***Curriculum Vitae***

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| **Sarbjit Singh, PhD**  (Research Associate)  Department of Chemistry,  University of Texas at Dallas,  USA  Email id: sarbjit.dhami@gmail.com  Ph. No. +1-210-773-2400 | C:\Users\Singh\Dropbox\General things to apply everywhere\Photograph_Sarbjit.jpg |

**Education:**

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| **Year** | **Degree** | **Institute/University** | **Class/Grade** |
| 2000-2003 | B.Sc. (H.S.) Chemistry) | Guru Nanak Dev University, INDIA | 1st |
| 2003-2005 | M.Sc. (H.S.) Chemistry) | Guru Nanak Dev University, INDIA | 1st |
| 2006-2012 | Ph.D. | Guru Nanak Dev University, INDIA | - |

**PhD Title: “***Development of Small Organic Molecules as Catalysts for Asymmetric Organic Transformations”* supervised by Dr. Swapandeep Singh Chimni

**Professional Experience**

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| **Years** | **Designation** | **Company/University** |
| Jan 2012-Feb 2013 | Research Associate | Sphaera Pharma Pvt Ltd., Gurgaon, India. |
| 22 Mar 2013- 31 Dec 2014 | Research Professor | College of Life Sciences and Biotechnology, Korea University, Seoul-136-701, Republic of Korea. |
| 1 Jan 2015-28 Feb 2015 | Research Fellow | College of Pharmacy, Dongguk University-Seoul, Republic of Korea. |
| 1 March 2015-31 October 2016 | Assistant Professor | College of Pharmacy, Dongguk University-Seoul, Republic of Korea. |
| 1 November 2016-Current | Research Associate | Department of Chemistry,  University of Texas at Dallas,  USA |

**Research Experience after PhD: ~**5 years of research experience in Medicinal Chemistry (Drug Discovery) after PhD.

**Highlights of the work done so far:**

1. Design and synthesis of small organic molecules for various infectious disease like AIDS (HIV-1 and HIV-2 reverse transcriptase inhibitors), Multi-drug-resistant tuberculosis and metabolic disorders like rheumatoid arthritis (interleukin-6 inhibitors) and type 2 diabetes mellitus (ketohexokinase inhibitors).
2. Treatment of Cancer with small organic molecules targeting PI3K/AKT/mTOR pathway.
3. Treatment of cancer metastasis targeting multi-tRNA synthetase complex.
4. Design and synthesis of peptidomimetics (α-Helices) as androgen receptors inhibitors for the treatment of prostate cancer.
5. Design and synthesis of small organic molecules as jumonji histone demethylase inhibitors for the treatment of cancer.
6. Design and synthesis of agrochemicals with larvicidal activities against *P. xylostella* (L.) targeting steroidal prohormone (ecdysone).
7. Natural product synthesis (total synthesis of Catechin, Epicatechin and their analogues).
8. Development of water compatible organocatalysts for asymmetric aldol and Michael reactions.
9. Solid phase peptide synthesis (synthesis of linear peptides using rinkamide, 2-CTC and aminomethyl resins).
10. Synthesis of bioactive heterocycles.

**Industrial projects handled**

1. Design and synthesis of small organic molecules for the treatment of multi drug resistant tuberculosis (MDR-TB). (**Sphaera Pharma Pvt Ltd**).
2. Design and synthesis of small organic molecules for the treatment of type 2 diabetes mellitus targeting KHK (ketohexokinase). (**Sphaera Pharma Pvt Ltd**).
3. Synthesis of novel analogues of Epicatechin and related polyphenols (Total synthesis). (**Sphaera Pharma Pvt Ltd**).
4. Design and synthesis of anti-cancer compounds for the treatment of chemoresistant epithelial ovarian cancer targeting AIMP2-DX2, a splicing variant of tumor suppressor AIMP2. (For **BIOCON Korea** at Donnguk University)
5. Design and synthesis of small organic molecules to treat Cancer Metastasis by inhibiting the interactions between KRS (Lysyl-tRNA synthetase) and 67LR (67-kDa laminin receptors) (For **BIOCON Korea** at Dongguk University).

