 Graduate Education Committee  
2008-2009 Graduate Education Committee  
2010 RPT Committee Chair  
2009-2012 Graduate Education Chair  
2010-2012 Advisory Committee (Organic Representative)  
2012-2019 Space Committee (Chair)  
2013-2016 American Chemical Society Student Affiliates (co-Advisor)  
2015-2019 Director BS/MS program  
2013-2019 Vice Chair for Academic Affairs  
2019-2020 Undergraduate Education Committee  
2021-present Teaching Assignment Advisory Committee  
2020-present Peer-Teaching Mentoring Committee

**University Committees**

1998 Faculty Research Mentor, Summer Research Institute  
2002-2003 Academic Senate  
2006-2008 College of Science Advisory Committee  
2009-present Consolidated Hearing Committee (CHC)  
2009-2012 University Promotion and Tenure Advisory Committee (UPTAC)  
2014-present Limited Submissions Committee

2018-2019 UPSTEM Member

2018-2021 Academic Senate

2019 COS Curriculum Committee

2019-2020 CSME Faculty Associate

2019-2020 Chair, Limited Submissions Committee

2019-2020 Senate Advisory Committee on Academic Policy

2021-2022 Inclusive STEM Teaching Project Facilitator

### **Extramural**

### **Professional Society Activities & Symposia Organized**

Spring 1997 Poster Session Organizer, 12<sup>th</sup> Biennial Marvel Symposium, Tucson, AZ

Spring 1998 Organizer, 14<sup>th</sup> Annual Rocky Mountain Regional Meeting of the American Chemical Society, Tucson, AZ, "Natural Products"

Spring 1998 Program Chair, 14<sup>th</sup> Annual Rocky Mountain Regional Meeting of the American Chemical Society, Tucson, AZ

Winter 2002 Co-Organizer with Professor Masahiro Hiram (University of Tohoku), Tetrahedron "Symposium in Print", Volume 58, issue 10.

Spring 2003 Co-Organizer with Professor Fred West (University of Alberta), 225<sup>th</sup> meeting of the American Chemical Society, New Orleans, LA

Summer 2003 Ad-Hoc Member Medicinal Chemistry A Study Section, National Institutes of Health

Summer 2003 Vice Chair, 52<sup>nd</sup> Gordon Research Conference on Natural Products, Tilton School, Tilton, New Hampshire

Winter 2004 Ad-Hoc Member Post-Doctoral Study Section, National Institutes of Health

Summer 2004 Chair, 53<sup>rd</sup> Gordon Research Conference on Natural Products, Tilton School, Tilton, New Hampshire

Winter 2005 Ad-Hoc Member SBC-B Study Section, National Institutes of Health

Summer 2005 Local Chair, 39<sup>th</sup> National Organic Chemistry Symposium, Salt Lake City, UT

Winter 2006 Ad-Hoc Member Postdoctoral Fellowship Study Section, National Institutes of Health  
Winter 2007 Ad-Hoc Member Postdoctoral Fellowship Study Section, National Institutes of Health

Fall 2007 NSF/NIH/DOE Workshop on Diversity

Winter 2008 Ad-Hoc Member SBC-B Study Section, National Institutes of Health

Winter 2008 Ad-Hoc Member NSF Chemical Synthesis Study Section

Spring 2009 Ad-Hoc Member Minority Biomedical Research Program, National Institutes of Health

Spring 2010 Ad-Hoc Member Minority Biomedical Research Program, National Institutes of Health

Fall 2010 Co-organizer with Professor Raymond Andersen, University of British Columbia and Professor Michio Murata, Osaka University, Symposium on “Marine Natural Products, Synthesis, Bioactivity and Ecology”, 2010 Pacificchem Meeting, Honolulu, Hawaii

Fall 2010 Ad-Hoc Member NSF Chemical Synthesis Study Section

Winter 2011 Ad-Hoc Member SBC-B Study Section, National Institutes of Health

Winter 2012 Ad-Hoc Member Postdoctoral Fellowship Study Section, National Institutes of Health

Spring 2012 Review Committee Member: University of Texas Southwestern Medical School Department of Biochemistry

