

# Shu Yu

Process Research and Development  
Pfizer Worldwide R&D-Groton  
Groton, CT

## Education

08/1993-08/1997 Ph.D., Organic Chemistry, Clemson University, Clemson, SC.  
08/1981-07/1985 B.S., Chemistry, Peking University, Beijing, China.

## Experience

2006-present Associate research Fellow, Pfizer WRD-Groton, Groton, CT  
2000-2005 Senior Principle Scientist, Pfizer Global R&D-La Jolla Laboratories, San Diego, CA  
1997-1999 Postdoctoral Research Associate, University of Wisconsin-Milwaukee, Milwaukee, WI  
Research advisor: Dr. James M. Cook.  
1986-1992 Beijing Institute of Non-ferrous Metals, Beijing, China

## Awards and Honors

- Heroes of Chemistry Award-American Chemical Society, 2018
- Upjohn Award, 2015
- Green Chemistry Award, 2012
- Green Chemistry Award, 2006
- Pfizer Achievement Award, Pfizer, 2002.
- Scientific Achievement Award for Outstanding Research, International Cannabinoid Research Society, 1997.

## Publications and Patents

1. Li, Chengxi; Wan, Feng; Chen, Yuan; Peng, Henian; Tang, Wenjun; **Yu, Shu**; McWilliams, J. Christopher; Mustakis, Jason; Samp, Lacey; Maguire, Robert J. "Stereo-electronic Effects in Ligand Design: Enantioselective Rhodium-Catalyzed Hydrogenation of Aliphatic Cyclic Tetrasubstituted Enamides and Concise Synthesis of (R)-Tofacitinib", *Angew. Chem., Int. Ed.* **2019**, 58(38), 13573-13583.
2. Akin, Anne; Barilla, Mark T.; Brandt, Thomas A.; Brennan, John; Henegar, Kevin E.; Hoagland, Steve; Kumar, Rajesh; Magano, Javier; McInturff, Emma L.; Nematalla, Asaad; "Overcoming the Challenges of Making a Single Enantiomer N-1 Substituted Tetrazole Prodrug Using a Tin-Mediated Alkylation and Enzymatic Resolution" *Org. Process Res. Dev.* **2019**, 23(6), 1167-1177.
3. Li, Bryan; Li, Ruizhi; Dorff, Peter; McWilliams, J. Christopher; Guinn, Robert M.; Guinness, Steven M.; Han, Lu; Wang, Ke; Yu, Shu "Deprotection of N-Boc Groups under Continuous-Flow High-Temperature Conditions" *J. Org. Chem.* **2019**, 84(8), 4846-4855.
4. Burns, Michael; Martinez, Carlos A.; Vanderplas, Brian; Wisdom, Richard; **Yu, Shu**; Singer, Robert A. A "Chemoenzymatic Route to Chiral Intermediates Used in the Multikilogram Synthesis of a Gamma Secretase Inhibitor" *Org. Process Res. Dev.* **2017**, 21(6), 871-877.
5. **Yu, Shu**; Dirat, Olivier "Early and late stage process development for the manufacture of dacomitinib" *ACS Symposium Series* **2016**, 1239 (*Comprehensive Accounts of Pharmaceutical Research and Development: From Discovery to Late-Stage Process Development, Volume 1*), 235-252
6. Chekal, Brian; Damon, David; LaFrance, Danny; Leeman, Kyle; Mojica, Carlos; Palm, Andrew; St. Pierre, Michael; Sieser, Janice; Sutherland, Karen; Vaidyanathan, Rajappa; Van Alsten, John; Vanderplas, Brian; Wager, Carrie; Weisenburger, Gerald; Withbroe, Gregory; Yu, Shu "Development of the Commercial Route for the Manufacture of a 5-Lipoxygenase Inhibitor PF-04191834", *Org. Process Res. Dev.* **2015**, 19(12), 1944-1953.
7. Cai, Weiling; Chekal, Brian; Damon, David; LaFrance, Danny; Leeman, Kyle; Mojica, Carlos; Palm, Andrew; St. Pierre, Michael; Sieser, Janice; Sutherland, Karen; Vaidyanathan, Rajappa; Van Alsten, John; Vanderplas, Brian; Wager, Carrie; Weisenburger, Gerald; Withbroe, Greg; Yu, Shu "Development of Migita coupling for the manufacture of a 5-lipoxygenase inhibitor" in *Transition Metal - Catalyzed Couplings in Process Chemistry-Case Studies from the Pharmaceutical Industry* (ISBN:9783527332793) Magano, Javier; Dunetz, Joshua R. Ed. Wiley, New York, 2013.