**Key strength:** Strong hold on synthetic organic chemistry and skills to design potent lead molecules from initial hits.

**Academic awards/Fellowship/Achievements**

1. Qualified CSIR-UGC examination (held on 19-12-04) for the award of LECTURESHIP in chemical science.
2. Qualified CSIR-UGC examination (held on 19-06-05) as junior research fellow (JRF) under CSIR fellowship scheme.
3. Qualified GATE-2005 held by IIT with all over India rank 435 with percentile score of 87.58 under the category of chemical sciences

**List of publications/Patents/Conferences participations**

**Research Outcome:** No. of patents = 2 (1 granted and 1 filed), No. of book chapters = 2, No. of publications = 19 (12 research papers + 7 review articles), Total number of citations (searched by google scholar) = 176, Total impact points = 45.73, Oral presentations in international conferences = 2

**a) PATENTS**

1) Sandeep Dugar, Dinesh Mahajan, Santosh Kumar Rai, **Sarbjit Singh,** Rakesh Ishwar patil. *Novel Analogues of Epicatechin and related polyphenols*. WO2014/162320 A2.

2) Yongseok Choi, Ja-Il Goo, **Sarbjit Singh.** *Novel compounds having HIV inhibitory activity and use thereof.* (App. No. 10-2015-0165607, Patent filed (Korean Patent).

**b) BOOK CHAPTERS**

3) **Sarbjit Singh**, Kyeong Lee, Yongseok Choi. *Synthesis and anti-cancer activities of 1, 3, 5-triazine derivatives*. Heterocyclic Compounds and Biological Application. Science Publishing Group USA, ISBN: 978-1-940366-76-0.

4) Divya Utreja, Pooja Sharma, **Sarbjit Singh** and Manpreet Kaur. *Organophosphorous Compounds as Pesticides*. NanoBioMedicine book series published by M/s Studium Press LLC, USA, ISBN: 1-626990-50-6.

**b) RESEARCH PAPERS** (Year wise)

5) **Sarbjit Singh**, Ja-Il Goo, Hyojin Noh, Sung Jae Lee, Myoung Woo Kim, Hyejun Park, Hitesh B. Jalani, Kyeong Lee, Chunsook Kim, Won-Ki Kim, Chung Ju\*, Yongseok Choi\*. Discovery of a novel series of *N*-hydroxypyridone derivatives protecting astrocytes against hydrogen peroxide-induced toxicity *via* improved mitochondrial. *Bioorg. Med. Chem.,* **2017**, *25*, 1394-1405.

6) **Sarbjit Singh**, Veeraswamy Gajulapati, Minkyoung Kim, Ja-Il Goo, Jae Kyun Lee, Kyeong Lee, Chong-Kyo Lee, Yongseok Choi\*. A Divergent Approach for the Synthesis of Novel 4'-*C*-ethynyl Dioxolane Nucleoside Analogues with Potent Anti-HIV Activity. *SYNTHESIS*, **2016**, *48*, 3050-3056.

7) **Sarbjit Singh**, Veeraswamy Gajulapati, Kondaji Gajulapati, Ja-Il Goo, Yeon-Hwa Park, Hwa Young Jung, Sung Yoon Lee, Jung Ho Choi, Young Kook Kim, Kyeong Lee, Tae-Hwe Heo, Yongseok Choi. Structure–Activity Relationship Study of a Novel Series of Oxazolidinone Derivatives as IL-6 Signaling Blockers. *Bio. Org. Med. Chem. Lett.* **2016**, *26*, 1282-1286.

8) Soon-Sun Hong, Jung Ho Choi, Sung Yoon Lee, Yeon-Hwa Park, Kyung-Yeon Park, Joo Young Lee, Juyoung Kim, Veeraswamy Gajulapati, Ja-Il Goo, **Sarbjit Singh**, Kyeong Lee, Young-Kook Kim, So Hee Im, Sung-Hoon Ahn, Stefan Rose-John, Tae-Hwe Heo\*, Yongseok Choi\*. A Novel Small-Molecule Inhibitor Targeting the IL-6 Receptor β Subunit, Glycoprotein 130. *The Journal of Immunology* **2015**, *195*, 237-45.