Winter 2013 Ad-Hoc Member NSF Chemical Synthesis Study Section

Winter 2015 Ad-Hoc Member NSF Chemical Synthesis Study Section

Winter 2017 Ad-Hoc Member NSF Chemical Synthesis Study Section

### **Ad Hoc Reviews**

### **Manuscript Reviews**

Journal of the American Chemical Society

Journal of Organic Chemistry

Organic Letters

Tetrahedron Letters

Tetrahedron

Journal of the Chemical Society, Chemical Communications

Canadian Journal of Chemistry

Organometallics

Carbohydrate Research

Chemical Reviews

### **Proposal Reviews**

National Science Foundation

Petroleum Research Fund

Research Corporation

Austrian Science Foundation

National Institutes of Health

## **E. PUBLICATIONS**

### **Refereed Journal Articles**

1. Dai, C.; Zhao, X.; Song, C.; Schwartz, Z. Rainier, J.D. "Biphenyl Cyclobutenone Photoelectrocyclizations," *J. Org. Chem.* **2021**, *86*, 15164-15176.
2. Wade, A.; Rallabandi, R.; Lucas, S.; Oberg, C.; Gorusupudi, A.; Bernstein, P.S.; Rainier, J.D. "The synthesis of the very long chain polyunsaturated fatty acid (VLC-PUFA) 32:6 n-3," *Org. Biomol. Chem.* **2021**, *19*, 5563-5566.
3. Gorusupudi, A.; Rallabandi, R.; Cheng, V.; Lucas, S.; Rognan, G.; Wade, A.; Rainier, J.D.; Conboy, J.C.; Bernstein, P.W. Retinal Bioavailability and Membrane Biophysics of a Synthetic Retinal Bioavailability and Membrane Biophysics of a Synthetic *Proc. Natl. Acad. Sci.* **2021**, *118*, e2017739118.
4. Zhao, X.; Rainier, J. D. "The Synthesis of Conjugated Bis-Aryl Vinyl Substrates and Their Photoelectrocyclization Reactions Towards Phenanthrene Derivatives," *Synthesis* **2021**, *53*, 1200-1212.
5. Zhao, X.; Song, C.; Rainier, J.D. "Photoelectrocyclization Reactions of Conjugated Cycloalkenenones. Scope and Reactivity," *J. Org. Chem.* **2020**, *85*, 5449-5463.
6. Yin, J.; Landward, M. B.; Rainier, J.D. "Photoelectrocyclization Reactions of Amidonaphthoquinones," *J. Org. Chem.* **2020**, *85*, 4298-4311.
7. Yin, J.; Rainier, J.D. "The One-Pot Synthesis of Amidonaphthoquinones from Aminonaphthoquinones," *Tetrahedron Lett.* **2020**, *61*, 151800/
8. Zhao, X.; Song, C. Rainier, J.D. "Stereodivergent Photoelectrocyclization Reactions of Bis-aryl Cycloalkenenones: Intercepting Photoelectrocyclization Intermediates with Acid," *Org. Lett.* **2019**, *21*, 8611-8614.
9. Kumar, S.; Nakashizuka, H.; Jones, A.; Lambert, A.; Zhao, X.; Shen, M.; Parker, M.; Wang, S.; Berriochoa, Z.; Fnu, A.; VanBeuge, S.; Chévez-Barríos, P.; Tso, M.; Rainier, J.; Fu, Y. "Proteolytic Degradation and Inflammation Play Critical Roles in Polypoidal Choroidal Vasculopathy," *Am. J. Pathol.* **2017**, *187*, 2841-2857.
10. Osei, Akoto, C.; Rainier, J.D. "Concise Seven-Membered Oxepene/Oxepane Synthesis-Structural Motifs in Natural and Synthetic Products," *Synthesis*, **2019**, *51*, 3529-3535.
11. Zhao, X.; Rainier, J.D. "Pyridone photoelectrocyclizations to pyridophanthrenes," *Tetrahedron* **2017**, *73*, 4786-4789.
12. Martinez-Morales, E.; Kopljar, I.; Rainier, J.D.; Tytgat, J.; Snyders, D.J.; Labro, A.J. "Gambierol and n-alkanols inhibit Shaker Kv channel via distinct binding sites outside the K<sup>+</sup> pore," *Toxicon* **2016**, *120*, 57-60.
13. Zhang, T.; Cao, L.-H.; Kumar, S.; Enemchukwu, N.O.; Zhang, N.; Lambert, A.; Zhao, X.; Jones, A.; Wang, S.; Dennis, E.; Fnu, A.; Ham, S.; Rainier, J.D.; Yau, K.-W.; Fu, Y. "Dimerization of visual pigments in vivo," *Proc. Nat. Acad. Sci.* **2016**, *113*, 9093-9098.
14. Zhang, Y.; Rainier, J.D. "Synthesis of the ABCDEF and FGHI ring system of yessotoxin and adriatoxin," *J. Antibiotics (issue dedicated to Professor Amos B. Smith, III)* **2016**, *69*, 259-272.
15. Kopljar, I.; Grottesi, A.; de Block, T.; Rainier, J.D.; Tytgat, J.; Labro, A.J.; Snyders, D.J. "Voltage-sensor conformation shapes the intra-membrane drug binding site that determines gambierol affinity in Kv channels," *Neuropharmacol.* **2016**, *107*, 160-167.
16. Rocha, D.D.; Espejo, V.R.; Rainier, J.D.; La Clair, J.J.; Costa-Lotufo, L.V. "Fluorescent kapakahines serve as non-toxic probes for live cell Golgi imaging" *Life Sci.* **2015**, *136*, 163-167.

17. Rallabandi, R.; Jana, S.; Rainier, J.D. "Iodo-hexahydropyridindolones. Formation and reactivity," *Tetrahedron Lett. (issue dedicated to Professor Harry Wasserman)* **2015**, *56*, 3538-3540.
18. Wang, J.; Rainier, J.D. "Reactivity of Vinyl Phosphonate Containing Diazoesters: Formation, Reactivity, and Utility," *Org. Lett.* **2015**, *17*, 266-269.
19. Cao, Z.; Cui, Y.; Busse, E.; Mehrotra, S.; Rainier, J.D.; Murray, T.F. "Gambierol inhibition of voltage-gated potassium channels augments spontaneous Ca<sup>2+</sup> Oscillations in cerebrocortical neurons," *J. Pharmacol. Exp. Therap.* **2014**, *350*, 615.
20. Jana, S.; Rainier, J.D. "The Synthesis of Indoline and Benzofuran Scaffolds Using a Suzuki-Miyaura Coupling/Oxidative Cyclization Strategy," *Org. Lett.* **2013**, *15*, 4426.
21. Kopljar, I.; Labro, A.J.; de Block, T.; Rainier, J.D.; Tytgat, J.; Snyders, D.J. "The ladder-shaped polyether toxin gambierol anchors the gating machinery of Kv3.1 channels in the resting state" *J. Gen. Physiol.* **2013**, *141*, 359.
22. Gautam, M.; Benson, C.J.; Rainier, J. D.; Light, A.R.; Sluka, K.A. "ASICs do not play a role in maintaining hyperalgesia induced by repeated intramuscular acid injections," *Pain Res. Treat.* **2012**, 817347, 9 pp.
23. Kopljar, I.; Labro, A.J.; de Block, T.; Rainier, J.D.; Tytgat, J.; Snyders, D.J. "Voltage Sensor Trapping in Voltage-Gated K-Channels by the Marine Neurotoxin Gambierol," *Toxicon* **2012**, *60*, 150.
24. Espejo, V.R.; Rainier, J.D. "Total Synthesis of Kapakahine E and F" *Isr. J. Chem. (Issue Dedicated to Amos B. Smith, III)* **2011**, *51*, 473-482.
25. Zhang, Y.; Rohanna, J.R.; Zhou, J.; Iyer, K.; Rainier, J.D. "Total Synthesis of Brevenal," *J. Am. Chem. Soc.* **2011**, *133*, 3208-3216.
26. Wang, J.; Rainier, J.D. "Vinyl Diazophosphonates as Precursors to Highly Substituted Indolines and Cyclopentenes," *Org. Lett.* **2011**, *13*, 700-702.
27. Espejo, V.R.; Li, X.-B.; Rainier, J.D., "Cyclopropylazetoidolines as Precursors to C(3)-Quaternary-Substituted Indolines," *J. Am. Chem. Soc.* **2010**, *132*, 8282.
28. Espejo, V.R.; Rainier, J.D., "Total Synthesis of Kapakahine E and F," *Org. Lett.* **2010**, *12*, 2154.
29. Sabahi, A.; Rainier, J.D., "Synthesis of the debrominated analog of dihydroflustramine C Utilizing a Sulfur Ylide Initiated Thio-Claisen Rearrangement," *ARKIVOC (Issue Dedicated to Cynthia Maryanoff)* **2010**, 116.
30. Walder, R.Y.; Rasumussen, L.A.; Rainier, J.D.; Light, A.R.; Wemmie, J.A.; Sluka, K.A. "ASIC1 and ASIC3 Play Different Roles in the Development of Hyperalgesia After Inflammatory Muscle Injury," *J. Pain* **2010** *11*, 210.
31. Zhou, J.; Rainier, J. D. "Olefinic-Amide and Olefinic-Lactam Cyclizations" *Org. Lett.* **2009**, *11*, 3774.
32. Kopljar, I.; Labro, A. J.; Cuypers, E.; Johnson, H. W. B.; Rainier, J. D.; Tytgat, J.; Snyders, D. J. "A polyether biotoxin binding site on the lipid-exposed face of the pore domain of Kv channels revealed by the marine toxin gambierol," *Proc. Nat. Acad. Sci.* **2009** *106*, 9896.
33. Coryell, M.; Wunsch, A.; Haenfler, J.; Allen, J.; Schnizler, M.; Ziemann, A.; Cook, M.; Dunning, J.; Price, M.; Rainier, J. D.; Liu, Z.; Light, A.; Langbehn, D.; Wemmie, J. "Acid-sensing ion channel-1a in the amygdala, a novel therapeutic target in depression related behavior" *J. Neurosci.* **2009** *29*, 5481.
34. Zhang, Y.; Rainier, J. D. "Two Directional Olefinic-Ester and Diene Ring-Closing



