

II. Curriculum Vitae

B. Frank Gupton, PhD

Professor and Chair,
Department of Chemical and Life Science Engineering
Virginia Commonwealth University,
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Phone: (804) 828-4799; Email: bfgupton@vcu.edu

(a) Education

Ph.D. (1998) Chemistry, Virginia Commonwealth University
M.S. (1976) Chemistry, Georgia Institute of Technology
B.S. (1973) Chemistry, University of Richmond

(b) Academic and Industrial Appointments

2014 – present **Chair**, Chemical and Life Science Engineering, Virginia Commonwealth University
2008 – 2014 **Interim Chair**, Chemical and Life Science Engineering, Virginia Commonwealth University
2007 – present **Research Professor**, Department of Chemistry and Department of Chemical and Life Science Engineering, Virginia Commonwealth University
2001 – 2007 **Executive Director**, Process Development, Boehringer Ingelheim Pharmaceuticals, Inc.
1993 – 2000 **Director, Process Development**, Boehringer Ingelheim Pharmaceuticals, Inc.
1987– 1993 **Manager**, Product Development, Hoechst-Celanese Corp.
1981– 1986 **Project Leader**, Celanese Corp.
1976 –1980 **Senior Research Associate**, Celanese Corp.

(c) Publications, Patents and Presentations

All completed works are shown below.

[Since 2007]

(c.1) Published/In Press

1. Korwar, S.; Brinkley, K.; Siamaki, AR; Gupton, BF; Ellis, KC. Selective N-chelation-directed C-H Activation Reactions catalyzed by Pd(II) NanoParticles Supported on Multi-Walled Carbon NanoTubes. *Organic Letters* **2015**, 17(7): 1782-5.
2. Brinkley, Kendra W.; Burkholder, Michael; Siamaki, Ali R.; Belecki, Katherine; Gupton, B. Frank. The continuous synthesis and application of graphene supported palladium nanoparticles: a highly effective catalyst for Suzuki-Miyaura cross-coupling reactions. *Green Processing and Synthesis* **2015**, 4(3), 241-246.
3. Martin, Alex D.; Siamaki, Ali R.; Belecki, Katherine; Gupton, B. Frank. A Flow-based Synthesis of Telmisartan. *Journal of Flow Chemistry* **2015**. In press: DOI 10.1556/JFC-D-15-00002.

4. Elazab, Hany A.; Siamaki, Ali R.; Moussa, Sherif; Gupton, B. Frank; El-Shall, M. Samy. Highly Efficient and Magnetically Recyclable Graphene-Supported Pd/Fe₃O₄ Nanoparticle Catalysts for Suzuki and Heck Cross-Coupling Reactions. *Applied Catalysis, A: General* **2015**, 491, 58-69.
5. Martin, Alex D.; Siamaki, Ali R.; Belecki, Katherine; Gupton, B. Frank. A Convergent Approach to the Total Synthesis of Telmisartan via a Suzuki Cross-Coupling Reaction between Two Functionalized Benzimidazoles. *Journal of Organic Chemistry* **2015**, 80(3), 1915-1919.
6. Elazab, Hany A.; Moussa, Sherif; Gupton, B. Frank; El-Shall, M. Samy. Microwave Assisted Synthesis of Pd Nanoparticles Supported on Fe₃O₄, Co₃O₄, and Ni(OH)₂ Nanoplates and Catalysis Application for CO Oxidation. *Journal of Nanoparticle Research* **2014**, 16(7), 1-11.
7. Longstreet, Ashley R.; Campbell, Brian S.; Gupton, B. Frank; McQuade, D. Tyler. Improved Synthesis of Mono- and Disubstituted 2-Halonicotinonitriles from Alkylidene Malononitriles. *Organic Letters* **2013**, 15(20), 5298-5301.
8. Siamaki, Ali R.; Lin, Yi; Woodberry, Kendra; Connell, John W.; Gupton, B. Frank. Palladium Nanoparticles Supported on Carbon Nanotubes from Solventless Preparations: Versatile Catalysts for Ligand-free Suzuki Cross Coupling Reactions. *Journal of Materials Chemistry A: Materials for Energy and Sustainability* **2013**, 1(41), 12909-12918.
9. Longstreet, Ashley R.; Opalka, Suzanne M.; Campbell, Brian S.; McQuade, D. Tyler; Gupton, B. Frank. Investigating the Continuous Synthesis of a Nicotinonitrile Precursor to Nevirapine. *Beilstein Journal of Organic Chemistry* **2013**, 92570-92578.
10. Miller, L. Zane; Steinbacher, Jeremy L.; Houjeiry, Tania I.; Longstreet, Ashley R.; Woodberry, Kendra L.; Gupton, B. Frank; Chen, Banghao; Clark, Ron; McQuade, D. Tyler. Controlled Synthesis of Silica Capsules: Taming the Reactivity of SiCl₄ Using Flow and Chemistry. *Journal of Flow Chemistry* **2012**, 2, 92-102.
11. Moussa, Sherif; Siamaki, Ali R.; Gupton, B. Frank; El-Shall, M. Samy. Pd-Partially Reduced Graphene Oxide Catalysts (Pd/PRGO): Laser Synthesis of Pd Nanoparticles Supported on PRGO Nanosheets for Carbon-Carbon Cross Coupling Reactions. *ACS Catalysis* **2012**, 2(1), 145-154.
12. Siamaki, Ali R.; Khder, Abd El Rahman S.; Abdelsayed, Victor; El-Shall, M. Samy; Gupton, B. Frank. Microwave-assisted Synthesis of Palladium Nanoparticles Supported on Graphene: A Highly Active and Recyclable Catalyst for Carbon-Carbon Cross-Coupling Reactions. *Journal of Catalysis* **2011**, 279(1), 1-11.

