APURBA BHATTACHARYA
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EDUCATION

Ph.D. Organic Chemistry, University of Texas at Austin: 1982
M.S. Chemistry, I. I. T.. Kanpur, India: 1976
B.S. Chemistry, Calcutta University, India: 1974

EMPLOYMENT

2008-Present	Associate Professor, Texas A&M Kingsville
2007- 2008	Senior Vice President. Dr. Reddy's Laboratories, India.
2006-2007	Vice President, Head of Global Research & Development; Dr. Reddy's Laboratories, India.
2004-2006	Tenured, Associate Professor
1999-2004	Assistant Professor, Texas A&M University, Kingsville.
1997-1999	Group Leader, Bristol Myers Squibb, Central Process Research
1995-1997	Lead Chemist; Innovator Group, Hoechst.
1994-1995	Staff Chemist, Hoechst-Celanese.
1990-1994	Senior Research Chemist, Hoechst-Celanese.
1988-1990	Research Fellow, Process Research and Development, Merck & Co., Inc.
1983-1988	Senior Research Chemist, Process Research and Development, Merck & Co., Inc.

CONSULTANT:

A. Advisory Board for the Clinton Foundation HIV/AIDS Initiative (CHAI)

B. Member of the National Academies' Chemical Sciences Roundtable (CSR). This is a committee of advisors that reports its recommendation of the directions of US Science to the US Congress and the President.

C. Member of the U.S. National Academies Committee on Promoting Safe and secure chemical Management in Developing countries. At the request of the US Department of State, the committee will provide guidance on a baseline of practices.to promote safety and security in the chemical industry in the developing nations.

D. American Chemical Society Green Chemistry Institute (ACS GCI) Pharmaceutical Roundtable. The mission of the roundtable is to catalyze the implementation of Green Chemistry and Green Engineering in the pharmaceutical Development.

E. Resident Consultant

1. Daiichi Sankyo Ranbaxy Laboratories.

2. Dr Reddy's Laboratories. Hyderabad, India.

F. Editorial Board: Open Journal of Medicinal Chemistry [http://www.scirp.org/journal/ojmc/]

G. Editorial Board: Modern Research in Catalyst (MRC) [www.scirp.org/journal/MRC]

H. Editorial Board: Open Journal of Synthesis Theory and Applications [http://www.scirp.org/journal/ojsta/]

I. Editorial Board: Infinity Press: Communications in Applied Sciences [http://infinitypress.info/index.php/cas/pages/view/Editorial]

J. Member: ***Panel of Drug Evaluators for Current Drugs*** **(CD).** Responsible for the evaluation of drugs, which are being launched worldwide under FDA guidelines.

K. Honorary Visiting Professor at Institute of Life Sciences (ILS) Hyderabad, India.

L. Bill & Melinda Gates Foundation

M. Scientific Process Advisor:

3. PHARM-ECO A Johnson Matthey Company
4. Texas Bio Technology.
5. Bristol Myers Squibb Pharmaceutical Co.
6. Boehringer-Ingelheim Pharmaceutical.
7. Johnson & Johnson Pharmaceutical Research & Development.
8. Ambion.
9. National Advisory Committee, Osmania University, India.
10. Bill & Melinda Gates Foundation.
11. "Pharmaceutical Expert witness" in the areas of "Drug Development"

N. Consultant:

1. Senator Kay Bailey Hutchison's List of Designated Expert in Environmental Chemistry .
2. Corpus Christi Regional Economic Development Corporation

O. Advisory Board Member: Chembiotek, India.

P. Advisor: NIH: SSS-L study section, SBIR/STTR applications in Drug Discovery, Development and Delivery.

Q. Advisor: NIH Panel "Preclinical Drug Development for the Division of Preclinical Innovation (DPI), National Center for Advancing Translational Sciences (NCATS)"

R. Director, NIH Texas Bridges to Doctorate Program.

ACADEMIC EXPERIENCE

Graduate Research Assistant, (1977-1982), Professor James K. Whitesell. Department of Chemistry, University of Texas at Austin. Asymmetric induction in carbon-carbon bond forming reaction was studied. Very high asymmetric induction (92-99%) were achieved in the nucleophilic addition of chiral glyoxylate and pyruvate esters as well as concerted "-ene" and cycloaddition reactions. Kinetic resolutions of simple olefins were accomplished via asymmetric "-ene" reactions. Intramolecular Diels-Alder reactions were exploited for asymmetric synthesis of a natural product, antibiotic **"X-14547A"**

Teaching Assistant Undergraduate organic chemistry laboratory.

INDUSTRIAL EXPERIENCE

Senior Vice President, Global Head of Research & Development; Active Pharmaceutical Ingredient (A.P.I.) Dr. Reddy's Laboratories:

Responsibilities:

The responsibilities as the Sr. Vice President in the world-wide Active Pharmaceutical Ingredient (API) Business in Dr Reddy's Laboratories R&D function across Asia, Europe and USA include the following:

- Provide leadership and strategic direction for the global R&D (consisting of more than 700 Ph.D. Chemists and Engineers) and serve on senior R&D staff that is responsible for ensuring effective and innovative product development.
- Direct the activities of multiple project team leaders, pilot pharmaceutical production and chemistry/pharmaceutical services throughout the API and Generics product organization.
- Demonstrate a wealth of scientific, business and cGMP experience in pharmaceutical process development.
- Work in a strongly collaborative and collegial fashion with peers in engineering, formulation and preclinical/pharmacology disciplines to develop novel products involving the release of therapeutic products such as biologics, drugs and other agents.
- Actively participate in the preparation and analysis of the company's strategic direction, tactical operating plans and new portfolio plan for product development.
- Play a key role in managing the intellectual property output of the R&D group and serve on the world-wide patent portfolio management committee.
- Drive projects to ensure the achievement of product development timelines, which are consistent with corporate objectives, ensuring the highest quality control and output standards.
- Establish and maintain an adequate organizational structure and resources to ensure devices are designed and produced in compliance with applicable federal and international regulations/standards.

- Act as a technical advisor/consultant to senior management as well as multi-disciplinary project teams and other functional areas interfacing with key marketing/sales personnel as well as interfacing with physician customers and business development.
- Team building including hiring of people, their development and motivation from business perspectives while meeting forecasted costs and deliverables maintaining competitive advantage worldwide with cutting edge technology.