- Metathesis using Reduced Ti Alkylidenes. A Rapid Entry into Polycyclic Ether Skeletons," *Org. Lett.* **2009**, *11*, 237.
35. Rohanna, J. C.; Rainier, J. D. "Olefinic-Lactone Cyclizations to Macrocycles," *Org. Lett.* **2009**, *11*, 493.
  36. Hayes, S. G.; McCord, J. L.; Rainier, J.; Liu, Z.; Kaufman, M. P. "Role Played by Acid-Sensitive Ion Channels in Evoking the Exercise Pressor Reflex," *Am. J. Phys.* **2008**, *295*, H1720.
  37. Espejo, V. R.; Rainier, J. D. "An Expeditious Synthesis of C(3)-N(1') Heterodimeric Indolines," *J. Am. Chem. Soc.* **2008**, *130*, 12894.
  38. Osei Akoto, C.; Rainier, J. D. "Harnessing Glycal Epoxide Rearrangements. The Generation of the A,B-, E,F-, and I,J-Rings of Adriatoxin" *Angew. Chem. Int. Ed.* **2008**, *47*, 8055.
  39. Boyarskikh, V.; Nyong, A.; Rainier, J. D. "Highly Diastereoselective Sulfonium Ylide Rearrangements to Quaternary Substituted Indolines," *Angew. Chem. Int. Ed.* **2008**, *47*, 5374.
  40. Light, A.R.; Hughen, R.W.; Zhang, Z.; Rainier, J.; Liu, Z.; Lee, J. "Dorsal root ganglion neurons innervating skeletal muscle respond to physiological combinations of protons, ATP and lactate mediated by ASIC, P2X and TRPV1," *J. Neurophysiol.* **2008**, *100*, 1169.
  41. Cuypers, E.; Abdel-Mottaleb, Y.; Rainier, J. D.; Tytgat, J. "Gambierol, A Toxicol Produced by the Gambierdiscus toxicus, is a Potent blocker of Voltage-Gated Potassium Channels," *Toxicon*, **2008**, *51*, 974.
  42. Cao, Z.; George, J.; Gerwick, W. H.; Baden, D. G.; Rainier, J. D.; Murray, T. F. "Influence of Lipid Soluble Gating Modifier Toxins on Sodium Influx in Neocortical Neurons," *J. Pharm. Exp. Therap.* **2008**, *362*, 604.
  43. Iyer, K.; Rainier, J. D. "Olefinic-Ester and Diene Ring-Closing Metathesis Using a Reduced Titanium Alkylidene," *J. Am. Chem. Soc.* **2007**, *129*, 12604.
  44. Cuypers, E.; Yanagihara, A.; Rainier, J. D.; Tytgat, J. "TRPV1 as a key determinant in ciguatera and neurotoxic shellfish poisoning," *Biochem. Biophys. Res. Commun.* **2007** *361*, 214.
  45. LePage, K. T.; Rainier, J. D.; Johnson, H. W. B.; Baden, D. G.; Murray, T. F. "Gambierol Acts as a Functional Antagonist of Neurotoxin Site 5 on Voltage-Gated Sodium Channels in Cerebellar Granule Neurons," *J. Pharm. Exp. Therap.* **2007**, *323*, 174.
  46. Roberts, S. W.; Rainier, J. D. "The Synthesis of an A-E Gambieric Acid Subunit using a C-Glycoside Centered Strategy," *Org. Lett.* **2007**, *9*, 227.
  47. Orendt, A. M.; Roberts, S. W.; Rainier, J. D. "The Role of Asynchronous Bond Formation in the Diastereoselective Epoxidation of Cyclic Enol Ethers: A Density Functional Theory Study," *J. Org. Chem.* **2006**, *71*, 5565.
  48. Sabahi, A.; Novikov, A.; Rainier, J. D. "2-Thioindoles as Precursors to Spiro-Fused Indolines: Synthesis of ( $\pm$ )-Dehaloperophoramidine," *Angew. Chem. Int. Ed.* **2006**, *45*, 4317.
  49. Majumder, U.; Cox, J. M.; Johnson, H. W. B.; Rainier, J. D. "The Total Synthesis of Gambierol. The Generation of the A-C and F-H Subunits Using a C-Glycoside Centered Strategy," *Chem. Eur. J.* **2006**, *12*, 1736.
  50. Johnson, H. W. B.; Majumder, U.; Rainier, J. D. "The Total Synthesis of Gambierol.