8. Ruggeri, Sally Gut; Caron, Stephane; Dube, Pascal; Ide, Nathan D.; Price, Kristin E.; Ragan, John A.; Yu, Shu "Reductions" in *Practical Synthetic Organic Chemistry: Reactions, Principles, and Techniques* (ISBN: 9780470037331 ) Stephane Caron Ed. Wiley, New York, 2011.
9. Flahive, Erik J.; Ewanicki, Brigitte L.; Sach, Neal W.; O'Neill-Slawecki, Stacy A.; Stankovic, Nebojsa S.; Yu, Shu; Guinness, Steven M.; Dunn, Jonathan "Development of an Effective Palladium Removal Process for VEGF Oncology Candidate AG13736 and a Simple, Efficient Screening Technique for Scavenger Reagent Identification" *Org. Process Res. Dev.* **2008**, *12*(4), 637-645.
10. Flahive, Erik; Ewanicki, Brigitte; Yu, Shu; Higginson, Paul D.; Sach, Neal W.; Morao, Inaki "A high-throughput methodology for screening solution-based chelating agents for efficient palladium removal" *QSAR Comb. Sci.* **2007**, *26*(5), 679-685.
11. Saenz, James; Mitchell, Mark; Bahmanyar, Sami; Stankovic, Nebojsa; Perry, Michael; Craig-Woods, Bridgette; Kline, Billie; Yu, Shu; Albizati, Kim "Process Development and Scale-up of AG035029" *Org. Process Res. Dev.* **2007**, *11*(1), 30-38.
12. Babu, Srinivasan; Dagnino, Raymond, Jr.; Haddach, Aubrey; Mitchell, Mark Bryan; Ouellette, Michael Allen; Saenz, James Edward; Srirangam, Jayaram Katsuri; Yu, Shu; Zook, Scott Edward "Process for preparation of indazoles" PCT Int. Appl. (2006), WO 2006048761 A2 20060511.
13. Bahmanyar, Sogole; Borer, Bennett C.; Kim, Young Mi; Kurtz, David M.; Yu, Shu. "Proximity Effects in the Palladium-Catalyzed Substitution of Aryl Fluorides." *Org. Lett.* **2005**, *7*(6), 1011-1014.
14. Srirangam, Jayaram K.; Guo, Ming; Yu, Shu; Grubbs, Alan W.; Saenz, James; Bender, Steven L.; Deal, Judith G.; Lee, Kuenshan S.; Liou, Jason; Szendroi, Robert; Faust, James; Albizati, Kim. "Process development for the MMP inhibitor AG3433." ACS Symposium Series (2004), 870 (Chemical Process Research), 111-123.
15. Huffman, John W.; Miller, John R. A.; Liddle, John; Yu, Shu; Thomas, Brian F.; Wiley, Jenny L.; Martin, Billy R. "Structure-activity relationships for 1',1'-dimethylalkyl- $\Delta^8$ -tetrahydrocannabinols." *Bioorg. Med. Chem.* **2003**, *11*, 1397-1410.
16. Kim, Young Mi; Yu, Shu "Palladium (0) catalyzed amination, Stille coupling and Suzuki coupling of electron deficient aryl fluorides." *J. Am. Chem. Soc.* **2003**, *125*, 1696-1697.
17. Wiley, Jenny L.; Jefferson, Renee G.; Griffin, Graeme; Liddle, John; Yu, Shu; Huffman, John W.; Martin, Billy R. "Paradoxical Pharmacological Effects of Deoxy-Tetrahydrocannabinol Analogs Lacking High CB1 Receptor Affinity." *Pharmacology* **2002**, *66*, 89-99.