9) Minkyoung Kim, Jinsun Kwon, Mun Ock Kim, **Sarbjit Singh**, Sang Kyum Kim, Kyeong Lee, Kiho Lee, Hyun Sun Lee and Yongseok Choi*\**. Discovery of a Novel Series of Indolyl Hydrazide Derivatives as Diacylglycerol Acyltransferase-1 Inhibitors. *Bull. Kor. Chem. Soc.* **2015**, *36*, 628-635.

10) Ravi Naik, Misun Won, Hyun Seung Ban, Deepak Bhattarai, Xuezhen Xu, Yumi Eo, Ye Seul Hong, **Sarbjit Singh**, Yongseok Choi, Hee-Chul Ahn, and Kyeong Lee\*. Synthesis and Structure–Activity Relationship Study of Chemical Probes as Hypoxia Induced Factor-1α/Malate Dehydrogenase 2 Inhibitors. *J. Med. Chem*. **2014**, *57*, 9522–9538.

11) P. Chohan, **Sarbjit Singh**, S. S. Chimni\*. *D*-camphor-10-sulfonic acid - a water compatible organocatalyst for Friedel-Crafts reaction of indoles with electron deficient olefins. *Indian Journal of chemistry-section B* **2013**, *52B*, 245-251.

12) **Sarbjit Singh** and S. S. Chimini\*. Pyrrolidine catalyzed diastereoselective aldol reaction of cyclic ketones in water-A green approach. *Indian Journal of chemistry-section B* **2013**, *52B*, 1202-1209.

13) **Sarbjit Singh** and S. S. Chimni\*. Chiral amines catalyzed enantio- and diastereoselective Michael reaction in brine. *Tetrahedron Asymmetry* **2012**, *23*, 1068-1079.

14) A. Kumar, **Sarbjit Singh**, V. Kumar and S. S. Chimni\*. Asymmetric *syn* selective direct aldol reaction of protected hydroxyl acetone catalyzed by primary amino acids derived bifunctional organocatalysts in the presence of water. *Org. Biomol. Chem.* **2011**, *9*, 2731–2742.

15) S. S. Chimni,\* **Sarbjit Singh**, A. Kumar. The pH of the reaction controls the stereoselectivity of organocatalyzed direct aldol reactions in water. *Tetrahedron: Asymmetry* **2009**, *20*, 1722-1724.

16) S. S. Chimni,\* **Sarbjit Singh**, D. Mahajan. Protonated (*S*)-prolinamides derivatives-water compatible organocatalysts for direct asymmetric aldol reaction. *Tetrahedron: Asymmetry* **2008**, *19*, 2276-2284.

**c) REVIEW PAPERS**

17) Deepak Bhattarai, **Sarbjit Singh,** Yerin Jang, Seung Hyeon Han, Kyeong Lee\*, Yongseok Choi\*. An Insight in the Drug Repositioning for the Development of Novel Anticancer Drugs. *Current Topics in medicinal Chemistry* **2016**, *16*, 2156-2168.

18) **Sarbjit Singh**, Deepak Bhattarai, Gajulapati Veeraswamy, Yongseok Choi, Kyeong Lee. Nucleosides with modified sugar ring: Synthesis and Biological Activities. *Current Organic Chemistry* **2016**, *20*, 856-897.

19) **Sarbjit Singh**, Jail Goo, Veeraswamy Gajulapati, Tong-Shin Chang, Kyeong Lee,\* Yongseok Choi\*. Recent Advances in Anticancer Chemotherapeutics based upon Azepine Scaffold. *Anti-Cancer Agents in Medicinal Chemistry* **2016**, *16*, 539-557.

20) Amit Sharma, **Sarbjit Singh**, Divya Utreja. Recent advances in synthesis and antifungal activity of 1,3,5-triazines. *Current Organic Synthesis* **2016**, *13*, 484-503.

21) **Sarbjit Singh**, S. S. Chimni\*. Recent Advances in Iodine Monochloride Mediated Electrophilic Cyclizations. *Synthesis* **2015**, *47*, 1961–1989.