- Subunit Coupling and Completion," *Chem. Eur. J.* **2006**, *12*, 1747.
51. Liu, Z.; Rainier, J. D. "Ring-Opening/ring-Closing Metathesis (RORCM) Reactions of 7-Azanorbornene Derivatives. An Entry into Perhydroindolines," *Org. Lett.* **2006**, *8*, 459.
  52. Majumder, U.; Rainier, J. D. "Olefinic-ester cyclizations using Takai-Utimoto reduced titanium alkylidenes," *Tetrahedron Lett.* **2005**, *46*, 7209.
  53. Roberts, S. W.; Rainier, J. D. Substitution and Remote Protecting Group Influence on the Oxidation/Addition of  $\alpha$ -Substituted 1,2-Anhydroglycosides: A Novel Entry into C-Ketosides," *Org. Lett.* **2005**, *7*, 1141.
  54. Johnson, H. W. B.; Majumder, U.; Rainier, J. D.\* "The Total Synthesis of Gambierol," *J. Am. Chem. Soc.* **2005**, *127*, 848.
  55. Liu, Z.; Rainier, J. D. "Regioselective Ring-Opening/Cross-Metathesis Reactions of Norbornene Derivatives with Electron Rich Olefins," *Org. Lett.* **2005**, *7*, 131.
  56. Nyong, A.; Rainier, J. D. "The diastereoselective synthesis of quaternary substituted thioindolines from sulfur ylide intermediates," *J. Org. Chem.* **2005**, *70*, 746.
  57. Weerasakere, M.; Liu, Z.; Rainier, J. D. "Highly Regioselective Ring-Opening/Cross-Metathesis Reactions of 2-Sulfonylnorbornene Derivatives," *Org. Lett.* **2004**, *6*, 1625.
  58. Smith, A. B., III; Kanoh, N.; Ishiyama, H.; Minakawa, N.; Rainier, J. D.; Hartz, R. A.; Cho, Y. S.; Cui, H.; Moser, W. H. "The Total Synthesis of (-)-Penitrem D," *J. Am. Chem. Soc.* **2003**, *125*, 8228.
  59. Novikov, A. N.; Kennedy, A. R.; Rainier, J. D. "Sulfur Ylide Initiated Thioclaissen Rearrangements. The Synthesis of Highly Substituted Indolines," *J. Org. Chem.* **2003**, *68*, 993.
  60. Novikov, A. N.; Sabahi, A.; Nyong, A. M.; Rainier, J. D. "The diastereoselective Synthesis of Quaternary Substituted Indolines from Sulfur Ylide Intermediates," *Tetrahedron Asymm.* **2003** *14*, 911.
  61. Majumder, U.; Cox, J. M.; Rainier, J. D. "Synthesis of an F-H Gambierol Subunit Using a C-Glycoside Centered Strategy," *Org. Lett.* **2003** *5*, 913.
  62. Weerasakere, M.; Xu, Q.; Rainier, J. D. "An Anionic Condensation and Fragmentation Approach to 3-Pyrrolines" *Tetrahedron Lett.* **2002**, *43*, 8913.
  63. Allwein, S. P.; Cox, J. M.; Howard, B., E.; Johnson, H., W, B.; Rainier, J. D.§ "C-Glycosides to Fused Polycyclic Ethers" *Tetrahedron* **2002**, *58*, 1997.
  64. Imbriglio, J. E.; Rainier, J. D.§ "[2+2+1] Cycloadditions of Ynol Ethers. The Synthesis of Iron Complexes of 3-Alkoxy-cyclopentadienones" *Tetrahedron Lett.* **2001**, *42*, 6987.
  65. Cox, J. M.; Rainier, J. D. "C-Glycosides to Fused Polycyclic Ethers. An Efficient Entry into the A-D Ring System of Gambierol," *Org. Lett.* **2001**, *3*, 2919.
  66. Xu, Q.; Weerasakere, M.; Rainier, J. D. "Anionic Ring Expansion Reactions of Oxabicyclo[4.2.1]heptenones. An Efficient Entry into the Carbon Framework of Oxygenated Cembranoids," *Tetrahedron* **2001**, *57*, 8029.
  67. Kennedy, A. R.; Taday, M. H.; Rainier, J. D. "The Use of Sulfur Ylides in the Synthesis of Substituted Indoles," *Org. Lett.* **2001**, *3*, 2407.
  68. Rainier, J. D.; Cox, J. M.; Allwein, S. P. "Enol Ether-Olefin Ring Closing Metathesis Using the Grubbs Ruthenium Imidazole Catalyst," *Tetrahedron Lett.* **2001**, *42*, 179.
  69. Rainier, J. D.; Allwein, S. P.; Cox, J. M. "C-Glycosides to Fused Polyethers. A Formal Synthesis of ( $\pm$ )-Hemibrevetoxin B," *J. Org. Chem.* **2001**, *66*, 1380.
  70. Rainier, J. D. and Smith, A. B., III "Polyene Cyclizations to Indole Diterpenes. The

- First Synthesis of (+)-Emindole SA Using a Biomimetic Approach," *Tetrahedron Lett.* **2000**, *41*, 9419.
71. Rainier, J. D.; Kennedy, A. R. "Cascades to Substituted Indoles," *J. Org. Chem.* **2000**, *65*, 6213.
  72. Rainier, J. D.; Imbriglio, J. I. "The Synthesis and Chemoselective Reactivity of 3-Aminocyclopentadienones," *J. Org. Chem.* **2000**, *65*, 7272.
  73. Rainier, J. D.; Cox, J. M. "Aluminum and Boron Mediated C-Glycoside Synthesis From 1,2-Anhydroglycosides," *Org. Lett.* **2000**, *2*, 2707.
  74. Rainier, J. D.; Allwein, S. P.; Cox, J. M. "A Highly Efficient Synthesis of the Hemibrevetoxin B Ring System," *Org. Lett.* **2000**, *2*, 231.
  75. Rainier, J. D.; Imbriglio, J. E. "The Synthesis and Chemoselective Reactivity of 3-Aminocyclopentadienones," *Org. Lett.* **1999**, *1*, 2037.
  76. Rainier, J. D.; Xu, Q. "Anionic Two-Carbon Ring Expansions of Oxabicyclo[2.2.1]heptenes and Oxabicyclo[4.2.1]nonenes," *Org. Lett.* **1999**, *1*, 1161.
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  81. Rainier, J. D.; Allwein, S. P. "An Iterative Approach to Fused Ether Ring Systems," *J. Org. Chem.* **1998**, *63*, 5310.
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## BOOK CHAPTERS

87. Rainier, J.D. "Synthesis of Substituted Tetrahydrofurans," in *Topics in Heterocyclic Chemistry*, J. Cossy (Ed); Springer (2013)
88. Rainier, J.D. "Synthesis of Natural Products Containing Medium-Size Oxygen Heterocycles by Ring-Closing Alkene Metathesis," in *Metathesis in Natural Product Synthesis*, J. Cossy, S. Arseniyadis, C. Meyer (Ed.'s); Wiley-VCH, Weinheim,

Germany; (2010), pp. 87-127.

89. Rainier, J. D. Application of C-Glycosides in the Total Synthesis of (-)-Gambierol,” Strategies and Tactics in Organic Synthesis, M. Harmata (Ed.); Elsevier, Amsterdam; (2008), vol. 7, pp. 154-216.
90. Roberts, S.; Rainier, J. D. “Product Class 1: Synthesis of 5-, 6-, and Larger Oxa-3-Cycloalkenes by Ring Closing Metathesis,” in Science of Synthesis; Forsyth, C. J. Ed.;Thieme, Stuttgart; (2009), vol. 37, pp. 531-551.
91. Iyer, K.; Rainier, J. D. “Product Class 1: Synthesis of 5-, 6-, and Larger Oxa-3-Cycloalkenes From Other Cyclic Ethers,” in Science of Synthesis; Forsyth, C. J. Ed.;Thieme, Stuttgart; (2009), vol. 37, pp. 555-579.