Merck.

Discovered and developed novel silicon mediated quinone oxidation of aza-steroids successfully implemented for the production of Finasteride (**PROSCAR™ / PROPECIA™)** and other benign prostatic hypertrophy (BPH)-candidates.

Process Research and Development designing novel, practical and cost-effective synthesis of drug candidates from bench scale to commercialization.
Introduced efficient chiral phase-transfer technology to prepare either enantiomer of the drug candidate **L-644, 711**.

Hoechst.

Devised and devoloped a unique **amphoteric copolymer** derived from vinylpyridine and acetoxystyrene.

Discovered and developed a waste-free synthesis of chiral **ibuprofen** via unprecedented diastereoreversal.

Discovered and developed a synthesis of **D-p-hydroxyphenylglycine** via a novel crystallization induced asymmetric transformation.

Identified and developed a new synthesis of **2-alkyl indanones**.

Devised and developed a synthesis of **cromolyn sodium™**

Identified and developed a novel synthesis **of 4-quinazolinones as pharmaceutical intermediates**.

Involved in the development from bench scale to commercialization of a 20-step synthesis of Gd/Lu Texaphyrin, agent **for MRI imaging, photosensitizer and photodynamic therapy of cancer**.

ACADEMIC EXPERIENCE

Texas A&M Kingsville.

Developed one of the most successful and unique **MS programs in Chemistry, based on Industry-University Collaboration in USA.**

Developed a novel surfactant mediated waste-free "**Green Technology**"

Developed a "Green" economic one-step synthesis of **Acetaminophen™ (Tylenol®).**

HONORS AND AWARDS:

- Robert A. Welch Fellowship (1980-1983).
- Phi Kappa Phi Fellowship for academic excellence (1982-1983).
- Outstanding teaching assistant award (1980).
- National Scholarship (India) (1969-1974).
- Merck Speakers Program Award 1989-1990.
- MSDRL Selected Publications, Centennial Year Edition Award (1988-1989).
- Member: American Chemical Society (1983-present).
- Speaker: American Chemical Society Presidential Anniversary Symposium. August. 2004.
- UTMB Galveston Research Award (2003)
- Featured in the American Chemical Society PRF (ACS PRF) Brochure 2006.
- Annual Faculty Lecture Award

Featured in several newspaper articles:

Dr Reddy's woos talent (**Economic Times, National Ed. April 16, 2007**)
R&D: Story of Return & Discover (***dna.SUNDAY*, Mumbai, February 11, 2007**)
Green Chemistry for more efficient drugs (**The *Hitavada, January 20, 2007***).
Calling on India (***Mumbai Mirror, The Sunday Read, June 25, 2006***)
API Manufacturing: Production Process Increase Productivity (***Pharm-Tech October 4, 2004***)
Bridges program offers students road to success (***Corpus Christi Caller-Times* July 6, 2004**)
Professor to speak at annual symposium (***Corpus Christi Caller-Times June 15, 2004***).
A&M Kingsville paves way to PhD's (***Corpus Christi Caller-Times September 6, 2003***)
Professor simplifies Tylenol production (***Corpus Christi Caller-Times October 14, 2002***)

A&M Professor's Goal: more life-saving Drugs ***(Austin American Statesman, November 26, 1999***)
Professor hopes to inspire Texas students (***Houston Chronicle November 14, 1999***)

Renowned chemist sharing his vision (***Corpus Christi Caller-Times November 1, 1999***)

Chemist who invented baldness drug joins A&M Kingsville (***Fort Worth Star Telegram November 26, 1999***)
Partnership with Drug Industry (***Corpus Christi Caller-Times August 1, 2001***)

Process chemistry collaboration (***Chemical & Engineering News July 23, 2001***)

Spark of learning: (***Corpus Christi Caller-Times Editorial August 6, 2001***).

PROFESSIONAL ACTIVITIES

- American Chemical Society
- Merck and Hoechst ambassador in University of Texas at Austin , Houston and Texas A & M University.
- Who's Who in Sciences Higher Education (WWSHE).

- **PANEL DISCUSSIONS.**

- Moderator. Panel discussions in the pharmaceutical section of the "Green Chemistry Workshop" (July 20-25, 2002) at the University of Oregon.
- Moderator. Panel discussion in *Career Development programs at Texas A&M* October 1, 2001 on pharmaceutical process R&D.
- Research Incentive Committee, TAMUK.
- Arts and Sciences Tenure Committee, TAMUK.
- Advisor: NIH Panel "Preclinical Drug Development for the Division of Preclinical Innovation (DPI), National Center for Advancing Translational Sciences (NCATS)"

PUBLICATIONS / PATENTS / PRESENTATIONS

I. Book Chapter

1. "Methyl Glyoxylate" Book Chapter, *Encyclopedia of Reagents for Organic Synthesis (EROS),* Bhattacharya, A., Edited by **Leo A. Paquette,** John Wiley & Sons, **1994**.
2. "Phenmenthyl Glyoxylate" Book Chapter, *Encyclopedia of Reagents for Organic Synthesis (EROS),* Bhattacharya, A. Edited by **Leo A. Paquette,** John Wiley & Sons, **1994**.
3. "Green Technologies in the Generic Pharmaceutical Industry" *Green Chemistry in the Pharmaceutical Industry*. Edited by Peter J. Dunn, Andrew S. Wells, and Michael T. Williams. WILEY-VCH. **2010**.

4. “Promoting Chemical Safety and Security in Developing Countries” National Research Council of the National Academies. [www.nap.edu/catalog.php?record_id=12857]. The National Academic Press. Washington, D.C.**2010**.
5. “Chemical Laboratory Safety and Security A Guide to Prudent Chemical Management” National Research Council of the National Academies. [http://dels.nas.edu/global/bcst/Chemical-Management]. The National Academic Press. Washington, D.C.**2010**.
6. “Green Chemistry in Drug Development” pp 25-40. *Scalable Green Chemistry. Case Studies from Pharmaceutical Industry*” Edited by Stefan G. Koenig. Pan Stanford Publishing, **2013**.
7. “Improved Greener Process for Pioglitazone and its Pharmaceutically Acceptable Salts.” pp 141-154. *Scalable Green Chemistry. Case Studies from Pharmaceutical Industry*” Edited by Stefan G. Koenig. Pan Stanford Publishing, **2013**.