22) **Sarbjit Singh**, Gajulapati Veeraswamy, Deepak Bhattarai, Ja-Il Goo Kyeong Lee\* Yongseok Choi\*. Recent advances in pharmacologically active compounds containing benzoxazole scaffold. *Asian Journal of organic Chemistry* **2015**, 4, 1338–1361.

23) Divya Utreja\*, Vibhaa, **Sarbjit Singh\***, Manpreet Kaur. Schiff bases and their metal complexes as anti-cancer agents- A review. *Current Bioactive Compounds* **2015**, *11*, 215-230.

d) **ORAL PRESENTATIONS**

26) “Discovery of some novel compounds which protect mitochondria from H2O2 toxicity”, 10th PSK Medicinal chemistry workshop held on 18-19 June, **2015** at STX resort, Mungyeong, South Korea.

27) “Protonated *L*-prolinamides derivatives: Versatile catalysts for asymmetric direct aldol reaction in water”, 4th J-NOST Symposium” held on Dec 6-9, **2008** at Kamaraj University, Madurai, India.

e) **POSTER PRESENTATIONS**

28) **Sarbjit Singh**, Min Kyoung Kim, Kyeong Lee, Chong-Kyo Lee,Yongseok Choi\*. Design, Synthesis and Anti-HIV activity of novel Dioxolane Nucleosides: A Divergent Approach.2016 Korea chemical society Division of organic chemistry summer workshop held on 22-23 August 2016 atSeolak Del Pino resort at Goseong Gangwon.

29) **Sarbjit Singh,** Kyeong Lee, Chong-Kyo Lee, Yongseok Choi\*. A Divergent Approach for the Synthesis of *D*- and *L*-4′-Ethynyl Dioxolane Nucleosides with Potent Anti-HIV Activity. 12th PSK medicinal chemistry workshop held on 23-24 June, **2016** at Beache palace, Boryeong, South Korea.

30) **Sarbjit Singh**, Ja-il Goo, Hyejun Park, Yongseok Choi\*. Design and synthesis of 4’-*C*-ethynyl dioxalane nucleosides analogues with potent anti-HIV activity. 10th AFMC international medicinal chemistry Symposium held on 18-21 October, **2015** at ICC jeju, Korea.

31) **Sarbjit Singh**, Swapandeep Singh Chimni\*. Chiral Amines Catalyzed Enantio- and Diastereoselective Michael reaction in Brine. National Symposium on Chemistry in 21st Century held on 23-24 Dec, 2011 at Department of Chemistry, Guru Nanak Dev University, Amritsar.

32) **Sarbjit Singh**, Swapandeep Singh Chimni. Enantio- and diasteroselective aldol reaction in water. Chemistry and Environment held on Feb 11, 2006 at Khalsa College Amritsar, India.

**References**

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**PERSONAL DETAIL**

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| **Nationality:** | Indian |
| **Sex:** | Male |
| **Marital status:** | Married |
| **Date of Birth:** | 7 September 1981 |

**Research Summary**

1. **Work done at University of Texas at Dallas (Ongoing work):**

**1a) Synthesis of α-helical peptidomimetics as androgen receptors inhibitors**: The androgen receptor (AR) is a type of  [nuclear receptor](https://en.wikipedia.org/wiki/Nuclear_receptor) that is activated by binding either of the [androgenic](https://en.wikipedia.org/wiki/Androgen) hormones, [testosterone](https://en.wikipedia.org/wiki/Testosterone), or [dihydrotestosterone](https://en.wikipedia.org/wiki/Dihydrotestosterone) in the cytoplasm and then translocating into the nucleus. PELP1 (Proline-, glutamic acid- and leucine-rich protein) is a [protein](https://en.wikipedia.org/wiki/Protein) that in humans is encoded by the PELP1 [gene](https://en.wikipedia.org/wiki/Gene) is a [transcriptional](https://en.wikipedia.org/wiki/Transcription_(genetics)) corepressor for many [nuclear receptors](https://en.wikipedia.org/wiki/Intracellular_receptor) such as androgen receptors etc. Studies have shown that by preventing the interactions between AR and PELP1, AR mediated transcription of many proteins could be suppressed. Currently, I am designing and synthesizing some peptidomimetics with α-helical structures having the tendency to prevent such interactions. In the initial screening, these compounds have shown good potency as well as selectivity index against prostate cancer cell lines.