## **PATENTS**

92. Gorusupudi, A.; Bernstein, P.S.; Rainier, J.D.; Rallabandi, R. “Retinal bioavailability of synthetic very-long chain polyunsaturated fatty acids,” WO2021257636, 12-23-2021.

### **E.1. Submitted Manuscripts**

93. Zhang, T.; Hurlow, E.E.; Rainier, J.; Fu, Y. “Chemical Chaperone NQPhe Protects Cone Photoreceptors in Two Mouse Models of Leber Congenital Amaurosis by Inhibiting S-Opsin Aggregation,” *Amer. J. Path.* **2021** submitted.
94. Tummalapalli, K.S.S.; Zhao, X.; Rainier, J.D. “A Biaryl-Cyclohexenone Photoelectrocyclization/De aromatization Sequence to Substituted Terpenes,” *Angew. Chem. Int. Ed.* **2021** submitted.
95. Cheng, V.; Rallabandi, R.; Gorusupudi, A.; Lucas, S.; Rognan, G. Bernstein, P.S.; Rainier, J. D.; Conboy, J.C. “Influence of Very-Long Chain Polyunsaturated Fatty Acids on Membrane Structure and Dynamics,” *Biophysical J.* **2021** submitted.

### **E.2. Manuscripts in Preparation**

96. Yin, J.; Rainier, J.D. “A [2+2] Photocycloaddition Approach to Ansalactam Natural Products,” *Will be submitted in June, 2022*
97. Yin, J.; Johannson, H.; Rainier, J.D. “The Use of Flow Chemistry in Photoelectrocyclizations,” *Will be submitted in May, 2022.*
98. Yin, J.; Maturano, J.; Rainier, J.D. “An Photoelectrocyclization Approach to Discorhabdins,” *Will be submitted in June, 2022*

## **F. Scholarly Presentations**

Invited Research Colloquia (Since 1996):

\*all invited

1. University of Utah, January 6, 2021 “A PROTAC Approach to Inflammatory Diseases,: 3I Initiative, University of Utah.
2. California Polytechnic University, San Luis Obispo, February 28, 2020 “Targeting Bacteria and Virulence Using Natural Products and Light”
3. Gustavus Adolphus College, Nov. 15, 2019 “Targeting Bacteria and Virulence Using Natural Products and Light”

4. University of Utah CSME, January 16, 2020 “From Sage to Teacher The Evolution of an Instructor or Old Dogs Can Learn New Tricks”
5. Chemical Ecology Symposium of Natural Products, May 17, 2018 “Do VLC-PUFAs Play a Role in AMD?”
6. Science at Breakfast, Salt Lake City UT; Feb. 12 2018 “The Role of Synthetic Organic Chemistry in the Discovery of Therapeutics, A Macular Degeneration Case Study”
7. Philadelphia Organic Chemists Club, Philadelphia, PA; Oct. 27, 2016 “Targeting Heterocycles at 4700 Feet Above Sea Level”
8. Dow, Philadelphia, PA; November 3, 2014. “Targeting Heterocycles at 4700 Feet Above Sea Level”
9. William & Mary College, Williamsburg, VA; April 5, 2013. “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
10. Gonzaga University, Spokane, WA; March 1, 2013. “Targeting Heterocyclic Natural
11. Products at 4700 Feet Above Sea Level”
12. Michigan State University, East Lansing, MI; January 30, 2013. “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
13. University of Michigan, Ann Arbor, MI; January 29, 2013. “Targeting Heterocyclic
14. Natural Products at 4700 Feet Above Sea Level”
15. Wayne State University, Detroit, MI; January 28, 2013. Frontiers Seminar Series:
16. “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
17. Oregon State University, Corvallis, OR; March 10, 2011. “Targeting Heterocycli
18. Natural Products at 4700 Feet Above Sea Level”
19. University of Colorado, Boulder, CO; April 26, 2010. “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
20. University of Alberta, Alberta, CA; January 26, 2010. “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
21. Rutgers University, New Brunswick, NJ; August 14, 2009. “Targeting Heterocycles at 4700 Feet Above Sea Level”
22. The North Jersey Section of the American Chemical Society, New Brunswick, NJ; August 13, 2009. “Targeting Marine Natural Products at 4700 Feet Above Sea Level” Rainier, J.D.
23. Cephalon, Philadelphia, PA; June 2, 2009. “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
24. California State University, San Francisco; San Francisco, CA; April 17, 2009. “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
25. University of Texas Southwestern Medical Center; Dallas, Texas; February 24, 2009 “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
26. University of Ottawa; Nov 21, 2008. Boehringer Ingelheim Lecture “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
27. Boehringer Ingelheim; Montreal, Canada; November 20, 2008. “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
28. University of New Mexico; Nov 7, 2008. “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
29. University of California, San Diego; Nov 3, 2008. “Targeting Marine Natural Products at 4700 Feet Above Sea Level”
30. Gilead; South San Francisco, CA; May 6, 2008. “Targeting Polyether Natural Products

at 4700 Feet Above Sea Level”

31. Amgen; Thousand Oaks, CA; May 22, 2008. “Targeting Polyether Natural Products at 4700 Feet Above Sea Level”
32. Merck; Rahway, NJ.; November 14, 2007. “Targeting Polyether Natural Products at 4700 Feet Above Sea Level”
33. Pennsylvania State University; State College, PA; November 12, 2007. “Targeting Polyether Natural Products at 4700 Feet Above Sea Level”
34. California State University, Fullerton; Fullerton, Ca.; May 3, 2007. “Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level”
35. University of Utah; Salt Lake City, UT; September 9, 2005. “Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level”
36. Excelixis, Inc.; South San Francisco, Ca.; May 6, 2005. “Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level”
37. Celera; South San Francisco, Ca.; May 5, 2005. “Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level”
38. Sunesis; South San Francisco, Ca.; May 4, 2005. “Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level”
39. California State University, Long Beach; Long Beach, Ca.; March 9, 2005. “Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level”
40. University of Missouri, Columbia, Mo.; November 19, 2004. “Approaches to Heterocyclic Natural Products,”
41. University of Chicago, Chicago, Illinois; April 16, 2004. “Approaches to Heterocyclic Natural Products,”
42. University of Illinois at Chicago, Chicago, Illinois; April 15, 2004. “Approaches to Heterocyclic Natural Products,”
43. Wyeth Ayerst, Pearl River, New York; March 19, 2004. “Approaches to Heterocyclic Natural Products,”
44. Tokyo University, Tokyo, Japan; November 19, 2003. “Approaches to Heterocyclic Natural Products,”
45. Brigham Young University; Provo, Utah; November 6, 2003. “Recent Developments in Natural Products Synthesis”
46. Florida State University; Tallahassee, Florida; October 21, 2003. “Approaches to Heterocyclic Natural Products”
47. Abbott Laboratories; Chicago, Illinois; March 12, 2003. “C-Glycosides to Polycyclic Ethers; Total Synthesis of Gambierol”
48. Ohio State University; October 10, 2002. “C-Glycosides to Polycyclic Ethers; Progress to Gambierol”
49. Ohio University, October 11, 2002. “C-Glycosides to Polycyclic Ethers; Progress to Gambierol”
50. Pfizer; Groton, CT; May 30, 2002. “Efficient Approaches to Heterocyclic Natural Products”
51. The University of Utah; Salt Lake City, Utah; November 29, 2001 “Efficient Approaches to the Synthesis of Fused Polycyclic Ethers”
52. The University of Arizona; Tucson, Arizona; September 29, 2001. “Efficient