Submitted:

1. Journal of Catalysis-CuPD Nano Particles as a Catalyst in Suzuki, Heck, and Sonogashira Cross Coupling Reactions by Facile Oleylamine Synthesis ****CITATION TO BE FORMATTED****
2. Nature—The Origin of Heterogeneous Cross-Coupling Catalysis in Small Palladium Clusters on Reduced Graphene ****CITATION TO BE FORMATTED****

In preparation:

(c.2) Book Chapters

1. Belecki, K; Gupton, B. Frank, *Continuous Processing in Drug Discovery*. Green Chemistry Strategies for Drug Discovery, Royal Society of Chemistry 2015. *In press*.

(c.3) Invited Talks and Conference Presentations

1. Gupton, B. Frank, Streamlining Pharmaceutical Processes, October 2, 2015, University of Richmond, Richmond, VA
2. Gupton, B. Frank, The Medicines for All Initiative, SelectBio Flow Chemistry Congress, September 15, 2015, San Diego, CA
3. Gupton, B. Frank, A New Approach in Pharmaceutical Process Development, September 4, 2015, Virginia Polytechnic Institute and State University, Blacksburg, VA
4. Gupton, B. Frank, The Medicines for All Initiative, CPAC Annual Meeting, March 24, 2015, Rome, Italy
5. Gupton, B. Frank, A New Low Cost Approach for the Production of AIDS Drugs, March 20, 2015, University of Mainz, Mainz, Germany
6. Gupton, B. Frank, Strategic Applications of Heterogeneous Catalysis in Continuous Pharmaceutical Operations, Flow Chemistry Congress (keynote speaker), April 10, 2014, Boston, MA
7. Gupton, B. Frank, Streamlining Pharmaceutical Operations Into Continuous Processes, CPAC Annual Meeting, March 25, 2014, Rome, Italy
8. Gupton, B. Frank, Continuous Process Development for Active Pharmaceutical Ingredients, International Society for Pharmaceutical Engineering Annual Meeting, November 5, 2013, Washington, D.C.
9. Gupton, B. Frank, Continuous Processing in Pharmaceutical Applications (keynote speaker), Frontiers in Organic Synthesis Technology Symposium, October 17, 2013, Budapest, Hungary
10. Gupton, B. Frank, Continuous Pharmaceutical Process Development, Thales Nano, October 16, 2013, Budapest, Hungary
11. Gupton, B. Frank, Catalytic Applications in Continuous Processing, CPAC Annual Meeting, March 25, 2013, Rome, Italy
12. Gupton, B. Frank, Flow Chemistry in Pharmaceutical Operations, Old Dominion University, September 6, 2013, Norfolk, VA
13. Gupton, B. Frank, New Paradigms in Continuous Pharmaceutical Operations, Flow Chemistry Congress, May 15, 2013, Boston, MA
14. Gupton, B. Frank, Heterogeneous Cross-Coupling Catalysis with Novel Carbon Support Systems, DSM Corp., March 29, 2013, Linz, Austria
15. Gupton, B. Frank, Catalytic Applications in Continuous Processing, CPAC Annual Meeting, March