II Peer Reviewed Published Manuscripts

8. "Asymmetric Induction, Nucleophilic Addition to a Chiral Glyoxylate Ester", Whitesell, J. K.; Bhattacharya, A. ; and Henke, K., *J. Chem. Soc. Chem. Commun.,* 988-89 (**1982**).
9. "Asymmetric Induction. Ene Reactions of a Chiral Glyoxylate Ester", Whitesell, J. K.; Bhattacharya, A.; Aguilar, D. A.; and Henke, K., *J. Chem. Soc. Chem. Commun.*, 17, 989-90 (**1982**)
10. "A Glimpse Towards Asymmetric Induction", Bhattacharya, A., *Diss. Abstr. Int.* B, 43 (12, pt. 1), 3980 (**1983**)
11. "Asymmetric Induction. Reduction, Nucleophilic Addition to and Ene Reaction of Chiral Alpha-Keto Esters", Whitesell, J. K.; Bhattacharya, A.; and Deyo, D., *J Chem. Soc. Chem. Commun.,* 15, 802 (**1983**)
12. "Efficient Catalytic Asymmetric Alkylations. 2. Chiral Robinson Annulations via Phase-Transfer Catalysis", Bhattacharya, A.; Dolling, U.-H.; Grabowski, E. J. J.; Karady.; Ryan, K. M.; Weinstock, L. M., *Angew. Chem.*, 98, 442-443 (**1986**)
13. "Asymmetric Induction in the Ene Reaction of a Glyoxylate Ester of S-Phenyl Menthol", Whitesell, J. K.; Bhattacharya, A.; Chen, H. H.; Deyo, D.; James, D.; and Liu, C. L., *Tetrahedron*, 42 (11), 2993-3001 (**1986**).
14. "Efficient Asymmetric Alkylations via Chiral Phase-Transfer Catalysis: Applications and Mechanism", Dolling, U.-H.; Hughes, D. L.; Bhattacharya, A.; Ryan, K. M.; Karady, S.; Weinstock, L. M.; and Grabowski, E. J. J., In: Starks, C. M., Editor, "Phase Transfer Catalysis; New Chemistry, Catalysts, and Applications, Chapter 7", *ACS Symp. Ser.,* 326, 67-81 (**1987**).
15. "Efficient Asymmetric Alkylations via Chiral Phase-Transfer Catalysis. A Novel Dual Catalysis." Dolling, U.-H.; Hughes, D. L.; Bhattacharya, A.; Ryan, K. M.; Karady, S.; Weinstock. L. M.; Grenda, V. J.; and Grabowski, E. J. J., *Catalysis of Organic Reactions,* [edited by Paul N. Rylander, Hatedd Greenfield and Robert L. Augustine], 33, 65-86 (**1988**).
16. "Silylation-Mediated Oxidation of 4-Aza-3-Ketosteroids with DDQ Proceeds via DDQ-Substrate Adducts", Bhattacharya, A.; DiMichele, L. M.; Dolling, U.-H.; Douglas, A. W.; and Grabowski, E. J. J., *J. Am. Chem. Soc.*, 110, 3318-19 (**1988**).

17. "DDQ Oxidation of Silyl Enol Ethers to Enones Proceeds via DDQ-Substrate Adducts", Bhattacharya, A.; DiMichele, L. M.; Dolling, U.-H.; Grabowski, E. J. J.; Grenda, V. J., *J. Org. Chem.,* 54,6118-6120 (**1989**).
18. "Silicon Assisted Quinone Oxidations Proceeds via Quinone-Substrate Adducts". *Merck Speakers Program Brochure* **1989-1990**.
19. "Proscar ®" *Merck Index*, eleventh edition, 7888, **1989**.
20. "Oxidation of 4-Aza-3-Ketosteroids". Bhattacharya, A., *Centennial Year Edition, MSDRL Selected Publications*.
21. "Acylimidazolides as Versatile Synthetic Intermediates for the Preparation of Sterically Congested Amides and Ketones: A Practical Synthesis of Proscar" Bhattacharya, A.; Williams, J. M.; Amato, J. S.; Dolling, U.-H.; and Grabowski, E. J. J., Synthetic Communications 30(17), 2683-2690, **1990**.
22. "Crystallization Induced Asymmetric Transformation: Synthesis of D-p-Hydroxyphenylglycine" Bhattacharya, A.; Aruallo-Mcadams, C.; and Meier, M. B., Synthetic Communications, 24(17), 2449-2459, **1994**.
23. "Methyl Glyoxylate" Book Chapter, *Encyclopedia of Reagents for Organic Synthesis (EROS),* Bhattacharya, A.**1994**.
24. "Phenmenthyl Glyoxylate" Book Chapter, *Encyclopedia of Reagents for Organic Synthesis (EROS),* Bhattacharya, A. **1994**.
25. "Preparation of Acrylophenones and 2-Alkyl Indanones Utilizing Hexamethylenetetramine as an Inexpensive Mannich Reagent" Synthetic Communications, 26(9), 1775-1784 (**1996**).
26. "Environmentally Friendly Solvent-Free Processes: Application of a Novel Surfactant Induced Dual Catalysis in Henry Reaction" Organic Process Research Development" 7, 3, 254-258, **2003**.
27. "Temperature Selective Diastereo-Recognition (TSD): Enantiomeric Ibuprofen via Environmentally Benign Selective Crystallization". Organic Process Research Development" 7, 5, 717, **2003**.
28. "Benzoin Condensation: Monitoring a Chemical Reaction by High Pressure Liquid Chromatography". Journal of Chemical Education, 81, 7 1020-2, **2004**.
29. "An Efficient Conversion of Nitriles to Amides: Application in the Synthesis of N,N-Diethyl-p-toluamide (DEET™). Tetrahedron Letters 47, 505, **2006**.
30. "Surfactant-Mediated Solvent-Free Dealkylative Cleavage of Ethers and Esters and Trans-Alkylations under Neutral Conditions" Tetrahedron Letters 47, 565, **2006**.
31. "One-Step Reductive Amidation of Nitro-Arenes: Application in the Synthesis of Aceaminophen™)" Tetrahedron Letters 47, 1861, **2006**.
32. "Eco-friendly reductive acetamidation of arylnitro compounds by thioacetate anion through in situ catalytic re-generation: application in the synthesis of acetaminophen™,, **33.** Tetrahedron Letters 47, 3221, **2006.**
34. **"**Remarkable Solvent Effect in Barton-Zard Pyrrole Synthesis: Application in an Efficient One-Step Synthesis of Pyrrole Derivatives". Tetrahedron Letters, 47, 31, 5421, **2006.**
35. " Pseudo-Enzymatic Catalyst-Substrate Interactions in Ion-Pair Mediated Chiral Phase Transfer Catalysis". Tetrahedron Letters 47, 31, 5581, **2006**.
36. "An Efficient Electrophilic N-Amination Utilizing *in situ* Generated Chloramine Under Phase Transfer Conditions". Tetrahedron Letters 47, 30, 5341, **2006**.
37. "Preparing the Next Generation of Research Scientists" American Chemical Society: Petroleum Research Fund Publication, **2006**.

