

# DRUG PROCESS CHEMISTRY LABORATORY



**Dr. Manjinder Singh Gill**

*Assistant Professor*

Department of Pharmaceutical Technology (Process Chemistry)  
National Institute of Pharmaceutical Education and Research (NIPER)  
Sector 67, Ajitgarh (Mohali), Punjab-160 062  
Tel: 0172-2214683 ext. 2147, Fax: 0172-2214692  
Mobile: 9872721118, Email: [msingh@niper.ac.in](mailto:msingh@niper.ac.in)

## Research Area

- Synthesis of therapeutically important compounds with focus on anti-diabetics, anti-mycobacterial, anticancer and anti-HIV agents
- Drug Process research and development and scale-up of drug molecules, APIs and herbals
- Synthesis and characterization of process related impurities
- Synthesis of drug-drug conjugates and complexes to enhanced therapeutic profile
- Green chemistry: The reactions in aqueous, aqueous-organic media and use of switchable solvents
- Total synthesis of therapeutically important compounds

## Teaching Courses

- PT-510: Industrial process and scale-up techniques (M. Tech. Sem-I)
- PT-560: Synthetic aspects of process chemistry (M. Tech. Sem-I)
- PT-610: Topics relevant to drugs and pharmaceutical industry (M. Tech. & MBA Sem-II)
- PT-630: Synthetic bulk drug technology (M. Tech. Sem-II)
- PT-820: Topics in organic process chemistry (Ph. D)

## Industrial Research Projects (selected)

- Scale-up and Development Batches for ISLLC-361 Project (7 projects)
- Scale-up and validation of Industrial product. compound (4 projects)
- Scale up studies of curcumin extraction
- Drying Trials of AZPH
- VTD drying trial of cosmetic products
- Scale-up and validation studies of APIs: Cefozopran, Entecavir, Candesartan, Pioglitazone HCl, Fondaparinux, & Valsartan
- Scale-up and validation studies of Process R&D and scale up studies of antioxidant products (2 projects)
- Process R&D and scale-up of anti-inflammatory drugs (4 projects)
- Scale-up and validation studies of Vinadifformine
- Scale-up and validation studies involving Vinadifformine conversion into Vincamine
- Scale-up and validation studies involving synthesis of Vinprocetine
- Scale-up and validation studies of hydrogenation (2 projects)
- Scale-up and development of a drug candidate
- Process development for the final step of Levosulpiride synthesis

# Research Group

## Ph.D Students



**Rohani Prasad Burman** ([vermanniper@yahoo.com](mailto:vermanniper@yahoo.com))

*Design synthesis and process development of novel therapeutically important compounds and conjugates*



**Dinesh Kumar Tanwar** ([tanwar\\_dt@ymail.com](mailto:tanwar_dt@ymail.com))

*Development of New Processes and Scale-up of Marketed Drugs, APIs and design and synthesis of Novel Antidiabetic Agents*

## M. Tech (2015-17)



**Ravi Vaghela** ([vaghelaravi469@gmail.com](mailto:vaghelaravi469@gmail.com))

*Process for preparation of Cabozantinib, A tyrosine kinase inhibitor*



**Vishakha Dhiman** ([vishakha.dhiman93@gmail.com](mailto:vishakha.dhiman93@gmail.com))

*Design of New synthetic pathway for substituted Hydantoins and RU58841- an anti-baldness compound*



**Krishan Verma** ([krishanverma64.kv@gmail.com](mailto:krishanverma64.kv@gmail.com))

*Application of Green/Switchable solvents in API synthesis*



**Jyoti Bhatti** ([jyotibhattii755@gmail.com](mailto:jyotibhattii755@gmail.com))

*To develop the synthetic route of recently isolated bioactive molecules originated from marine sources-Carpatamide-A, B and C, Sanjunolide*



**Divakar Singh** ([divakarsingh420@gmail.com](mailto:divakarsingh420@gmail.com))

*Facile synthesis of Alogliptine and Trelagliptine*



**Pinigani Vani Nikhitha** ([vani.nikhitha0324@gmail.com](mailto:vani.nikhitha0324@gmail.com))

*Aspartic-acid based synthesis of anti-diabetic agents*

# Alumni

## M.Tech. 2014-16

<b>Anjali Ratan</b> Patent Research Analyst at Stellarix Consultancy Services Pvt. Ltd., Jaipur	<i>Process for Preparing Substituted Hydantoins and Synthesis of Antiepileptic Drug Ethotoin</i>
<b>Bhawana Deshmukh</b>	<i>Process for the Preparation of 1,2,4-Triazol-3-One and Synthesis of its Analogues as Antidepressant Agents</i>
<b>Devendra Rajak</b> Research Associate, CRD at ARK Healthcare Pvt Ltd., Derabassi	<i>An improved and scalable synthesis of indolic enamides: Coscinamide A, B and their analogues</i>
<b>Pinninti Dileep kumar</b> Patent Research Analyst at Stellarix Consultancy Services Pvt. Ltd., Jaipur	<i>Synthesis of Isatin semicarbazone as anticonvulsant agents</i>
<b>Shantanu Gupta</b> Research Associate, ARD at Biocon Limited, Bangalore	<i>Study toward Synthesis of Carpatamide A-B, Cytotoxic Arylamine Derivative from a Marine Derived Streptomyces sp.</i>