- Approaches to Heterocyclic Natural Products”
53. Eli Lilly; Indianapolis, Indiana; July 10, 2001. “Efficient Approaches to Heterocyclic Natural Products”
  54. Boehringer Ingelheim; Connecticut; June 26, 2001. “Efficient Approaches to Heterocyclic Natural Products”
  55. Bristol Meyers Squibb; Groton, Connecticut; June 25, 2001. “Efficient Approaches to Heterocyclic Natural Products”
  56. Merck and Company; West Point, Pennsylvania; April 20, 2001. “Efficient Approaches to Heterocyclic Natural Products,”
  57. Merck and Company; Rahway, New Jersey; January 16, 2001. “Efficient Approaches to Heterocyclic Natural Products”
  58. McAlister College; Minneapolis, Minnesota; December 13, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  59. North Dakota State University; Fargo, North Dakota; December 12, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  60. The University of Minnesota; Minneapolis, Minnesota; December 11, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  61. The University of North Carolina; Chapel Hill, North Carolina; December 6, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  62. Colorado State University; Fort Collins, Colorado; December 4, 2000. “Efficient Approaches to Heterocyclic Natural Products,”
  63. The University of Illinois; Champagne, Illinois; November 29, 2000. “Efficient Approaches to Heterocyclic Natural Products,”
  64. The University of Notre Dame; South Bend, Indiana; November 28, 2000. “Efficient Approaches to Heterocyclic Natural Products,”
  65. Indiana University; Bloomington, Indiana; November 27, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  66. Purdue University; West Lafayette, Indiana; November 14, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  67. Exelixis Pharmaceuticals; South San Francisco, California; November 9, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  68. Stanford University; Palo Alto, California; November 8, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  69. California State University, San Jose; San Jose, California; November 7, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  70. Oregon State University; Corvallis, Oregon; November 6, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  71. The University of North Carolina; Chapel Hill, North Carolina; October 27, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  72. Emory University; Atlanta, Georgia; October 25, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  73. The University of California, Los Angeles; Los Angeles, California; October 19, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  74. The University of California, Irvine; Irvine, California; October 18, 2000. “Efficient Approaches to Heterocyclic Natural Products”
  75. Scripps Research Institute; La Jolla, California; October 17, 2000. “Efficient

Approaches to Heterocyclic Natural Products”

76. The University of California, San Diego; San Diego, California; October 16, 2000. “Efficient Approaches to Heterocyclic Natural Products”
77. The University of Pittsburgh; Pittsburgh, Pennsylvania; October 12, 2000. “Efficient Approaches to Heterocyclic Natural Products”
78. Novartis Lecture, Yale University; New Haven, Connecticut; October 11, 2000. “Efficient Approaches to Heterocyclic Natural Products”
79. SmithKline Beecham Pharmaceuticals; King of Prussia, Pennsylvania; September 26, 2000. “Efficient Approaches to Heterocyclic Natural Products,” Rainier, J. D.
80. The University of Pennsylvania; Philadelphia, Pennsylvania; September 25, 2000. “Efficient Approaches to Heterocyclic Natural Products”
81. SUNY Buffalo; Buffalo, New York; September 22, 2000. “Efficient Approaches to Heterocyclic Natural Products”
82. Columbia University; New York, New York; September 21, 2000. “Efficient Approaches to Heterocyclic Natural Products”
83. University of Texas; Austin, Texas; September 15, 2000. “Efficient Approaches to Heterocyclic Natural Products”
84. Texas A&M University; College Station, Texas; September 14, 2000. “Efficient Approaches to Heterocyclic Natural Products”
85. Wyeth-Ayerst Research, Princeton, New Jersey; June 15, 2000. “Efficient Approaches to Heterocyclic Natural Products”
86. R.W. Johnson Pharmaceuticals, La Jolla, California; April 18, 2000. “Efficient Approaches to Heterocyclic Natural Products”
87. University of Utah, Salt Lake City, Utah; March 2, 2000. “Efficient Approaches to Heterocyclic Natural Products”
88. University of California, Santa Cruz, California; October 25, 1999. “Synthetic Studies Directed Toward Bioactive Natural Product”
89. University of California, Santa Barbara, California; October 8, 1999. “Synthetic Studies Directed Toward Bioactive Natural Products”
90. Abbott Laboratories, Chicago, Illinois; October 4, 1999. “Synthetic Studies Directed Toward Bioactive Natural Products”
91. University of Rochester, Rochester, New York; October 1, 1999. “Synthetic Studies Directed Toward Bioactive Natural Products”
92. New Mexico State University, Las Cruces, New Mexico, September 16, 1999. “Synthetic Studies Directed Toward Bioactive Natural Products”
93. University of California, Riverside; Riverside California; October 9, 1998. “Synthetic Studies Directed Toward Bioactive Natural Products”
94. California State University, Long Beach; Long Beach, California; October 7, 1999 “Synthetic Studies Directed Toward Bioactive Natural Products”

**Conference and Symposia Presentations (Since 1996)**

95. Gordon Research Conference on Stereochemistry, July 29, 2012, RI. Invited Lecture: “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
96. VIIth U.S.-Japan Seminar on Marine Natural Products: Cross-Disciplinary Expansions in Marine Bioorganic Chemistry; Okinawa, Japan; Dec. 11-16, 2011; Invited Lecture: “Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level”
97. EESF-COST High-Level Research Conference on Natural Products Chemistry,



