




**Dr. Madhu Chopra**  
**Assistant Professor &**  
**Coordinator Bioinformatics Facility**

Title	Dr.	First Name	<b>Madhu</b>	Last Name	<b>Chopra</b>	
Designation	<b>Assistant Professor</b>					
Address	<b>Dr. B. R. Ambedkar Center for Biomedical Research, North Campus, University of Delhi, Delhi 110007, India</b>					
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Web-Page	<a href="http://www.acbrdu.edu">www.acbrdu.edu</a>					
<b>Educational Qualifications</b>						
Degree	Institution				Year	
Ph.D.	<b>Department of Chemistry, University of Delhi</b>				<b>1995</b>	
PG	<b>Department of Chemistry, University of Delhi</b>				<b>1992</b>	
UG	<b>University of Delhi</b>				<b>1989</b>	
Any other qualification	<b>NET QUALIFIED</b>				<b>1992</b>	
<b>Career Profile</b>						
<ol style="list-style-type: none"> <li><b>1. Dr. B. R. Ambedkar Center for Biomedical research, Assistant Professor, Since December 2009</b></li> <li><b>2. Dr. B. R. Ambedkar Center for Biomedical research, Research Scientist, November 1997 - 2009</b></li> <li><b>3. Dr. B. R. Ambedkar Center for Biomedical research, Research Associate (CSIR), April 96 – October 1997</b></li> </ol>						
<b>Administrative Assignments</b>						
<ol style="list-style-type: none"> <li>1. Coordinator Bioinformatics Facility Sponsored by DBT since 2006</li> <li>2. Radiological Safety Officer Since 2006</li> <li>3. In-Charge Library ACBR Since 2007</li> <li>4. In-Charge Instrumentation facility such as LC-MS, HPLC, and Central Instrumentation facility of ACBR till April 2011</li> <li>5. Coordinator/examiner/superintendent of examination for various courses of Biomedical Sciences from time to time.</li> <li>6. Coordinator of SUMMER UNDERGRADUATE RESEARCH TRAINING PROGRAMME 2005, 2002 &amp; 2001</li> </ol>						
<b>Areas of Interest / Specialization</b>						
<p>We are doing active research in Computer Assisted Drug Design and Development. Using various computational methods such as pharmacophore modelling, 3D QSAR, virtual screening etc. we have identified several lead compounds against important cancer targets. Along with computational design my group is working towards development of anticancer compounds considering GPCR, HDAC and COX-2 as molecular Targets. The projects involve detailed mechanistic studies, protein-protein interaction networks (PPIs) of cancer targets in order to find effective combination therapy regimes against various cancer types.</p> <p>In addition, we are also pursuing synthesis of medicinally important compounds. Our group is also involved in isolating natural compounds having anticancer properties using cell based in vitro and in vivo screening methods. Nanoparticle based drug delivery agents is another area which our group is working to give target specific pharmaceutical agents.</p>						

### Our future plans include.....

- To continue with research projects involving modelling of GPCR, HDAC, cMET: Pharmacophore modelling, 3D QSAR, docking and virtual screening for development novel lead molecules.
- Virtual screening of plant derived molecules, building databases for virtual screening for drug like compounds.
- Development of nanoparticle based drug delivery agents
- Initiate collaborative programmes with other institutions for enriching biodiversity information resources and promoting human resource development in drug discovery and bioinformatics.

### Subjects Taught

1st Semester: Advanced Organic Chemistry I  
2nd Semester: Advanced Organic Chemistry II  
3rd Semester: Analytical and Biomedical Techniques & Instrumentation, Molecular oncology  
4th Semester: Advanced Medicinal Chemistry, Concepts in Drug Discovery and Mechanism