## M.Tech. 2013-15

<b>Kamlesh Kumar Jatav</b>	<i>Studies on various reactions in aqueous media and switchable solvents</i>
<b>Anchal Singh</b>	<i>Synthesis and process development of raloxifene and process related impurities</i>
<b>M. Ravi</b>	<i>Synthesis and process development of OXI8006, combretastatin like indole as a vascular disrupting agents</i>
<b>Ripudaman</b>	<i>Synthesis and process development of rizatriptan and process related impurities</i>
<b>Bhagwana Ram</b>	<i>Synthesis and process development of amiodarone and their derivatives as anti leishmanial derivatives</i>
<b>M. Siddardh Sai</b>	<i>Synthesis of novel isatin derivatives and their biological evaluation as anti-HIV compounds</i>

## M.Tech. 2012-14

<b>P. Sravan Kumar</b>	<i>Synthesis of noscapine-ascorbic acid conjugates</i>
<b>Nikunj Patel</b>	<i>Process research and development for synthesis of an anticancer drug vismodegib</i>
<b>Dasari Manikanta</b>	<i>Methodology development of regioselective ring opening of aspartic acid cyclic anhydride with various nucleophiles</i>
<b>Laxminarayana</b>	<i>Synthesis of novel drug lipid conjugates</i>
<b>Raghvender Reddy</b>	<i>Synthesis of novel sildenafil-fluoxetine hybrid molecules</i>
<b>Nishtha</b>	<i>A novel efficient approach towards the synthesis of potent insulinotropic 4-hydroxyisoleucine</i>
<b>Nandini Sarviya</b>	<i>Process development of propafenone synthesis and its analogues for MDR</i>
<b>Kumaraswami Musku</b>	<i>Synthesis and biological evaluation of novel indole derivatives as antitubercular agents</i>

## M.Tech. 2011-13

<b>Banu Petiwala</b>	<i>Synthesis of aromatase inhibitors</i>
<b>D. Ramya Sri</b>	<i>Synthesis of nitroindazole and benzimidazole derivatives</i>
<b>Gurpreet Kaur</b>	<i>Synthesis of curcumin-drug conjugates</i>
<b>Mukul Dhiman</b>	<i>Synthesis of drug-Phospholipid conjugates</i>

## M.Tech. 2010-12

<b>Monika Jain</b>	<i>Synthesis of 5-Arylidene-2-Imino-4-Thiazolidinones</i>
<b>Rohani Prasad Burman</b>	<i>An approach to Sulfonylurea from Sulfonylchloride and Urea derivatives</i>
<b>Neetu Dayal</b>	<i>Studies Towards Synthesis of (±)-Funebrine</i>
<b>Santosh Kumar Manupati</b>	<i>Synthesis of 1,2,5-substituted pyrrols</i>

## M.Tech. 2009-11

<b>Amit Tailor</b>	<i>Synthesis of Novel Imidazole and Thiazole Derivatives as Antimicrobial Agents</i>
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# Publications