18. Yu, Shu; Saenz, James; Srirangam, Jayaram K. "Facile Synthesis of N-Aryl Pyrroles via Cu(II) Mediated Cross Coupling of Electron Deficient Pyrroles and Arylboronic Acids." *J. Org. Chem.* **2002**, *67*, 1699.
19. Ma, Chunrong; Liu, Xiaoxiang; Li, Xiaoyan; Flippen- Anderson, Judith; Yu, Shu; Cook, James M. "Efficient Asymmetric Synthesis of Biologically Important Tryptophan Analogues via a Palladium Heteroannulation Reaction." *J. Org. Chem.* **2001**, *66*, 4525-4542.
20. Yu, Shu; Berner, Otto Mathias; Cook, James M. "General Approach for the Synthesis of Indole Alkaloids via the Asymmetric Pictet-Spengler Reaction: First Enantiospecific Total Synthesis of (-)-Corynantheidine as Well as the Enantiospecific Total Synthesis of (-)-Corynantheidol, (-)-Geissoschizol, and (+)-Geissoschizine." *J. Am. Chem. Soc.* **2000**, *122*, 7827-7828.
21. He, Xiaohui; Huang, Qi; Ma, Chunrong; Yu, Shu; McKernan, Ruth; Cook, James M. "Pharmacophore/receptor models for GABAA/BzR  $\alpha 2\beta 3\gamma 2$ ,  $\alpha 3\beta 3\gamma 2$  and  $\alpha 4\beta 3\gamma 2$  recombinant subtypes. Included volume analysis and comparison to  $\alpha 1\beta 3\gamma 2$ ,  $\alpha 5\beta 3\gamma 2$  and  $\alpha 6\beta 3\gamma 2$  subtypes." *Drug Des. Discovery* **2000**, *17*, 131-171.
22. Ma, Chunrong; Yu, Shu; He, Xiaohui; Liu, Xiaoxiang; Cook, James M. "Efficient asymmetric synthesis of important tryptophan analogs for biological research via the Schollkopf chiral auxiliary." *Tetrahedron Lett.* **2000**, *41*, 2781-2785.
23. Huang, Qi; He, Xiaohui; Ma, Chunrong; Liu, Ruiyan; Yu, Shu; Dayer, Charlotte A.; Wenger, Galen R.; McKernan, Ruth; Cook, James M. "Pharmacophore/receptor models for GABAA/BzR subtypes ( $\alpha 1\beta 3\gamma 2$ ,  $\alpha 5\beta 3\gamma 2$ , and  $\alpha 6\beta 3\gamma 2$ ) via a comprehensive ligand-mapping approach" *J. Med. Chem.* **2000**, *43*, 71-95.
24. Huffman, John W.; Liddle, John; Yu, Shu; Aung, Mie Mie; Abood, Mary E.; Wiley, Jenny L.; Martin, Billy R. "3-(1',1'-Dimethylbutyl)-1-deoxy- $\Delta^8$ -THC and related compounds: synthesis of selective ligands for the CB2 receptor." *Bioorg. Med. Chem.* **1999**, *7*, 2905-2914.
25. He, Xiaohui; Huang, Qi; Yu, Shu; Ma, Chunrong; McKernan, Ruth; Cook, James M. "Studies of molecular pharmacophore/receptor models for GABA<sub>A</sub>/BzR subtypes: binding affinities of symmetrically substituted pyrazolo[4,3-c]quinolin-3-ones at recombinant  $\alpha x\beta 3\gamma 2$  subtypes and quantitative structure-