### Research Guidance

#### **Supervision of awarded Doctoral Thesis**

**10**

1. **Lubna Wasim, September 2017** "Understanding the mechanism of action of HDAC inhibitors in epigenetic regulation of cancer"
2. **Monika Sharma, 2016** "3D QSAR and virtual screening for development of novel histone deacetylase (HDAC) inhibitors.
3. **Manisha Sikka, 2016** "Investigation of combined effect of Cyclooxygenase – 2 Inhibitor, Etoricoxib and Cholecystokinin receptor -2 (CCK-2) antagonists on pancreatic cancer cells"
4. **Monal Sharma, March, 2012**, Studying the effect of Suberoylanilide hydroxamic acid (SAHA), a HDAC inhibitor and Vitamin E on Human Cervical (HeLa) cancer cell line.
5. **Ruby Gupta, February 2012**, "Pharmacophore Modeling, Virtual Screening and Development of COX-2 Selective Inhibitors. (Thesis Submitted)
6. **Shweta Tripathi, March 2011**, "Mechanistic Study Involving Antiproliferative Effect of Cyclooxygenase-2 Selective Inhibitor on Human Cancer Cell Lines."
7. **Rakhi Srivastava, February 2011**, "Screening and Isolation of Active Principles from *Boerhaavia diffusa* as Potential Anticancer agents and their Mechanistic Study"
8. **Joyita Chaudhary, March 2009**: "Biological Evaluation Of Quinazolinone Derivatives On Cholecystokinin-B Receptor Expressing Cell Lines."
9. **Saroj Kumari December 2006** "Synthesis and evaluation of cholecystokinin receptor specific antagonists taking lead from naturally occurring ligand.
10. **Mita Sarkar, July 2006** "Studies on Oxidative stress and antioxidants in thyroid dysfunction"

#### **Supervision of Doctoral Thesis, under progress**

11. **Nalini Yadav**, Thesis Submitted 2017 "Elucidating mechanism of action of active principles from *Boerhaavia diffusa*."
12. **Priya Poonia - Design and development of subtype selective HDAC inhibitors as anticancer agents.**
13. **Sumeet - To understand molecular mechanism of HDAC inhibition with subtype selective inhibitors.**

#### **Other Research scholars worked in collaboration**

14. **Gautam Behl, (SRF, ICMR)** Development of nanoparticle based drug delivery agents. (Completed Ph.D. 2013)
15. **Priyanka Verma**, Joint Registration at AIIMS with Dr. Krishana Dalal, " Estimation of the level of Cartilage Oligomeric Matrix protein (COMP) in Osteoarthritis and Designing of an Inhibitor to control the progression of Osteoarthritis" (Completed Ph.D. 2013)
16. **Praveen Kumar**, Design and Development of HDAC inhibitors as anticancer compounds. (Thesis Submitted, 2016)

#### **Supervision of awarded M.Sc. dissertations = 40**

1. **Shreya, May 2016**, In Silico studies of Phytosterols and their derivatives on Cholesterol absorption mediated by NPC1L1
2. **Sulakshana Deka, May 2016**, Anti – proliferative effect of Vorinostat and its nano-formulation on growth of HeLa cells
3. **Preety Loaura, May 2016**, Synthesis and Characterization of Polymeric Nanogel for the Delivery of Doxorubicin,
4. **Namit Dey, May 2015**, "Co-delivery of etoposide and vorinostat encapsulated on biodegradable poly(oligoethylene glycol)methylacrylate PEOMA nanaogels as anticancer combinatorial drug treatment."
5. **Dounai Annajarvis, May 2015**, "Synthesis and evaluation of sitosteryl esters as potential anti-cancer agents."
6. **Basabi Pegu, May 2014**, "In silico docking and evaluation of antiproliferative activity of plant based Sitosteryl esters as Estrogen Receptor modulators."
7. **Manisha Kadam, May 2014**, "Synergistic Effect of HDAC inhibitor and Topoisomerase inhibitors on Human cervical cancer cell lines."
8. **Neha Kanojia, May 2013**, "To study the antiproliferative activity of Panobinostat (PS), a Histone deacetylases (HDAC) inhibitor in combination with Curcumin on human cervical cancer cells and comparative *in silico* binding study of Panobinostat in HADAC1"
9. **Bhawani, May 2013**, "To study the anti-proliferative activity of Sitosteryl oleate, its analogs Sitosteryl acetate and Sitosteryl benzoate on human glioblastoma cell line (U87). Elucidation of a putative mechanism of action of Sitosteryl oleate in these cells.
10. **Noopur Singh, May 2012**, "Elucidating possible mechanism for antiproliferative action of sitosteryl oleate and hypothesizing suitable analogues with better activity.
11. **Utpraksha Vaish, May 2012**, "To explicate the biochemical efficiency of novel cyclooxygenase-2 inhibitor.
12. **Chhaya Dhiman, May 2011**, "Elucidating the probable mechanism of active principles from Boerhaavia diffusa.
13. **Vivek kant Mishra, May 2011**, "Synthesis and characterization of biodegradable nanoparticle for targeted drug delivery".
14. **Tahir, May 2011**, "Understanding the antiproliferative action of Etoricoxib".
15. **Nalini Yadav, May 2010**, "Screening of the chemically synthesized active principle (Sitosterol Oleate) from Boerhaavia diffusa as potential anticancer agents.
16. **Deepshikha, May 2010**, "Targeting Cancer through Cholecystokinin-B Receptor Antagonists."
17. **Astha Gupta, May 2009**, "Three dimensional pharmacophore modeling of histone deacetylase (HDAC) inhibitors.
18. **Poonam, May 2009**, "Isolation and purification of Cytotoxic Constituents from Boerhaavia diffusa root extract and to study the effect of one of the active principles on Apoptosis in U-87 cell line"
19. **Angad Garg, May 2008** "To study the effect of COX-2 selective inhibitor on proliferation of pancreatic cell line (Mia Paca-2)"
20. **Manish Muhuri, May 2008** "To study the expression of CCK-B/Gastrin Receptor on various cell lines and to evaluate the biological activity of quinazolinone derivatives."
21. **Paromita Gupta, May 2008** "Synthesis of Histone Deacetylase Inhibitors and to study the effect of SAHA for inducing oxidative injury and apoptosis in Hela cell line."
22. **Garima Chauhan, "Screening and isolation of potential cytotoxic natural compounds from the leaf extract of Boerhaavia diffusa."**
23. **Sheetal Kaw, May 2007**, "To study the expression of CCK-BR/ CCK-CR in various cancer cell lines and to