1. **M. S. Gill** and D. K. Tanwar. A Facile Synthesis of *N*-alkyl *O*-aryl Cabamates and their Use in Synthesis of Other Therapeutically Important Compounds. Abstract published in 99th Canadian Chemistry Conference and Exhibition. Halifax, NS. June 5-9, 2016.
2. H. Pawar, S. K. Surapaneni, K. Tikoo, C. Singh, R. Burman, **M. S. Gill**, and S. Suresh: Folic acid Functionalized long-circulation co-encapsulated docetaxel and curcumin solid lipid nanoparicles: In vitro evaluation, pharmacokinetic and biodistribution in rats. *Drug Delivery*, 1-16, 2016.
3. F. J. Bolla, P. Iyer, **M.S. Gill** and M.E. Sobhia: *In silico* Identification and Validation of Targets for Novel Scaffold, 2-Thiazolylimino-5-benzylidin-thiazolidin-4-one. *Molecular Diversity*, Volume 19 (4), 855-870, 2015.
4. V. Avasathi, H. Pawar, C. P. Dora, P. Bansod, **M.S. Gill** and S. Suresh: A novel nanogel formulation of Methotrexate for topical treatment of psoriasis: optimization, *in vitro* and *in vivo* evaluation. *Pharm Dev Technol*, 1-9, 2015.
5. M. Jain, R. P. Burman, V. S. Negi, S. S. Jhamb, A. Mital and **M. S. Gill**: Synthesis and Biological Evaluation of 2-thiazolylimino-5-arylidene-4- thiazolidinone Derivatives as Potent Antimycobacterial Agents. *Anti-Infective Agents*, 13, 105-113, 2015.
6. Charan Singh, T. D. Bhatt, **M. S. Gill**, S. Suresh: Novel rifampicin-phospholipid complex for tubercular therapy: synthesis, physicochemical characterization and in-vivo evaluation. *International Journal of Pharmaceutics* 460, 220–227, 2014.
7. A.K. Choubey, C. P. Dora, T. D. Bhatt, **M. S. Gill**, S. Suresh: Development and Evaluation of PEGylated Enoxaparin: a Novel Approach for Enhanced Anti-Xa Activity. *Bioorganic Chemistry*, 54, 1-6, 2014.
8. S. K. Jain, **M. S. Gill**, H. S. Pawar and S. Suresh: Novel Curcumin Diclofenac Conjugate Enhanced Curcumin Bioavailability and Efficacy in Streptococcal Cell Wall-induced Arthritis. *Indian Journal of Pharmaceutical Sciences*, 415-422, 2014.
9. C.Singh; L. Jodave; Tara D Bhatt; **M.S. Gill**, S. Suresh. Hepatoprotective agent tethered isoniazid for the treatment of drug induced hepatotoxicity: Synthesis, biochemical and histopathological evaluation. *Toxicology Reports*, 1, 885-893, 2014.
10. V. Aggarwal, A. K. Angrish, A. Sharma and **M. S. Gill**: API Business in India: Opportunities and Threats. *Currents Research &Information on Pharmaceutical Sciences (CRIPS)*, Vol. 14 , No. 4, 70-76, 2013.
11. B.M. Petiwala, and **M. S. Gill**: Dual Aromatase and Sulfatase Inhibitors (DAS(s): Structure and activity. *Currents Research &Information on Pharmaceutical Sciences (CRIPS)*, Vol. 13, No. 2, 29-33, 2012.
12. S. Suresh, L. Jodave, S. K. Jena, **M. S. Gill**: Antibody-Drug Conjugates: New Generation Therapeutics in Cancer Therapy. *Currents Research &Information on Pharmaceutical Sciences (CRIPS)*, Vol. 13, No. 3, 51-58, 2012.
13. Vivek Avasatthi, Harish Pawar, Chander Parkash, Prajeet Bansod, **M. S. Gill**, Sarasija Suresh. Development of Nanostructured Lipid Carrier of Methotrexate by Quality by Design Approach (*Submitted to European Journal of Pharmaceutical Sciences*) May, 2014.