38. "An Improved Process for Repaglinide *via* an Efficient and One Pot Process of (1*S*)-3-methyl-1-(2-piperidin-1-ylphenyl)butan-1-amine - A Useful Intermediate". CHIMIA International Journal for Chemistry, Volume 60, Number 9, pp. 593-597(5), September **2006**.
39. "Substrate Modification Approach to Achieve Efficient Resolution: Didesmethylcitalopram-A Key Intermediate for Escitalopram" Organic Process Research Development 11(2), 289-292, **2007**.
40. "An Efficient and Impurity-Free Process for Telmisartan: An Antihypertensive Drug"**.** Organic Process Research & Development, 11(1), 81-85, **2007**.
41. "Efficient synthesis of (1R)-[3,5-bis (trifluoromethyl) phenyl] ethanol; a key intermediate for aprepitant, an NK-1 receptor antagonist". Synthetic Communications. 37: 3439–3446, **2007**.
42. "**(**S)-3-(Aminomethyl)-5-methylhexanoic acid (Pregabalin)**"**. Acta Cryst. Section C, C63, o306±o308, **2007**.
43. "An Alternative Approach to Achieve Enantiopure (3S)-4-Benzyl-3- (4-fluorophenyl)morpholin-2-one: A Key Intermediate of Aprepitant, an NK1 Receptor Antagonist**"** Organic Process Research & Development. 11(3), 455-457, **2007**.
44. "Effect of Solvent on Stereoselectivity in Pd-C (Type-39K) Catalyzed
45. Hydrogena-tion of Methyl 3-oxo-4-aza-5-α-androstene-17-carboxylate- A
46. Key Intermediate for Finasteride and Dutasteride". Organic Process Research & Development, 11(5); 889-891, **2007**.
47. "An Alternate Route to 2-Amino-3-Nitro-5-Bromo Picoline: Regioselective Pyridine Synthesis via 2-Nitramino Picoline Intermediate". Organic Process Research & Development, 11(5); 885-888. **2007**. [Top ten most downloaded paper in 2007]
48. "An Improved Synthesis of Rimonabant: Anti-obesity Drug" Organic Process Research & Development, 11(5), 910-912, **2007**. [Top ten most downloaded paper in 2007]
49. "A convergent approach to the synthesis of aprepitant: A potent human NK-1 receptor antagonist" Tetrahedron Letters. 48, 8001–8004, **2007**.
50. "Total synthesis of (-)-galanthamine hydrobromide**".** Abstracts of Papers, 234th ACS National Meeting, Boston, MA, United States, August 19-23, **2007**,
51. "Boric Acid Cataylyzed Amidation in the synthesis of Active Pharmaceutical Ingredients" Organic Process Research & Development, 11(6); 1065-1068, **2007**.
52. "Boric Acid: An Efficient and Environmentally Benign Catalyst for
53. Transesterification of _-Keto Esters" *49*, 106-109, Tetrahedron Letters. **2008**.
54. "An Expeditious Synthesis of Ramipril: an Angiotensin Converting Enzyme (ACE) Inhibitor[#]" Synthetic Communications 38(11), 1737-1744, **2008**.
55. "An Investigation on Key Parameters That Influence the Resolution of Omeprazole Sodium**†"** Organic Process Research & Development, 12(1), 66-68. **2008**.
56. "An alternative total synthesis of (-)-galanthamine hydrobromide" Synthetic Communications 38: 2138–2149, **2008**.
57. "Synthesis of Rimonabant Regioisomer" Monatshefte fur Chemie - Chemical Monthly, 139(9), 1091-1093, **2008**.
58. "A Novel Synthesis of Fosphenytoin: Anti-convulsant Prodrug" Synthetic Communications 38(17), 2950-2957, **2008**.
59. "A Non-infringing Synthesis of Simvastatin: HMG-CoA Reductase Inhibitor" Synthetic Communications **2008** (in press).