- determine the antagonistic activity of new quinazolinone derivative on CCK-BR positive cell lines
24. **Anamika Ghosh**, May 2007, "In silico designing & synthesis of novel HDAC inhibitors and studying the synergistic effect of VPA with known anticancer compounds."
  25. **Ishan Shankar**, May 2007 "To predict the structure of DNA Gyrase subunit A and B of Neisseria gonorrhoea using the homology modelling technique."
  26. **Priyanka Kant**, May 2007 "Standardization of Analytical technique for purification of Ciprofloxacin derivatives using HPLC."
  27. **Rajni Bala**, May 2007, "Radiolabeling and biological evaluation of 99mTc labelled cycloserine DTPA conjugate for Tuberculosis diagnosis."
  28. **Amit Kumar Yadav**, June 2006, "Three Dimensional Pharmacophore Modeling, *In Silico* Screening and Docking Studies for Identification of Novel Leads as Cyclooxygenase-2 Selective Inhibitors"
  29. **Lunminlal Kipgen**, June 2006, "Virtual screening for novel CCK-B antagonists using pharmacophore based database search"
  30. **Rajeshwari Singh**, July 2006, "To study the role of non-steroidal anti-inflammatory drugs (NSAIDs) in apoptosis using HeLa Cell line."
  31. **Swati Gupta**, June 2005, "Three Dimensional Pharmacophore Modeling of COX – 2 Inhibitors"
  32. **Amresh Prakash**, June 2005, " In silico protein Structure Prediction and Pharmacophore Modeling"
  33. **Pronoti Sarkar**, June 2005, "Isolation and Screening of Anticancer Metabolites from *Boerhaavia diffusa* and *Oxalis corniculata*"
  34. **Puneet Kumar Gupta**, June 2004 Isolation and screening of anticancer metabolites from *Boerhaavia diffusa* (part-I) and Homology Modelling of Cholecystokinin Receptor Type A (Part II)
  35. **P. V. Sunandini**, 2004, "Synthesis of CCK-B/Gastrin Receptor Specific Antagonist using Asperlicin"
  36. **Anubha Singh**, June 2003, "Synthesis of Benzopyran Derivatives and to study the Antifertility Potential in Rats"
  37. **Ram Azore**, June 2003, "To Check the Expression of CCK-B Receptor in Tumour Cell Lines"
  38. **Asha Kumari** , June 2002 "Expression of Cholecystokinin type B Receptor Using pEG Vector and to Study Interaction of Synthesized Ligand Using Fluorescence Techniques."
  39. **Nitu Kumari**, July 2002 "Radiolabeled Nonpeptidic Ligand for Targeting Cholecystokinin –B/Gastrin Receptor Expressing Tumors & Expression of CCK-B receptor in pEG vector"
  40. **Saroj Kumari**, June 2001 "Design, Synthesis and Evaluation of non Peptidic CCK-B/gastrin Receptor Specific Antagonists Taking Lead from Naturally Occurring Ligand."