- activity relationship studies via a comparative molecular field analysis.” *Drug Des. Discovery* **1999**, *16*, 77-91.
26. Yu, Shu; He, Xiaohui; Ma, Chunrong; McKernan, Ruth; Cook, James M. “Studies in search of  $\alpha 2$  selective ligands for GABA<sub>A</sub>/BzR receptor subtypes. Part I. Evidence for the conservation of pharmacophoric descriptors for DS subtypes.” *Med. Chem. Res.* **1999**, *9*, 186-202.
  27. Yu, Shu; Ma, Chunrong; He, Xiaohui; McKernan, Ruth; Cook, James M. “Studies in the search for  $\alpha 5$  subtype selective agonists for GABA<sub>A</sub>/BzR sites.” *Med. Chem. Res.* **1999**, *9*, 71-88.
  28. Ma, Chunrong; He, Xiaohui; Liu, Xiaoxiang; Yu, Shu; Zhao, Shuo; Cook, James M. “Effect of the leaving group on the alkylation diastereoselectivity of the Schollkopf chiral auxiliary.” *Tetrahedron Lett.* **1999**, *40*, 2917-2918.
  29. Ma, Chunrong; Liu, Xiaoxiang; Yu, Shu; Zhao, Shuo; Cook, James M. “Concise synthesis of optically active ring-A substituted tryptophans.” *Tetrahedron Lett.* **1999**, *40*, 657-660.
  30. Huffman, John W.; Liddle, John; Duncan, Sammy G. Jr.; Yu, Shu; Martin, Billy R.; Wiley, Jenny L. “Synthesis and Pharmacology of the Isomeric Methylheptyl- $\Delta^8$ -tetrahydrocannabinols.” *Bioorg. Med. Chem.* **1998**, *6*, 2383-2396.
  31. Huffman, John W.; Yu, Shu. “Synthesis of a tetracyclic, conformationally constrained analog of  $\Delta^8$ -THC.” *Bioorg. Med. Chem.* **1998**, *6*, 2281-2288.
  32. Griffin, Graeme; Fernando, Susanthi R.; Ross, Ruth A.; McKay, Neil G.; Ashford, Michael L. J.; Shire, David; Huffman, John W.; Yu, Shu; Lainton, Julia A. H. Pertwee, Roger G. “Evidence for the Presence of CB2-like Cannabinoid Receptors on Peripheral Nerve Terminals.” *Eur. J. Pharmacol.* **1997**, *339*, 53-61.
  33. Huffman, John W.; Lainton, Julia A. H.; Banner, W. Kenneth; Duncan, Sammy G., Jr.; Jordan, Robert D.; Yu, Shu; Dai, Dong; Martin, Billy R.; Wiley, Jenny L.; Compton, David R. “Side chain methyl analogs of  $\Delta^8$ -THC.” *Tetrahedron* **1997**, *53*, 1557-1576.
  34. Huffman, John W.; Yu, Shu; Showalter, Vincent; Abood, Mary E.; Wiley, Jenny L.; Compton, David R.; Martin, Billy R.; Bramblett, R. Daniel; Reggio, Patricia H. “Synthesis and Pharmacology of a Very Potent Cannabinoid Lacking a Phenolic Hydroxyl with High Affinity for the CB2 Receptor.” *J. Med. Chem.* **1996**, *39*, 3875-3877.
  35. Yu, Shu “Investigation of Cu-Ag-Sn-P Quaternary Systems for Low Melting Brazing Filler Alloys.” *Proceedings of 6<sup>th</sup> National Chinese Welding Society Meeting*, **1990**, *1*, 168-173.
  36. Sun, Shusheng; Yu, Shu “Separation and concentration of palladium and gold.” *Beijing Daxue Xuebao, Ziran Kexueban* **1987**, *6*, 67-71.