60. “An Alternative Synthesis of Tadalafil: PDE5 Inhibitor” Synthetic Communications, 38(23), 4265-4271, **2008**.
61. "Reaction of Finasteride Intermediate with Benzeneseleninic Anhydride: An In-depth Study" Industrial & Engineering Chemistry Research 47(23), 9201-9205, **2008**.
62. “An improved process for eszopiclone: anti-insomnia agent**”** Organic Communications. 1(2), 33-38, **2008**.
63. “Borid acid catalyzed environmentally benign amidation and esterification processes in the synthesis of active pharmaceutical ingredients**”.** Abstracts of Papers, 236th ACS National Meeting, Philadelphia, PA, United States, August 17-21, **2008**.
64. “Synthesis of quinoline analogs. Search for antimalarial agents**”.** Monatshefte fuer Chemie. 139(2), 179-181, **2008**.
65. “Efficient Synthesis of Olmesartan Medoxomil, an Antihypertensive Drug” Synthetic Communications, 39 (2): 291–298, **2009.**
66. “Novel synthesis of fosphenytoin. anti-convulsant prodrug”. Synthetic Communications. 39(4), 748. **2009.**
67. Ab initio structure determination of anhydrous sodium alendronate from laboratory powder X-ray diffraction data . Journal of Pharmaceutical Sciences 98(6), 2113-2121, **2009**.
68. Preparative Chromatography Technique in the Removal of Isostructural Genotoxic Impurity in Rizatriptan: Use of Physicochemical Descriptors of Solute and Adsorbent. Organic Process Research & Development, 13 (4), 683. **2009**.
69. “Scalable Process for the Premix of Esomeprazole†” Organic Process Research & Development, 13 (6), 1122. **2009**.
70. “An Improved Process for Pioglitazone and Its Pharmaceutically Acceptable Salt†”, Organic Process Research & Development, 13(6), 1190, **2009**.
71. “Recycling of undesired isomers of key intermediate for Aprepitant Green Chemistry”. Letters and Reviews, 2: 4, 243, **2009**.
72. “Green Technologies in the Generic Pharmaceutical Industry” An invited Book Chapter. From *Green Chemistry in the Pharmaceutical Industry* 289-309., Edited by Dunn, Peter J.; Wells, Andrew S.; Williams, Michael T. John Wiley & Sons, **2010**.
73. “Synthesis and Process Optimization of Amtolmetin: An Antiinflammatory Agent” Organic Process Research & Development 14(2), 362, **2010**.
74. “Emerging trends in the synthesis of central core of HIV protease inhibitors” [Accepted]. Research Trends, **2010**.
75. “Synthesis of All Enantiomerically Pure Diastereomers of Aprepitant” Synthetic Communications1, 40: 2254, **2010.**
76. “Novel Approach to the Synthesis of Omeprazole: An Antipeptic Ulcer Agent” Synthetic Communications1, 40: 2983, **2010.**
77. **“**An alternate synthesis of levetiracetam” Green Chemistry Letters and Reviews (**2010**), 3(3), 225-230.
78. “Asymmetric synthesis of (S,S,S)-2-aza-bicyclo[3.3.0]octane-3-carboxylic acid benzyl ester. Formal synthesis of ramipril” Synthetic Communications (**2011**), 41(8), 1186-1191.
79. “Emerging trends in the synthesis of central core of HIV protease inhibitors” Trends in Organic Chemistry. 14, 83-92, **2010**.
80. **“**An alternate synthesis of valganciclovir: a little twist in traditional approach” Trends in Organic Chemistry. 14, 79-82, **2010**.

81. "An efficient synthesis of dexlansoprazole employing asymmetric oxidation strategy" Tetrahedron Letters, 52(42), 5464-5466, **2011**.
82. "Diastereoselective synthesis of a core fragment of ritonavir and lopinavir" Tetrahedron Letters, 52(51), 6968-6970, **2011**.
83. "Asymmetric reduction of a key intermediate of eslicarbazepine acetate using whole cell biotransformation in a biphasic medium. Catalysis Science & Technology 2(8), 1602-1605, **2012**.
84. "Green Chemistry Articles of Interest to the Pharmaceutical Industry" *Org. Process Res. Dev.*, *16* (4), pp 535–544, (Green Chemistry Highlights), April 10, **2012.**
85. "Crystallization Engineering in Aza-Steroid: Application in the Development of Finasteride" *Org. Process Res. Dev.*, Organic Process Research & Development 17(3), 599-602, **2013**.
86. "Green Chemistry Articles of Interest to the Pharmaceutical Industry" *Org. Process Res. Dev.*, *17(4), 615-626* **2013.**
87. "Green Chemistry in Drug Development" pp 25-40. *Scalable Green Chemistry. Case Studies from Pharmaceutical Industry*" Edited by Stefan G. Koenig. Pan Stanford Publishing, **2013**.
88. "Improved Greener Process for Pioglitazone and its Pharmaceutically Acceptable Salts." pp 141-154. *Scalable Green Chemistry. Case Studies from Pharmaceutical Industry*" Edited by Stefan G. Koenig. Pan Stanford Publishing, **2013**.
89. "Green Chemistry Articles of Interest to the Pharmaceutical Industry" *Org. Process Res. Dev.*, **DOI:** 10.1021/op400263a. **2013.**

III Patents

90. "Preparation of an Enantiomer of a Substituted Fluorenyloxy Acetic Acid", Application No: 06/766,376, Publication No. U.S. Patent 4605760, Application Date: 1985-08-16, Publication Date: **1986**-08-12.
91. "Enantiomers of a Substituted Fluorenyloxy Acetic Acid": Application No: EP19850112149 19850925, Publication No: European Patent. EP-176947, Publication Date: **1986**-04-09.
92. "Preparation of Enantiomers of a Substituted Fluorenyloxy Acetic Acid": Application No: 06/656,577, Publication No U.S. Patent 45857357, Application Date: 1984-10-01, Publication Date: **1986**-05-06.
93. "Steroid Dehydrogenation Process Intermediates" : Application No: 07/520,991, Publication No. U.S. Patent 5116983, Application Date: 1990-05-08, Publication Date: **1992**-05-26.
94. "Dehydrogenation of Azasteroids", Application No: 07/478,064, Publication No: U.S. Patent 5084574, Application Date: 1990-02-07, Publication Date: **1992**-01-28.
95. "Preparation of 4-Azo-chol-1-ene-3, 20-dione derivatives as testosterone reductase inhibitors" Application No: EP19890311066 19891026, Publication No: European Patent EP 0367502 (A1), Publication Date: **1990**-05-09.
96. "Process for the dehydrogenation of 3-oxo steroids (and especially 3-oxo-4aza steroids) in the 1,2-position using quinones and silylating agents, and quinone-steroid adduct intermediates" Application No: EP19880305926 19880627, Publication No, European Patent EP-298652 (A2), Publication Date: **1989**-01-11.