**Supervision of M.Sc Summer Projects** (2 months duration)

Completed 33 Projects

#### Publications Profile

**1. Books/Monographs (Authored/Edited)**

<u>Year of Publication</u>	<u>Title</u>	<u>Publisher</u>	<u>Co-Author</u>
2008, 2012 (2 <sup>nd</sup> ed.)	Medicinal Chemistry	ANE Books (CRC PRESS)	V. K. Ahluwalia

**2. Research papers published in Refereed/Peer Reviewed Journals**

1. Sinha, R., Singh, P., Saini, N. K., Kumar, A., Pathak, R., Chandolia, A., ... Bose, M. (2018). Methyl-accepting chemotaxis like Rv3499c (Mce4A) protein in Mycobacterium tuberculosis H37Rv mediates cholesterol-dependent survival. *Tuberculosis*, 109. <https://doi.org/10.1016/j.tube.2018.01.004>
2. Wasim, L., & Chopra, M. (2017). Synergistic anticancer effect of panobinostat and topoisomerase inhibitors through ROS generation and intrinsic apoptotic pathway induction in cervical cancer cells. *Cellular Oncology*. <https://doi.org/10.1007/s13402-017-0366-0>
3. Kumari, S., Chowdhury, J., Sikka, M., Verma, P., Jha, P., Mishra, A. K., ... Chopra, M. (2017). Identification of potent cholecystikinin-B receptor antagonists: Synthesis, molecular modeling and anti-cancer activity against pancreatic cancer cells. *MedChemComm*, 8(7). <https://doi.org/10.1039/c7md00171a>
4. Kapoor, H., Yadav, N., Chopra, M., Mahapatra, S. C., & Agrawal, V. (2017). Strong anti-tumorous potential of Nardostachys jatamansi rhizome extract on glioblastoma and In Silico analysis of its molecular drug targets. *Current Cancer Drug Targets*, 17(1). <https://doi.org/10.2174/1570163813666161019143740>
5. Kumar, P., Wasim, L., Chopra, M., & Chhikara, A. (2017). Co-delivery of Vorinostat and Etoposide Via Disulfide Cross-Linked Biodegradable Polymeric Nanogels: Synthesis, Characterization, Biodegradation, and Anticancer Activity. *AAPS PharmSciTech*. <https://doi.org/10.1208/s12249-017-0863-5>
6. Yadav, N., Kumar, P., Chhikara, A., & Chopra, M. (2017). Development of 1,3,4-oxadiazole thione based novel anticancer agents: Design, synthesis and in-vitro studies. *Biomedicine and Pharmacotherapy*, 95. <https://doi.org/10.1016/j.biopha.2017.08.110>
7. Kumar, P., Yadav, N., Chhikara, A., Chopra, M. (2017). Combinatorial Solid Phase Synthesis: Techniques, Characterization and its Application in Drug Development, *Current Biochemical Engineering*, Vol 4 (1), 9-33. DOI 10.2174/2212711903666160622085741
8. Kumar, P., Behl, G., Sikka, M., Chhikara, A., & Chopra, M. (2016). Poly(ethylene glycol)-co-methacrylamide-co-acrylic acid based nanogels for delivery of doxorubicin. *Journal of Biomaterials Science, Polymer Edition*, 27(14). <https://doi.org/10.1080/09205063.2016.1207588>
9. Verma, P., Dalal, K., & Chopra, M. (2016). Pharmacophore development and screening for discovery of potential inhibitors of ADAMTS-4 for osteoarthritis therapy. *Journal of Molecular Modeling*, 22(8). <https://doi.org/10.1007/s00894-016-3035-8>
10. Wasim, L., & Chopra, M. (2016). Panobinostat induces apoptosis via production of reactive