25, 2013, Rome, Italy

16. Gupton, B. Frank, Novel Heterogeneous Palladium Catalysts for Cross-Coupling Catalysis, Boehringer Ingelheim Pharmaceuticals, Inc, December 13, 2012, Ridgefield, CT
17. Gupton, B. Frank, New Manufacturing Paradigms for Active Pharmaceutical Ingredients, FDA Center for Drug Evaluation and Research, December 3, 2012, Silver Springs, MD
18. Gupton, B. Frank, Cross-Coupling Catalysis in Pharmaceutical Applications, GlaxoSmithKline Pharmaceuticals, Inc., July 1, 2012, Research Triangle Park, NC
19. Gupton, B. Frank, Continuous Process for the Production of Telmisartan, Flow Chemistry Congress, April 24, 2012, Boston, MA
20. Gupton, B. Frank, Palladium Cross-Coupling Reactions in Flow, the International Conference on Microreaction Technology, February 22, 2012, Lyon, France.
21. Gupton, B. Frank, Applications of Flow Chemistry in Pharmaceutical Process Development, Jansen Pharmaceuticals, Inc., February 15, 2012 Antwerp, Belgium
22. Gupton, B. Frank, Palladium Catalyzed Cross-Coupling Reactions In Flow, South Eastern Regional Meeting of the American Chemical Society, October 28, 2011, Richmond, VA
23. Gupton, B. Frank, Decentralized Pharmaceutical Manufacturing: A Pathway to Personalized Medicine, 5th International Conference on Green and Sustainable Chemistry, June 23, 2011, Washington, D.C.
24. Gupton, B. Frank (keynote speaker), Suzuki Cross Coupling Reaction with Palladium Multi-Wall Carbon Nano Tubes in Flow, 2nd International Symposium on Continuous Flow Reactor Technology for Industrial Applications, October 5, 2010, Paris, France
25. Gupton, B. Frank, Heterogeneous Cross Coupling Reactions in Flow, 3rd International Symposium on Green Processing in Pharmaceutical and Fine Chemical Industries, October 30, 2010, Boston, MA
26. Gupton, B. Frank, Trends in Chemical Process and Drug Development, National Academy of Science, January 15, 2010, Washington, D.C.
27. Gupton, B. Frank, Multi-functional Pyridines in Pharmaceutical Synthesis, Howard University, March 27, 2009, Washington, D.C.
28. Gupton, B. Frank, "Multi-Functional Pyridines: From Agricultural Products to AIDS Drugs"; Georgia Institute of Technology, April, 2007, Atlanta, GA

(c.4) Patents

1. El-Shall, M. S., V. Abdelsayed, H. M. A. Hassan, A. E. R. S. Khder, K. M. Abouzeld, Q. Dai, P. Afshani, F. Gupton, A. R. Siamaki, Z. A. M. Alothman & H. Z. Alkathlan **2011**. Production of graphene and nanoparticle catalysts supported on graphene using microwave radiation. WO2011119961A2.
2. El-Shall, M. S., V. Abdelsayed, H. M. A. Hassan, A. E. R. S. Khder, K. M. Abouzeld, Q. Dai, P. Afshani, F. Gupton, A. R. Siamaki, Z. A. M. Alothman & H. Z. Alkathlan **2011**. Production of

graphene and nanoparticle catalysts supported on graphene using microwave radiation. WO2011119961A2.

3. Ahmad, S., R. F. Boswell, J. D. Brown, C. M. Davis, K. O. Donsbach, B. F. Gupton, C. P. Johnson, A. Khodabocus, V. R. Kulkarni & Y. S. Lo **2007**. Improved process for preparation of 5,11-dihydro-11-ethyl-5-methyl-8-{2-[(1-oxido-4-quinolinyl)oxy]ethyl}-6H-di pyrido[3,2-b:2',3'-e][1,4]diazepin-6-one used as HIV-RT inhibitor. US20070129542A1.