97. “Amphoteric copolymer derived from vinylpyridine and acetoxystyrene” Application No: 08/003,350, Publication No: US Patent 5232995, Application Date: 1993-01-12, Publication Date: **1993**-08-03.
98. "Amphoteric Copolymer Derived from Vinylpyridine and Acetoxystyrene" Application No: 07/968,741, Publication No. U.S. Patent: 5210149, Application Date: 1992-10-30, Publication Date: **1993**-05-11.
99. "Amphoteric Copolymer Derived from Vinylpyridine and Acetoxystyrene" Application No: 08/042,358, Publication No: U. S. Patent: 5304610, Application Date: 1993-04-02, Publication Date: **1994**-04-19.
100. “Amphoteric copolymer derived from vinylpyridine & acetoxystyrene | Copolymere amphotere derive de la vinylpyridine et de l'acetoxystyrene” Publication No: Canadian Patent CA 2158555, Application Date: 1994-03-23, Publication Date: **1994**-10-13.
101. “Amphoteric copolymer derived from vinylpyridine & acetoxystyrene” Application No: PCT/US1994/003133, Publication No: WO 1994/022929, Application Date: 1994-03-23, Publication Date: **1994**-10-13.
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September 29-October 4 (2004), SEPT04-068. Publisher: American Chemical Society, Washington, D. C

37. "Amidation of Acids" **Muramulla, Savitha**; Villarreal, Victor; Cherukuri, Sankara; Bhattacharya, Apurba*. Abstracts, 60th Southwest Regional Meeting of the American Chemical Society, Fort Worth, TX, United States, September 29-October 4 (2004), SEPT04-159. Publisher: American Chemical Society, Washington, D. C.

38. "A Rational Approach to Catalyst Design via Chiral Alkylation of Indanones" **Ramirez, Thomas**; Plata, Robert; Vasques, Tomas; Bhattacharya, Apurba*. Abstracts, 60th Southwest Regional Meeting of the American Chemical Society, Fort Worth, TX, United States, September 29-October 4 (2004), SEPT04-161. Publisher: American Chemical Society, Washington, D. C.

39. "Surfactant Mediated Solvent-Free Reductions of Aryl Carbonyl Substrates to Aryl Alcohols" **Ceaser A. Almaranz**, Fernando Pedraza, Savitha Murmulla, Apurba Bhattacharya*. IUCCP symposium October 18-20, 2004; College Station, Texas.

40. "Environmentally Friendly, Surfactant-Mediated, Solvent-Free Oxidations of Primary Alcohols to Aldehydes" **Fernando Pedraza**, Apurba Bhattacharya*.
IUCCP symposium October 18-20, 2004; College Station, Texas.

41. "Rational Design of a Chiral Phase-Transfer Catalyst for the Alkylation of Substituted 2-Alkyl Indanones" **Thomas Ramirez**, Tomas Vasques, Eric Plata, Apurba Bhattacharya*. IUCCP symposium October 18-20, 2004; College Station, Texas

42. "Waste-Free Environmentally Friendly Acetamidation of Aryl Nitro Compounds: Application in the Synthesis of Aetaminophen" **Victor Suarez**, Victoriano Tamez, Jr., Srinivas Reddy, Apurba Bhattacharya*. IUCCP symposium October 18-20, 2004; College Station, Texas

43. "Remarkable Solvent Effect in the Barton-Zard Pyrrole Synthesis: An Efficient Synthesis of 3,4-Dialkyl-1-H-Pyrrole-2-Carboxylates: Application to a One-Step Synthesis of Pyrrole Derivatives" **Victoriano Tamez**, Jr., Shankar Cheukuri, Nitinchandra Patel, Apurba Bhattacharya*. IUCCP symposium October 18-20, 2004; College Station, Texas.

44. "Efficient One-Pot Synthesis of Amides from Aryl Nitriles and Carboxylic Acids" **Victor Villareal Jr**. Rick Sanchez, Savitha Murmula, Apurba Bhattacharya*.

44. "Environmentally Processes in Organic Synthesis: Application of Zeolites in Etherification, Fromylation and Hydrolysis" **Richard Sanchez, Jr**., Ritesh Tichkule, Ronny G. Thomas, James Ogle, Shane Tichy, Apurba Bhattacharya*. Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas.

45. "Green Chemistry in Organic Synthesis: Environmentally Friendly Waste-Free Bromination of Substituted Acetophenones, Bezocyclic Ketones and Aromatic Compounds" **Robert Erik Plata**, Apurba Bhattacharya*.

Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas.

46. "Surfactant Mediated Solvent-Free Reductions of Aryl Carbonyl Substrates to Aryl Alchols" **Ceaser Almaranz,** Apuba Bhattacharya*. Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas.

47. "An Efficient Waste-Free Acetamidation of Aryl Nitro Compounds; Application in the Synthesis of Acetaminophen" **Victor H. Suarez**, Apurba Bhattacharya*. Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas.

48. "Remrarkable Solvent Effect in Barton-Zard Pyrrole Synthesis: An efficient Synthesis of 3,4-Dialkyl-1-H-Pyrrole-2-Carboxylates:Application to a One-Step Synthesis of Pyrrole Derivatives" **Victoriano Tamez, Jr**., Shankar Cherukuri, Nitinchandra Patel, Apuba Bhattacharya*. Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas.

49. "Environmentally-Friendly Surfactant-Mediated Solvent-Free Oxidation of Aryl Alcohols to Aldehydes" **Fernando Pedraza**, Apurba Bhattacharya*.
Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas

50. "Efficient One-Pot Transformation of Aryl Nitriles and Carboxylic Acids to Amides" **Victor Villareal Jr**. Rick Sanchez, Savitha Murmula, Apurba Bhattacharya*. Annual Biomedical Conference for Minority Students (ABRCMS), November 10-13, 2004; Dallas, Texas.

51. "Green technology in organic synthesis: An efficient one-step synthesis of acetaminophen™" **Victor H Suarez**, Victoriano Tamez, Srinivas Reddy, Frank Rinaldi and Apurba Bhattacharya. 229th meeting of the American Chemical Society, San Diego, March 2005.

52. "Environmentally friendly surfactant-mediated cleavage of aryl esters and ethers under neutral conditions" **Nitinchandra Patel**, Ritesh Tichkule , Rick Sanchez , Apurba Bhattacharya and Jiejun Wu. 229th meeting of the American Chemical Society, San Diego, March 2005.

53. "Surfactant-mediated, solvent-free oxidation of primary alcohols to aldehydes". **Fernando Pedraza**, Jiejun Wu, and Apurba Bhattacharya. 229th meeting of the American Chemical Society, San Diego, March 2005.