**1b)** **Jumonji domain-containing histone-lysine demethylases Inhibitors:** The methylation status of lysine residues in histones determines the transcription of surrounding genes by modulating the chromatin architecture. Jumonji domain-containing histone-lysine demethylases (Jmj-KDMs) remove the methyl moiety from lysine residues in histones by utilizing Fe2+ and α-ketoglutarate. Since genetic alterations in Jmj-KDMs occur in various human cancers, the roles of Jmj-KDMs in cancer development and progression have been investigated. Currently, I am designing and synthesizing small organic molecules as (Jmj-KDMs) inhibitors. These compounds have shown good inhibitory activities against H3K4me3 (KDM5A) and H3K9me3 (KDM4D-E) demethylases.

**1c) Solid phase peptide synthesis:** Along with this work I am also doing solid phase peptide chemistry here. I have synthesized some linear peptides using 2-CTC and rink amide resins. All peptides were characterized from their mass on MALDI mass spectrometer. Recently, I have synthesized 14 units containing peptides having residues such as Biotin, Carboxyfluorescein and Maleimide etc.

1. **Work done in South Korea at Korea University and Dongguk University**

**2a) Nucleoside Analogues with Potent Anti-HIV Activity:** Novel 4’-*C*-ethynyl isomeric dioxolane nucleosides analogues **15a-15d** (β-D, α-D, β-L, and α-D, respectively) were successfully synthesized *via* a divergent strategy from a same starting material (*Z*)-but-2-ene-1,4-diol (Scheme 1). All the isomeric nucleosides **15a-d** were characterized and evaluated for their anti-HIV-1 and HIV-2 activities. Compounds **15a** and **15c** displayed potent *in vitro* activities against HIV-1 (IIIB) with EC50 values of 0.32 and 0.29 µM, respectively, and against HIV-2 (ROD) with EC50 values of 0.20 and 0.18 µM, respectively, in comparison with ddC (EC50, 0.32 µM (HIV-1) and 0.30 µM (HIV-2)). In addition, compounds **15a** and **15c** potently inhibited different drug resistant strains of HIV-1 virus such as L100I, K103N, Y181C, and V106A. The selectivity index and cytotoxic profile of compounds **15a** and **15c** was much better than ddC.



**Scheme 1.** A Divergent Approach for the Synthesis of Novel 4'-*C*-ethynyl Dioxolane Nucleoside Analogues with Potent Anti-HIV Activity.

**2b) Design, Synthesis, and Structure–Activity Relationship of a Novel Series of oxazolidinone derivatives as IL-6 signaling blockers:** A series of oxazolidinone and indole derivatives were synthesized and evaluated as IL-6 signaling blockers by measuring the effects of these compounds on IL-6–induced luciferase expression in human hepatocarcinoma HepG2 cells transfected with



**Figure 1.** Structures and IL-6 inhibitory activity of (+)-Madindoline A (ref. compound) and our lead compound **4d**.

p-STAT3-Luc. Among different compounds screened, compound **4d** was emerged as the most potent IL-6 signaling blockers with IC50 value of 5.9 µM which was much better than (+)-Madindoline A (IC50 = 21µM), a known inhibitor of IL-6 (Figure 1). The synthetic plan of synthesis of oxazolidinone and indole derivatives is shown in schemes 2 and 3, respectively.



**Scheme 2.** Reagents and conditions: (a) (Me)2NH·HCl, 37% HCHO; (b) *n*-Bu2BOTf, DIPEA, CH2Cl2, -78 oC.



**Scheme 3.** Reagents and conditions: (a) NaBH3CN, AcOH, 37%; (b) Imidazole, TBSCl, CH2Cl2, 93%; (c) HATU, DIPEA, DMF, 60%; (d) DDQ, Benzene, 74%; (e) PTSA/MeOH, 94%; (f) BH3.DMS, THF, 73%; (g) DDQ, Benzene, 37%; (h) TBAF, THF, 36%.