(c.5) Provisional Patents

1. D.T. McQuade, B.F. Gupton, A.R. Longstreet, & S. M. Opalka **2014**. Continuous Synthesis of a Nicotinonitrile Precursor to Nevirapine. Application Number 61/871496

[Prior to 2007]

Published/In Press:

1. Gupton, B. Frank; Carroll, David L.; Tuhy, Peter M.; Kam, Chih Min; Powers, James C. Reaction of Azapeptides with Chymotrypsin-like Enzymes. New Inhibitors and Active Site Titrants for Chymotrypsin A_a, Subtilisin BPN', Subtilisin Carlsberg, and Human Leukocyte Cathepsin G. *Journal of Biological Chemistry* **1984**, 259(7), 4279-4287.
2. Powers, J. C.; Boone, R.; Carroll, D. L.; Gupton, B. F.; Kam, C. M.; Nishino, N.; Sakamoto, M.; Tuhy, P.M. Reaction of Azapeptides with Human Leukocyte Elastase and Porcine Pancreatic Elastase. New Inhibitors and Active Site Titrants. *The Journal of Biological Chemistry*, **1984**, 259(7), 4288-4294.
3. Powers, J. C.; Yasutake, A.; Nishino, N.; Gupton, B. F.; Kam, C. M. Synthetic Elastase Inhibitors and their Role in the Treatment of Disease. *Pept.: Synth., Struct., Funct., Proc. Am. Pept. Symp.* **1981**, 391-399.
4. Powers, James C.; Gupton, B. Frank; Lively, Mark O.; Norikazu Nishino; Whitley, Ronald J. Synthetic Inhibitors of Granulocyte Elastase and Cathepsin G. *Neutral Proteases Hum. Polymorphonucl. Leukocytes* **1978**, 221-233.
5. Powers, James C.; Gupton, B. Frank; Harley, A. Dale; Nishino, Norikazu; Whitley, Ronald J. Specificity of Porcine Pancreatic Elastase, Human Leukocyte Elastase, and Cathepsin G. Inhibition with Peptide Chloromethyl Ketones. *Biochimica et Biophysica Acta, Enzymology* **1977**, 485(1), 156-166.
6. Powers, James C.; Gupton, B. Frank. Reaction of Serine Proteases with Aza-amino Acid and Aza-peptide Derivatives. *Methods in Enzymology* **1977**, 46, 208-216.
7. Power, J. C.; Gupton, B. F.; Harley, A. D.; Nishino, N.; Witley, R. J. Specificity of Porcine Pancreatic Elastase, Human Leukocyte Elastase and Cathepsin G. Inhibition with Peptide Chloromethyl Ketones. *Biochimica et Biophysica Acta* **1977**, 485(1), 156-166.
8. Powers, J. C.; Gupton, B. F. Reaction of Serine Proteases with Aza-amino Acid and Aza-peptide Derivatives. *Methods in Enzymology* **1977**, 46, 208-216.

Book Chapters:

1. Gupton, B. Frank; Grozinger, Karl, *Pharmaceutical, Large Scale Synthesis*. Kirk –Other Encyclopedia of Chemical Technology, John Wiley & Sons 2005.
2. Gupton, B. Frank; Grozinger K., *Large-Scale Synthesis*, Burgers Medicinal Chemistry and Drug Discovery, John Wiley & Sons 2003.
3. Powers, J.C.; Gupton B.F., *Reaction of Serine Proteases with Aza Amino and Aza Peptide-Derivatives*, Methods in Enzymology, 1977 (46) 208-216.