54. Rationally engineered chiral phase-transfer catalysts in the alkylation of substituted 2-alkyl -1-indanones **Thomas Anthony Ramirez**, Tomas Vasques, Robert Erik Plata, Jiejun Wu, and Apurba Bhattacharya. 229th meeting of the American Chemical Society, San Diego, March 2005.

55. “Efficient one-pot, one-step synthesis of pyrrole derivatives: An unprecedented solvent selectivity in Barton-Zard pyrrole synthesis”. **Victoriano Tamez Jr**. Sankara Cherukuri, Nitinchandra Patel, John A. Grosso, Venkatapuram Palaniswamy and Apurba Bhattacharya. 229th meeting of the American Chemical Society, San Diego, March 2005.

56. “Solvent-free reactions in organic synthesis: Surfactant-mediated sodium borohydride reduction of aryl carbonyl substrates to aryl alcohols” **Caesar Aaron Almaraz,** Fernando Pedraza, Savitha Muramulla, Apurba Bhattacharya, and Jiejun Wu. 229th meeting of the American Chemical Society, San Diego, March 2005.

57. “Green technology in organic synthesis: Environmentally friendly waste free bromination of substituted acetophenones, benzocyclic ketones, and aromatic compounds” **Robert Erik Plata,** Veronica Jimenez, Celina Garcia, Vanessa Garcia, Alejandro Morales, Apurba Bhattacharya and Jiejun Wu. 229th meeting of the American Chemical Society, San Diego, March 2005.

58. “Zeolite catalysis in organic synthesis: Application in etherification, formylation, ester hydrolysis, and indole synthesis” **Richard Sanchez Jr**, Ritesh Tichkule, Ronnie Thomas, Jiejun Wu and Apurba Bhattacharya. 229th meeting of the American Chemical Society, San Diego, March 2005.

59. “Process Optimization of The Pharmaceutical Intermediate Tosyl Phosphonate” **Yvonne Jimenez**, Annette Ferrell and Apurba Bhattacharya. A&M System Pathways Research Symposium. Kingsville, Texas, November 4-5, 2005.

60. “An efficient One-Pot synthesis of sulfonamides” **Madeline Fair** and Apurba Bhattacharya. A&M System Pathways Research Symposium. Kingsville, Texas, November 4-5, 2005.

Student MS Thesis:

1. “Environmentally friendly solvent free processes: preparation of nitroalcohols, a class of valuable drug intermediates, by Henry reaction” by Vikram Chandrakant Purohit.

2. “Environmentally friendly synthesis: zeolite catalyzed electrophilic aromatic formylation and O- methylation” by James William Ogle.

3. “Surfactant mediated dual catalysis in organic syntheses: one step conversion of nitro groups to acetamides” by Gaurang Parmar.

4. “A rational approach to catalyst design via enantiomeric studies of chiral alkylation” by Tomas Vasques.

5. “Green technology towards pharmaceutical drug development” by Ritesh Tichkule.

6. “New developments toward the synthesis of heterocycles and applications in green chemistry” by Nitinchandra Patel.

7. “Zeolite catalysis in organic synthesis: applications in etherification, formylation, ester hydrolysis and heteroaromatic synthesis” by Richard Sanchez, Jr.

8. “Green chemistry in Pyrrole synthesis, I) Solvent effect in Barton-Zard Pyrrole synthesis: an improved synthesis of 3, 4-Dialkyl-1H-Pyrrole-2-Carboxylates, II) A novel route for the synthesis of pharmaceutically important Pyrrole derivatives” by Sankara R. Cherukuri.

9. “An environmentally and economically friendly process utilizing amino grignards for the synthesis of amides” by Victor R. Villarreal Jr.

10. “A simple and efficient synthesis of aromatic amides utilizing amino grignard reagents” by Savitha Muramulla.

11. “A scaleable synthesis of N-[4-chloro-3-(trifluoromethyl phenyl]-((4-[2-(N-methyl carbamoyl)(4-pyridyloxy)] phenyl) amino)carboxamide ; A scaleable synthesis of 4-Bromo-6-Methoxy Quinoline ; Synthesis of 3'-O-Methylguanosine” by Srinivasa E. Reddy.

12. “An efficient synthesis of heterocycles: an improved solvent effect in the Barton-Zard pyrrole synthesis and a one step synthesis of benzothiazole derivatives” by Victoriano Tamez, Jr.

13. “Solvent-free oxidation of primary aryl alcohols to aldehydes and II. Conversion of primary amide to nitrile using SiCl4, as the dehydrating agent” by Fernando Pedraza.

14. “One step, waste free reduction of aryl nitro compounds to aryl acetamides” by Victor Hugo Suarez.

15. “Green technology in organic synthesis: environmentally friendly, waste-free bromination of substituted acetophenones, benzocyclic ketones, and aromatic compounds” by Robert Erik Plata.

16. “Syntheses of chiral tricyclic enones” by Thomas Anthony Ramirez.

17. “An improved synthesis of Heptakis (2, 3-diacetyl-6-sulfato)-ß-cyclodextrin (HDAS) for chiral application” by S.B.B. Siddhartha Akasapu.

18. “Synthesis of novel diethanol amine based organocatalysts” by Prasanth Reddy Nyalapatla.

19. “Kinetic Resolution of Chiral Alcohols“ by Abimbola Bolanle.

20. “Green Synthesis of amines from alcohols” by Divyashree Boppana.

Courses Taught:

Graduate Courses.

- **Advanced Environmental Chemistry**
- **Advanced Analytical Chemistry**
- **Advanced Instrumentation**
- **Advanced Asymmetric Synthesis**
- **Advanced Organic Synthesis**
- **Physical Organic Chemistry**
- **Graduate Seminar**
- **Green Chemistry**
- **Heterocyclic Chemistry**

Undergraduate Courses.