- Biology and Medicine; Acquafredda di Maratea, Italy; Aug. 28-Sep. 2, 2011; Invited Lecture: "Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level"
98. Pacifichem, Honolulu, HI; Dec. 19, 2010. Invited Lecture: "Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level"
  99. Pacifichem, Honolulu, HI; Dec. 17, 2010. Invited Lecture: "Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level" Gordon Research Conference on Natural Products, July 2010, Tilton School, NH. Invited Lecture: "Targeting Heterocyclic Natural Products at 4700 Feet Above Sea Level"
  100. Gordon Research Conference on Heterocycles, June 2009, New Hampshire. Invited Lecturer: "Targeting Heterocycles at 4700 Feet Above Sea Level"
  101. Rocky Mountain Regional American Chemical Society Meeting, June 2008, Park City, UT; Natural Products Chemistry Symposium. Invited Lecturer: "Targeting Polyether Natural Products at 4700 Feet Above Sea Level"
  102. Gordon Research Conference on Marine Natural Products, February 24-29, 2008, Ventura, CA. Invited Lecturer: "Targeting Polyether Natural Products at 4700 Feet Above Sea Level"
  103. 41<sup>st</sup> Annual Western Regional American Chemical Society Meeting, San Diego, CA.; Heterocyclic Chemistry Symposium. Invited Lecturer: "Targeting Polyether Natural Products at 4700 Feet Above Sea Level"
  104. Gordon Research Conference on Natural Products, July 21-July 28, 2007, Tilton School, NH. Contributed Poster: "Progress Toward the Synthesis of Polycyclic Ethers at 4700 Feet Above Sea Level" Rainier, J. D
  105. Japan-America Symposium; Park City, USA, July 1-5, 2007. Invited Lecture: "Recent Developments in Marine Natural Products at 4700 Feet Above Sea Level" Rainier, J. D.
  106. Gordon Research Conference on Natural Products, July 21-July 28, 2006, Tilton School, NH. Contributed Poster: "Progress Toward the Total Synthesis of Indolines at 4700 Feet Above Sea Level"
  107. "Symposium on Recent Developments in Metathesis-Related Processes," 231<sup>st</sup> National Meeting of the American Chemical Society, March 26-30, 2006. Invited Lecture: "Metathesis Chemistry in the Synthesis of Heterocyclic Natural Products."
  108. Gordon Research Conference on Marine Natural Products, February 26-March 1, 2006, Ventura, CA. Contributed Poster: "The Synthesis of Marine Natural Products at 4700 Feet Above Sea Level"
  109. "Symposium on Developments in the Synthesis of Polycyclic Ethers," Pacifichem Meeting, Honolulu, Hawaii, December 12-16, 2005. Invited Lecture: Recent Developments in the Synthesis of Polycyclic Ether Natural Products at 4700 Feet Above Sea Level"
  110. Gordon Research Conference on Natural Products, July 24-July 29, 2005, Tilton School, NH. Contributed Poster: "Progress Toward the Total Synthesis of Perophoramidine, Rostratins B-D, and Related Indoline Containing Natural Products" Rainier, J. D; Liu, Z.; Sabahi, A.
  111. Gordon Research Conference on Natural Products, July 24-July 29, 2005, Tilton School, NH. Contributed Poster: "Progress Toward the Total Synthesis of Gambieric Acid, Brevenal, Psymberin, and Related Ethereal Natural Products"
  112. "New Frontier in Chemical Synthesis Symposium," Canadian Society for

- Chemistry Meeting; Saskatchewan, Canada, May 29-June 1, 2005. Invited Lecture: "Recent Developments in the Synthesis of Heterocyclic Natural Products at 4700 Feet Above Sea Level"
113. The 11<sup>th</sup> Symposium on the Latest Trends in Organic Synthesis; Brock University, St. Catharines, Ontario, Canada, August 11-15, 2004. Invited Lecture: "Recent Advances in Heterocycle Synthesis"
  114. First International Symposium of the Center of Excellence Program "Giant Molecules and Complex Systems"; Sendai, Japan, November 20-21, 2003. Invited Lecture: "C-Glycosides to Polycyclic Ethers. Progress Towards the Synthesis of the Marine Ladder Toxin Gambierol," Rainier, J. D.
  115. Japan-America Symposium; Japan, June 22-27 2003. Invited Lecture: Efficient Approaches to Polycyclic Ethers. Progress Towards the Synthesis of the Marine Ladder Toxin Gambierol," Rainier, J. D.
  116. 226<sup>th</sup> American Chemical Society National Meeting, New Orleans, LA; March 26-30, 2003; ORG , Invited lecture:"Progress Toward the Synthesis of Gambierol."
  117. Ischia Advanced School of Organic Chemistry, 2002 on New Frontiers and Future Challenges in Organic Synthesis; Ischia, Italy, September 25-29, 2002. Invited Lecture: "C-Glycosides to Polycyclic Ethers; Synthetic Efforts Targeting Gambierol,"
  118. Gordon Research Conference on Natural Products, July 29-August 3, 2002, Tilton School, NH. Invited Lecture: "Efficient Approaches to Substituted Indoles"
  119. Gordon Research Conference on Natural Products, July 29-August 3, 2001, Tilton School, NH. Contributed Poster: "Progress Toward the Total Synthesis of Gambierol"
  120. Gordon Research Conference on Natural Products, July 29-August 3, 2001, Tilton School, NH. Contributed Poster: "The Synthesis of Substituted Indoles"
  121. National Organic Symposium, Montana State University, Bozeman, MT; June 7-9, 2001. Contributed Poster:"The Synthesis of Substituted Indoles,"
  122. SynCon Meeting; Irvine, CA; April 28, 2001. Invited Lecture: "Approaches to Substituted Indoles" Rainier, J. D.
  123. Gordon Research Conference on Natural Products; July 30-August 4, 2000, Plymouth State College, NH. Contributed Poster:"A Formal Total Synthesis of Hemibrevetoxin B"
  124. Gordon Research Conference on Natural Products, July 30-August 4, 2000, Plymouth State College, NH. Contributed Poster: "Isonitrile Cascades to Indoles"
  125. National Science Foundation Workshop on Organic Synthesis, Squam Lake, New Hampshire; July 13-17, 2000. Invited Lecture: "A Novel Condensation and Fragmentation Approach to Oxygenated Cembranoids," Rainier, J. D.; Xu, Q.
  126. 219<sup>th</sup> American Chemical Society National Meeting, San Francisco, CA; March 26-30, 2000; ORG 675, Contributed lecture:"Progress Toward the Synthesis of Hemibrevetoxin B"
  127. Pacific Regional Meeting, Ontario, California; October 6, 1999. Invited Lecture: "Ynamine Cycloaddition Chemistry," Rainier, J. D.; Imbriglio, J. E.
  128. 218<sup>th</sup> American Chemical Society National Meeting, New Orleans, LA; August 25-29<sup>th</sup>, 1999; ORG. Contributed Lecture: "A Novel Condensation and Fragmentation Approach to Furan Containing Natural Products"
  129. 218<sup>th</sup> American Chemical Society National Meeting, New Orleans, Louisiana; August 25-29<sup>th</sup>, 1999; ORG. Invited Lecture: "Iterative Approaches to Fused Polyether