Patents:

1. Boswell, R. F., B. F. Gupton & Y. S. Lo **2004**. Method for making nevirapine. US20040002603A1.
2. Gupton, B. F. **2002**. Process for preparation of 3-amino-2-chloro-4-methylpyridine. WO2002030901A1.
3. Saukaitis, J. & F. B. Gupton **1998**. Process for preparing pyridine and quinoline derivatives. US5808067A.
4. Saukaitis, J. & F. B. Gupton **1995**. Method for preparing quinolinecarboxylic acids and their derivatives via cyclization of anilinemethylenemalonates, anilino fumarates, and anilino maleates in presence of chlorosulfonic acid and oleum. US5430152A.
5. Elango, V., D. R. Larkin, J. R. Fritch, M. P. Bodman, W. H. Mueller, B. F. Gupton & J. C. Saukaitis **1995**. Process for preparing pyridine and quinoline derivatives by dehydration of N-hydroxyaspartic acid derivatives followed by cyclocondensation with α,β -unsaturated carbonyl compounds. US5405987A.
6. Saukaitis, J. C. & F. B. Gupton **1994**. Method for preparing quinolinecarboxylic acids from the cyclocondensation of aniline derivatives. WO9419312A1.
7. Gupton, B. F. & J. Saukaitis **1993**. Conversion of pyridine-2,3-dicarboxylate diesters to cyclic anhydrides. US5208342A.
8. Elango, V., J. R. Fritch, D. R. Larkin, M. P. Bodman, W. H. Mueller, J. C. Saukaitis & B. F. Gupton **1992**. Process for preparing pyridinecarboxylic acid derivatives. EP511446A2.
9. Larkin, D. R., V. Elango, J. R. Fritch, W. H. Mueller & B. F. Gupton **1991**. Process for preparing pyridinecarboxylic acid derivatives. EP456504A2.
10. Gupton, B. F. & J. H. Rae **1990**. Preparation of sodium diethyl oxalacetate. US4902819A.
11. Gupton, B. F., J. H. Rea, W. H. Mueller & J. Saukaitis **1989**. Process for preparation of pyridinedicarboxylic acid esters as herbicide intermediates. WO8908103A1.
12. Gupton, F. & H. E. Ulmer **1986**. Treatment of waste stream from pentaerythritol manufacture. US4612389A.
13. Gupton, B. F. & E. D. Little **1985**. 2,6-Diisopropyl naphthalene dihydroperoxide. US4503262A.
14. Gupton, B. F. & H. E. Ulmer **1981**. Byproduct recovery from a pentaerythritol waste stream. US4277620A.

(d) Sponsorships of Scholarly Activities

<i>No.</i>	<i>Proposal Title</i>	<i>Organization</i>	<i>Amount Awarded</i>	<i>Dates</i>	<i>PI/co-PI</i>
1.	High Throughput Continuous Synthesis of Strategic Anti-HIV Drug Substances	VCU Presidential Research Incentive Program Award	\$40,000	Jan. 2010- Dec. 2010	Gupton
2.	Third Generation Nevirapine Process	Clinton Health Access Initiative	\$62,500	May 2012 – March 2013	Gupton
3.	Development of Reaction Conditions for Conversion of Artemisinic Acid to Dihydroartemisinic Acid	Clinton Health Access Initiative	\$24,000	May,2013 – Oct. 2014	Gupton
4.	Development of Asymmetric Heterogeneous Hydrogenation Catalysts	Boehringer Ingelheim Pharmaceuticals, Inc.	\$50,000	June 2013 - Aug. 2014	Gupton
5.	Collaborative Research Planning Grant: I/UCRC Center for Rational Catalyst Synthesis	National Science Foundation	\$11,500	April 2014 – Feb. 2015	Gupton
6.	Medicines For All Initiative	Bill & Melinda Gates Foundation	\$4,390,944 (\$1,172,700 to PI)	June 2014 - Nov. 2015	Gupton (PI), McQuade, Marquardt & Jamison (co-PI's)
7.	Heterogeneous Oxidation Catalysis in Continuous Flow	GlaxoSmithKline Pharmaceuticals, Inc.	\$250,000	July 2014 – June 2016	Gupton
8.	Center for Rational Catalyst Synthesis	National Science Foundation	\$325,000	March 2015 – Feb. 2020	Gupton
9.	Medicines for	Bill & Melinda	\$4,999,54	June 2015 – Nov. 2016	Gupton (PI),