- **Environmental Chemistry (and lab)**
- **CHEM 3323, Organic Chemistry I and Chem 3123 (Lab).**
- **CHEM 3425, Organic Chemistry II and Chem 3125 (Lab).**
- **Chem Lit 3181(Literature Search).**
- **Chem 1481.**

Ph.D. Committee:

- **Mr. Bob Castro (Env. Engineering: Student of Dr. John Kuruvilla)**
- **Ms. Ji Marie (Env. Engineering: Student of Dr. Ni-Bin Chang)**
- **Ms Christy Cole (Env. Engineering Student of Dr. Alvaro Martinez)**

RESEARCH INTERESTS:

Pharmaceutical Process Research and Development.

Process chemistry, the practice of scaling up chemical production from gram and kilograms to thousands of gallons while always of vital importance, has lately become a highly visible enterprise in the pharmaceutical sector. In the pharmaceutical industry, once the medicinal chemist defines the target molecule, the process chemist finds the most efficient, economical and safe route to make the molecule and its analogues. We have established collaborative programs with several leading pharmaceutical companies (e.g. Bristol-Myers Squibb Pharmaceuticals Research Institute, Johnson &Johnson, Texas BioTechnology and Pharmeco) whereby the research students are be involved in identifying and solving process related problems and issues of potential mutual interest. This involves synthesizing initial quantities of drug candidates using the existing-route as well as improving the existing synthesis, possibly following a completely different strategy from the medicinal route so that it can be scaled up for commercial production.

Environmentally Benign Processes in Organic Synthesis.

Over the past few years significant amount of research activities in the chemical community have been directed towards the development of new technologies and methodologies for environmentally benign processes. This area of chemistry has received

extensive attention and is often referred to as "green chemistry". "Green chemistry" focuses on the design, manufacture, and use of chemicals and processes that have little or no pollution potential or environmental risk and are both economically and technologically feasible. The principle of green chemistry can be applied to broad areas of chemistry including synthesis, catalysis, reaction conditions, separations, analysis and monitoring. Green Chemistry differs from conventional chemistry in several different categories including nature of starting materials, reagents, reaction conditions and target molecule. The scope of Research and Development in this area is enormous. We intend to concentrate on the following specific areas of chemistry.

- Solvent Minimization
- Reactions on Zeolite as Solid Support: Waste-free Catalytic Technology
- Organic Reactions in Water.
- Atom-Economy
- Energy conservation: Application of Microwave and Sonication in Organic Synthesis
- Chiral Phase-Transfer Catalysis.

Grants (Funded).

Year 2003.

- **"Instrumental Grant" (Department of Defense). $400,000.**

- **"Texas Bridges to Doctorate" (National Institute of Health). $600,000/3yrs**

- **"Solvent-free Processes in Green Chemistry: Application of Surfactants in Unique Dual Catalysis" (American Chemical Society-Petroleum Research Fund)**
  $50,000/3 yrs

- **Texas Excellence in Research FY2003 formula funding (HB 1839).**
  $7540.00

- **University of Texas Medical Center, Galvaston Award for Environmental Chemistry. $5000.00**

- **Deans Sharing Fund, 2003. $500.00**

Year 2002.

- **Tamuk-Bristol Myers Squibb Collaboration $25,000.00.**

- **Texas Excellence Fund FY 2003 $3,100.00**

- **Deans Sharing Fund, 2002. $500.00**

Year 2001.

- **Tamuk-Bristol Myers Squibb Collaboration** **$25,000.00.**
- **A&S indirect cost sharing fund**. **$5000.00.**
- **Excellence in Research**. **$1091.00.**
- **Dean's Sharing Fund**. **$600.00.**

Graduate Students.

MS students Graduated.

2002.

1. Virkram Purohit (Finished Ph.D. in Texas A&M Currently at Teva Pharmaceutical).

2. James Ogle (Finished Ph.D. Texas A&M currently employed in Halliburton).

2003.

3. Nishant Joshi (Industry, Iowa Chemical)

4. Mark Davis. (Industry, Novartis Pharmaceutical)

2004.

5. Senthil Kumar (Industry, Glaxo)

6. Gaurang Parmer (Industry, Ambion)

7. Tomas Vasques (MD PhD; U. Texas Medical Center Galveston).

8. 10. Ritesh Tichkule (Industry, Novartis Pharmaceutical)

2005.

9. Nitin Patel (Industry, Boehringer Ingelheim Pharmaceutical)

10. Rick Sanchez (Currently pursuing Ph.D. in Texas A&M)

11. Sankara Rao Cherikuri (Boehringer_Ingelheim Pharmaceutical)

12. Victor Villareal (Currently pursuing Ph.D. at U. North Texas)

13. Savitha Muramulla (Currently pursuing Ph.D. at UT San Antonio)

14. Srinivasa Reddy (Currently pursuing Ph.D. at UT San Antonio)

2006.

15. Victor Tamez (A&M)

16. Fernando Pedraza (pursuing Ph. D. at A&M)

17. Victor Suarez (pursuing Ph. D. A&M)

18. Caeaser Almaranz (U Tx at Austin)

19. Robert Eric Plata (pursuing Ph. D. at A&M)

20. Thomas Ramirez (pursuing Ph. D. at Colorado State U)

21. Tina Thomas (pursuing Ph. D. at Texas Tech)

2007**.**

22. Dr. Katherine Marie Kirmse (She had Ph.D. in engineering from U Texas at Austin). She transferred to Environmental Engineering.

23. Alejandro Morales (pursuing Ph. D. at A&M)

24. Sandra Longoria (Transferred to UNT Medical Center).

2009.

25. Surya B. Akasapu (pursuing Ph.D. at Purdue University)

2011

26. Prasanth Reddy Nyalapatla (pursuing Ph.D. at Purdue University)

2012

27. Tomoloju, Abimbola O**.**

2013

28. Divyashree Boppana

29. Hui Liu

Undergraduate Students

1. Jackie Besinoiz (McNair) (finished PhD at A&M, currently at P&G)

2. Madeline Fair (McNair)

3. Yvonne Jimenez (McNair)

4. Omar Vela

5. Tamara Hussein

6. Diego Armando Sanchez

7. Ambarish Kamdhar

8. Poonam Villabhavai

9. Jose A. Mendoza II

10. Sohum Kiran Desai

11. Celina Garcia (MS at Texas A&M Kingsville)

12. Venessa Lynn Garcia (MS at Texas A&M Kingsville)

13. Veronica Jiminez