Containing Natural Products”

130. Gordon Research Conference on Natural Products, New England College, Henniker, New Hampshire; July 25-30, 1999. Invited Lecture: "Approaches to Fused Poly Ether Ring Systems”
131. Gordon Research Conference on Natural Products, New England College, Henniker, New Hampshire; July 25-30, 1999. Contributed Poster: “A Novel Condensation and Fragmentation Approach to Furan Containing Natural Products”
132. National Organic Symposium, University of Wisconsin, Madison, WI; June 13-17, 1999. Contributed Poster: “A Novel Condensation and Fragmentation Approach to Furan Containing Natural Products”
133. 216th American Chemical Society National Meeting, Boston, MA; August 23-27th, 1998; ORG 657. Contributed Lecture: "Highly Efficient Approaches to Fused Ether Ring Systems”
134. Gordon Research Conference on Natural Products, New England College, Henniker, New Hampshire; July 5-13, 1998. Contributed Poster: "Highly Efficient Approaches to Fused Ether Ring Systems"
135. 14th Annual Rocky Mountain Regional Meeting of the American Chemical Society, Tucson, Arizona; March 15-18, 1998. Invited Lecture: "Iterative Approaches to Fused Ethers," Rainier, J. D.; Allwein, S. P.

## **G. GRANTS AND CONTRACTS (Since 1996)**

### **Federal**

#### **Current**

National Institutes of Health (NIGMS) “Photoelectrocyclizations to Virulence Inhibiting Natural Products” R01 GM132531-01  
04/01/2019-03/31/2023

Foundation for Fighting Blindness “VLC-PUFA Therapeutics for Dry AMD and Dominant Stargardt Disease (STGD3)” co-PI with Professor Paul Bernstein (Moran Eye Center, University of Utah) and Professor John Conboy (University of Utah, Department of Chemistry)

University of Utah Seed Grant  
05/01/20–04/30/21

“The Synthesis and Study of Silvestrol and Analogs as Broad Spectrum Antivirals”

This project aims to generate broad spectrum antivirals based on the natural product silvestrol.

National Institutes of Health (NIAID)  
R01AI139014  
06/14/18–05/31/22

“Discovery of Small Molecules Inhibiting Toll-Like Receptor-Mediated Inflammation” co-PI with Professor H. Haecker (University of Utah, Pathology)

This project aims to find and optimize small molecule anti-inflammatories with a focus on Toll-Like Receptor inhibitors.

#### **Completed**

National Science Foundation (CHE) “Research Experiences for Undergraduates at the University of Utah” co-PI with Professor Janis Louie (University of Utah, Department of Chemistry)  
07/2015-06/2020

National Science Foundation (CHE 1465113) “Acceptor-Acceptor Carbenoids in Selective Insertions and Cyclizations”  
07/15/2015-05/31/2019

National Institutes of Health (5RO1EY022614) “Cone Opsins in Photoreceptor Degeneration” Role: co-PI with Professor Yingbin Fu (Moran Eye Center) 07/01/12-06/30/17

National Institutes of Health (5RO1EY022901) “Mechanisms of Treatment Strategies for Polypoidal Choroidal” Role: co-PI with Professor Yingbin Fu (Moran Eye Center)  
02/01/14-01/31/17

National Science Foundation (CHE 1012670): "Indolines as Precursors to Highly Congested Stereocenters" Jon D. Rainier, PI, 09/01/10 – 08/31/13

National Institutes of Health (GM089158) 08/15/10-05/31/13 Role: co-PI with Professor's Matthew Sigman and Ryan Looper (University of Utah) “Discovery Based Studies of Medicinally Relevant Pharmacophore Libraries”.

National Institutes of Health, General Medical Sciences (GM56677): “Fungicidal and Neurotoxic Marine Natural Products,” Jon D. Rainier, PI, 01/01/98-12/31/12, Amount: \$2,900,000.

National Science Foundation (CHE-9983715): “Condensations Involving Fragmentations and the Incorporation of Inquiry Based Learning into the University Curriculum,” Jon D. Rainier, PI, 01/01/00-12/31/03, Amount: \$372,000.

National Institutes of Health, General Medical Sciences (GM61608): “Condensations and Cyclizations to Bioactive Heterocycles,” Jon D. Rainier, PI, 09/01/01-08/31/05, Amount: \$568,125.

National Science Foundation: “Sulfonium Ylides to Quaternary Substituted Indolines,” Jon D. Rainier, PI (08/01/07-07/31/10)

National Science Foundation (CHE-1012670): Generation of Quaternary Substituted Indolines,” Jon D. Rainier, PI (9/01/10-8/31/13)

## **State and Private Foundations**

### **Current**

Foundation for Fighting Blindness: “The Role of VLC-PUFAs in AMD” with Professors Paul Bernstein and John Conboy June 1, 2018 — May 31, 2021.

### **Completed**

University of Utah Center on Aging Seed Grant with Professor Paul Bernstein \$30,000 “The Role of VLC-PUFAs in AMD”, 2017-2018

University of Utah TCO Seed Grant “Studies into Apopsin” \$30,000

Cephalon, Inc. Jon D. Rainier, co-PI with Professor's Louie and Keck. Amount: \$229,000.

University of Utah, Seed Grant. "Nanoparticles for Ocular Drug Delivery," Role PI, Amount: \$35,000

Petroleum Research Fund, American Chemical Society: "New Catalyst Systems for the Study of Oxygenated Metals from Carbonyl-Olefin Ring-Closing Metathesis Reactions," Jon D. Rainier, PI, 09/01/97-08/31/99, Amount: \$20,000.

American Cancer Society, Institutional Research Grant: "The Total Synthesis of the Antineoplastic Agent Veitamine," Jon D. Rainier, PI, 05/01/97-04/30/98, Amount: \$13,400.

Research Corporation: "An Iterative Strategy to Bioactive Fused Ether Natural Products," Jon D. Rainier, PI, 1998, Amount: \$35,000.

The University of Arizona Foundation: "Amines in Diels-Alder Cycloadditions-Application to the Eleutherobin Core," Jon D. Rainier, PI, 1997, 01/01/98-12/31/98, Amount: \$5,000.

Arizona State University: "Asymmetric Diels-Alder Reactions." Jon D. Rainier, PI, Amount: \$378. Duration: 09/15/98-09/14/99.