# Patents

1. D. K. Tanwar, A. Ratan and **M. S. Gill**: “AN IMPROVED ONE POT PROCESS FOR SUBSTITUTED HYDANTOINS”, Submitted for filing.
2. D. K. Tanwar, A. Ratan and **M. S. Gill**: “PROCESS FOR PREPARING SUBSTITUTED 1-SULFONYL HYDANTOINS”, Submitted for filing.
3. D. K. Tanwar, N. Sarviya, R. P. Burman, S. Suresh and **M. S. Gill**: “A ONE POT PROCESS FOR SYNTHESIS OF PROPRANOLOL”, Indian Patent Application No: 2643/DEL/2015, Filing date: August 26, 2015.
4. N. Sarviya, D. K. Tanwar, S. Suresh and **M. S. Gill**: “NOVEL PROCESS FOR SYNTHESIS OF PROPAFENONE”, Indian Patent Application No: 2757/DEL/2015; Filing date: September 2, 2015.
5. D. K. Tanwar, A. Ratan, R. P. Burman, S. Suresh and **M. S. Gill**: “AN IMPROVED PROCESS FOR THE PREPARATION OF SULFONYLUREAS”, Indian Patent Application No: 3386/DEL/2015; Filing date: October 10, 2015.
6. D. K. Tanwar, A. Ratan, R. P. Burman, S. Suresh and **M. S. Gill**: “IMPROVED PROCESS FOR PREPARATION OF UNSYMMETRICAL UREAS”, Indian Patent Application No: 3387/DEL/2015; Filing date: October 10, 2015.
7. D. K. Tanwar, B. Deshmukh, P. Dileep kumar, R. P. Burman, S. Suresh and **M. S. Gill**: “PROCESS FOR THE PREPARATION OF SEMICARBAZIDES”, Indian Patent Application No: 3385/DEL/2015; Filing date: October 10, 2015.
8. D. K. Tanwar, P. Dileep kumar, B. Deshmukh, R. P. Burman, S. Suresh and **M. S. Gill**: “PROCESS FOR THE PREPARATION OF MONOSUBSTITUTED UREAS”, Indian Patent Application No: 3384/DEL/2015; Filing date: October 10, 2015.
9. A. Mital, A. Taylor and **M. S. Gill**: “A GREEN PROCESS FOR THE SYNTHESIS OF 2-IMINOTHIAZOLIDIN-4-ONE DERIVATIVES”, Indian Patent Application No. 2594/DEL/2012, Filing date: August 22, 2012. Pub. No. 09/2014, Pub. Date February 28, 2014.
10. S. K. Jain, S. Suresh, **M. S. Gill**: “NOVEL CURCUMIN-DRUG CONJUGATES”, Indian Patent Application No. 731/DEL/2012, Filing date: March 14, 2012, Pub. No. 34/2015, Pub. Date August 21, 2015.
11. S. Suresh, **M. S. Gill**, C. Singh: “NOVEL NANO-FORMULATIONS OF ANTI-TUBERCULAR DRUGS”, Indian Patent Application No: 1576/DEL/2013, Filing date: July 24, 2013, Pub. No. 37/2014, Pub. Date September 12, 2014.
12. D.I. Sherris, **M.S. Gill**, F. Ma, S.K. Bhal, R. Dunn-Default, M. Feher, P. Redden, J. Schmidt: “COMPOSITION AND METHODS TO TREAT SKIN DISEASE CHARACTERIZED BY CELLULAR PROLIFERATION AND ANGIOGENESIS”, PCT/US2006/040242; US11/412,618; US 14/171,217 Filed on February 03, 2014; US 13/901,011 Filed on May 23, 2013.
13. S. Suresh, **M. S. Gill** and Charan Singh: NOVEL NANO-FORMULATIONS OF ANTI-TUBERCULAR DRUGS, Indian Patent, 1576/DEL/2013.

14. Alka Mital, Amit Taylor and **M. S. Gill**: A GREEN PROCESS FOR THE SYNTHESIS OF 2-IMINOTHIAZOLIDIN-4-ONE DERIVATIVES , Indian Patent, 2594/DEL/2012.

## Presentations

1. D. K. Tanwar, N. Sarviya, S. Suresh and **M.S. Gill**. Green Synthesis of Propafenon: An Anti-Arrhythmic Drug. National Conference on Emerging Trends in Biological and Chemical Sciences, 25-16 March, 2016, S. Govt. Sc. College of Education and Research, Jagraon, Ludhiana, Punjab, India.
2. **M.S. Gill**. API Synthesis and Process Chemistry. PTU-PITTTR Sponsored Faculty Development Program on "Current Scenario and Future Prospective in Pharmaceutical Research", 8-12 March, 2016, GHG Khalsa College of Pharmacy, Gurusar Sudhar, Punjab, India.
3. D. K. Tanwar, N. Sarviya, S. Suresh and **M. S. Gill**. Novel Process of Synthesis for Propafenone. Professor Ram Chand Paul National Symposium on Progressive Trends in Chemical Sciences, January 23, 2016, Panjab University, Chandigarh, India.
4. **M. S. Gill**. Process Chemistry Approaches to Synthesis of Drug Molecules. 9<sup>th</sup> Chandigarh Science Congress, 25-27 February, 2015, Panjab University, Chandigarh, India.
5. **M. S. Gill**. Drug Conjugates as Novel Therapeutics. 8<sup>th</sup> Chandigarh Science Congress, 26-28 February, 2014, Panjab University, Chandigarh, India.
6. **M. S. Gill**. Synthesis of Drug Conjugates. Prof. R.C. Paul National Symposium on New Visions in Chemical Sciences, 15-15 February, 2014, Panjab University, Chandigarh, India.
7. A. Mital, A. Tailor, V. S. Negi, Monika Jain, D. Ramya Sri and **M. S. Gill**. A Green Process for the Synthesis of 2-imino-thiazolidine-4-one Derivatives. DAV National Congress on Science and Technology, DAV Institute of Engineering and Technology, Jalandhar, Punjab, 30-31 May 2013.
8. S. K. Jain, Gurpreet Kaur, **M. S. Gill** and S. Suresh. Synthesis of Curcumin-Diclofenac Conjugate for increased curcumin bioavailability, DAV National Congress on Science and Technology, DAV Institute of Engineering and Technology, Jalandhar, India, 30-31 May 2013.