	All Initiative	Gates Foundation	2 (\$1,486,780 to PI)		McQuade, Marquardt & Jamison (co-PIs)
10.	Planning for Medicines For All Institute	Bill & Melinda Gates Foundation	\$75,000	Oct. 2015—April 2016	Gupton
11.	Three Wave Mixing Technique for Chiral Analysis in Continuous Process Manufacturing	Virginia Biosciences Health Research Corporation: The Catalyst	\$400,000	September 2015—September 2017	Gupton, Pate (co-PIs)

(e) List of all Graduate Advisees

Former Graduate Students and Postdocs

<i>Name</i>	<i>Degree</i>	<i>Compl. Year</i>	<i>Current Position</i>	<i>Thesis/Dissertation or Research Area</i>
Hany Elazab	PhD	2013	Assistant Professor, British University Egypt	Graphene-Supported Metal Nanoparticles for Applications in Heterogeneous Catalysis
Ali Siamaki	PhD	2014	Assistant Professor, Fayetteville State University	Heterogeneous Cross-Coupling Catalysis
Stevara Clinton	MS	2015	Science Specialist, Richmond Public Schools	Continuous Synthesis of Quinolone Antibiotics
Alex Martin	PhD	2015	Assistant Professor, Nazareth College	Continuous Process for Telmisartan
Srividya Sharvankumar	MS	2015	Process Engineer, Amgen	Continuous Catalytic Oxidations
Kendra Woodberry	PhD	2015	Consultant	Nanoparticles for Catalysis

Current Graduate Students and Postdocs

<i>Name</i>	<i>Degree Sought</i>	<i>Research area</i>	<i>Year Started</i>
Carlos Castao Londono	Postdoc	Nanoparticles for Catalysis	2015

Drew Ehle	Postdoc	Medicines for All	2015
Stan Gilliland	Postdoc	Heterogeneous Catalysis	2015
Daniel Rivalti	Postdoc	Medicines for All	2015
Perrer Tosso	Postdoc	Medicines for All	2015
Jenson Verghese	Postdoc	Medicines for All	2014
Michael Burkholder	PhD	Nanoparticles for Catalysis	2015
Caleb Kong	PhD	Medicines for All	2015
Swara Fadnis	PhD	Medicines for All	2015
Dan Fisher	PhD	Heterogeneous Asymmetric Catalytic Hydrogenation	2011
Yuan Yang	PhD	Heterogeneous Cross-Coupling Catalysis	2015
Eric Yu	PhD	Medicines for All	2015

(f) Committee Memberships

- 2012 Search Committee for Dean of School of Engineering
2010-2012 VCU University Council
2010-2011 Search Committee for Dean of Humanities and Sciences
2010-2011 Search Committee for Director of the Institutes for Molecular Biology and Drug Discovery
2001 Nanotechnology Advisory Committee to the Virginia General Assembly

(g) Membership in Professional Organizations

1. Member: American Chemical Society, Organic Division
2. Member: Flow Chemistry Society
3. Member: American Institute of Chemical Engineers

(h) Special Awards, Fellowships and Other Honors

1. Lifetime Achievement Award, Richmond Joint Engineers Council (2015)
2. American Chemical Society Award for Industrial Innovation (2001)
3. Hoechst Schultheis Fellow (1991)
4. Merle E. Kise Award for Excellence in Industrial Research (1989,1990)

Teaching Material

Courses Taught

Fall 2008: Chemical Process Development and Senior Design Studio

Spring 2009: Senior Design Studio

Fall 2009: Chemical Process Development and Senior Design Studio

Spring 2010: Senior Design Studio and Advanced Organic Synthesis

Fall 2010: Chemical Process Development and Senior Design Studio

Spring 2011: Senior Design Studio

Fall 2011: Chemical Process Development and Senior Design Studio

Spring 2012: Senior Design Studio and Advanced Organic Synthesis

Fall 2012: Chemical Process Development and Senior Design Studio

Spring 2013: Senior Design Studio

Fall 2013: Chemical Process Development and Senior Design Studio

Spring 2014: Advanced Chemical Reaction Engineering, Advanced Organic Synthesis, Chemical Process Development, and Senior Design Studio

Fall 2014: Chemical Process Development and Senior Design Studio

Spring 2015: Pharmaceutical Engineering and Senior Design Studio

Fall 2015: Senior Design Studio

Spring 2016: Pharmaceutical Engineering and Senior Design Studio