**2c) Design, Synthesis, and Structure–Activity Relationship of a Novel Series of** *N*-**Hydroxypyridones as the protectors of mitochondria from hydrogen peroxide toxicity:** Astrocytes play a key role in brain homeostasis, protecting neurons against neurotoxic stimuli such as oxidative stress. Therefore, the neuroprotective therapeutics that enhance astrocytic functionality has been regarded as a promising strategy to reduce brain damage. Ciclopirox, a well-known antifungal *N*-hydroxypyridone compound, protects astrocytes from oxidative stress by enhancing mitochondrial function. Using the *N*-hydroxypyridone scaffold, we have synthesized a series of cytoprotective derivatives. Mitochondrial activity assay showed that *N*-hydroxypyridone derivatives with biphenyl group have comparable to better protective effects than ciclopirox in astrocytes exposed to H2O2 (Figure 2).



**Figure 2.** Structures and activities of Ciclopirox and our lead compound **11g**.



**Scheme 4.** Retrosynthetic plan for the synthesis of *N*-hydroxypyridone derivatives; A) Classical approach; B) Our approach.

The most interesting part of the synthesis was that these *N*-hydroxypyridones were synthesized by novel strategy compared to classical synthesis of cicopirox. With the classical synthetic approach *N*-hydroxypyridones were either not formed or obtained with very poor yield. The retrosynthetic plan of synthetic plan of synthesis of Ciclopirox by classical approach and our approach is shown in scheme 4.

**2d) Design, Synthesis and Insecticidal Evaluation of (1*S*)-(-)-Verbenone derivatives against *Plutella xylostella* (L.):** A series of (1*S*)-(-)-verbenone derivatives were designed, synthesized and evaluated for their insecticidal activities against *Plutella xylostella* (L.) (Scheme 5). Among 60 compounds screened, three compounds displayed 100% mortality at conc. of 50mg/L after 4 days. These compounds demonstrated good anti-feeding effect against *P. xylostella* (L.) on cabbage leaves. It was proved by docking and other biological studies that these compounds work by targeting ecdydone but have different binding sites compared to methoxyfenozide, a well-known ecdysone agonist. Also, synergistic effects were observed when a combination of these compounds and methoxyfenozide was used.



**Scheme 5.** Synthesis of (1*S*)-(-)-verbenone based agrochemicals.



**Scheme 6**. Synthetic scheme of synthesis of Catechin and epicatechin analouges.

1. **Work done in pharmaceutical industry**: I have worked on different industrial projects such as design and synthesis of organic molecules for the treatment of multi-drug-resistant tuberculosis (MDR-TB), type 2 diabetes mellitus (targeting ketohexokinase), Cancer (targeting PI3K, AkT mTOR). I have also synthesized many novel analogues of epicatechin and related polyphenols (Scheme 6). The synthetic scheme of synthesis of these analogues is displayed in scheme 6.
2. **Work done in PhD (Asymmetric organocatalysis):** During my PhD course, I worked in the field of Asymmetric organocatalysis where I explored different types of bifunctional catalysts for asymmetric organic transformations in aqueous media. All catalysts were synthesized from different natural primary and secondary amino acids (Scheme 7). The most intriguing part of the research was that the water was used as solvent for asymmetric transformations. To bring high enantioselectivity in aqueous media is always a challenging task for organic chemists since water interrupts the various types of interactions like H-bonding, ionic and dipole-dipole interactions between the catalysts and substrates in the transition state thus favors racemic products. Employing these catalysts, the enantioselectivity up to 98% and diastereoselectivity up to >99:1 (*anti*:*syn*) was observed for aldol reaction; whereas the enantioselectivity of up to 99% and dr up to 98:2 (*syn*:*anti*) was achieved for Michael reaction (Scheme 7). A correlation between enantioselectivity of aldol products and pH of the reaction mixture was also observed. Along with asymmetric transformations, the simple methodology was also developed to synthesize γ-nitro carbonyl compounds and β-hydroxy ketones in high yields using pyrrolidine as catalyst.



**Scheme 7.** A) Catalyst design and synthesis; B) Enatio- and diastereoselective aldol and Michael reaction in aqueous media.