- oxygen species and synergizes with topoisomerase inhibitors in cervical cancer cells. *Biomedicine and Pharmacotherapy*, 84. <https://doi.org/10.1016/j.biopha.2016.10.057>
11. Sharma, G., Kapoor, H., Chopra, M., Kumar, K., & Agrawal, V. (2014). Strong larvicidal potential of *Artemisia annua* leaf extract against malaria (*Anopheles stephensi* Liston) and dengue (*Aedes aegypti* L.) vectors and bioassay-driven isolation of the marker compounds. *Parasitology Research*, 113(1). <https://doi.org/10.1007/s00436-013-3644-4>
  12. Behl, G., Sikka, M., Chhikara, A., & Chopra, M. (2014). PEG-coumarin based biocompatible self-assembled fluorescent nanoaggregates synthesized via click reactions and studies of aggregation behavior. *Journal of Colloid and Interface Science*, 416. <https://doi.org/10.1016/j.jcis.2013.10.057>
  13. Behl, G., Sharma, M., Sikka, M., Dahiya, S., Chhikara, A., & Chopra, M. (2013). Gallic acid loaded disulfide cross-linked biocompatible polymeric nanogels as controlled release system: Synthesis, characterization, and antioxidant activity. *Journal of Biomaterials Science, Polymer Edition*, 24(7). <https://doi.org/10.1080/09205063.2012.723958>
  14. 2D-QSAR, Docking Studies, and *In Silico* ADMET Prediction of Polyphenolic Acetates as Substrates for Protein Acetyltransferase Function of Glutamine Synthetase of *Mycobacterium tuberculosis* Prija Ponnann, Shikhar Gupta, **Madhu Chopra**, Rashmi Tandon, Anil S. Baghel, Garima Gupta, Ashok K. Prasad, Ramesh C. Rastogi, Mridula Bose, and Hanumantharao G. Raj, *ISRN Structural Biology* Volume **2013**, Article ID 373516, 12 pages, <http://dx.doi.org/10.1155/2013/373516>.
  15. Kumari, S., Chowdhury, J., Mishra, A. K., Chandna, S., Saluja, D., & Chopra, M. (2012). Synthesis and Evaluation of a Fluorescent Non-Peptidic Cholecystokinin-B/Gastrin Receptor Specific Antagonist for Cancer Cell Imaging. *ChemBioChem*, 13(2). <https://doi.org/10.1002/cbic.201100593>
  16. Patra, M. C., Kumar, K., Pasha, S., & Chopra, M. (2012). Comparative modeling of human kappa opioid receptor and docking analysis with the peptide YFa. *Journal of Molecular Graphics and Modelling*, 33. <https://doi.org/10.1016/j.jmglm.2011.10.007>
  17. Pasricha, R., Chandolia, A., Ponnann, P., Saini, N. K., Sharma, S., Chopra, M., ... Bose, M. (2011). Single nucleotide polymorphism in the genes of *mce1* and *mce4* operons of *Mycobacterium tuberculosis*: Analysis of clinical isolates and standard reference strains. *BMC Microbiology*, 11. <https://doi.org/10.1186/1471-2180-11-41>
  18. Behl, G., Sharma, M., Dahiya, S., Chhikara, A., & Chopra, M. (2011). Synthesis, characterization, and evaluation of radical scavenging ability of ellagic acid-loaded nanogels. *Journal of Nanomaterials*, 2011. <https://doi.org/10.1155/2011/695138>
  19. Chopra, M., Srivastava, R., Saluja, D., & Dwarakanath, B. S. (2011). Inhibition of human cervical cancer cell growth by ethanolic extract of *Boerhaavia diffusa* Linn. (punarnava) root. *Evidence-Based Complementary and Alternative Medicine*, 2011. <https://doi.org/10.1093/ecam/nep223>
  20. Pandey, V., Chopra, M., & Agrawal, V. (2011). In vitro isolation and characterization of biolarvicidal compounds from micropropagated plants of *Spilanthes acmella*. *Parasitology Research*, 108(2). <https://doi.org/10.1007/s00436-010-2056-y>
  21. Mathur, R., Suman, S., Beaume, N., Ali, M., Bhatt, A. N., Chopra, M., ... Dwarakanath, B. S. (2010). Interaction and structural modification of topoisomerase II $\alpha$  by peptidyl prolyl isomerase, pin1: An *In Silico* study. *Protein and Peptide Letters*, 17(2). <https://doi.org/10.2174/092986610790226030>
  22. Bansal, S., Ponnann, P., Raj, H. G., Weintraub, S. T., Chopra, M., Kumari, R., ... Parmar, V. S. (2009). Autoacetylation of purified calreticulin transacetylase utilizing acetoxycoumarin as

- the acetyl group donor. *Applied Biochemistry and Biotechnology*, 157(2).  
<https://doi.org/10.1007/s12010-008-8357-2>
23. Bansal, S., Ponnann, P., Raj, H. G., Weintraub, S. T., Chopra, M., Kumari, R., ... Parmar, V. S. (2009). Erratum: Autoacetylation of purified calreticulin transacetylase utilizing acetoxycoumarin as the acetyl group donor (*Applied Biochemistry and Biotechnology*) DOI:10.1007/s12010-008-8357-2). *Applied Biochemistry and Biotechnology*, 152(1).  
<https://doi.org/10.1007/s12010-008-8394-x>
24. Dahiya, S., Chuttani, K., Khar, R. K., Saluja, D., Mishra, A. K., & Chopra, M. (2009). Synthesis and evaluation of Ciprofloxacin derivatives as diagnostic tools for bacterial infection by *Staphylococcus aureus*. *Metallomics*, 1(5). <https://doi.org/10.1039/b908474f>
25. Chaudhary, S., Vats, I. D., Chopra, M., Biswas, P., & Pasha, S. (2009). Effect of varying chain length between P1 and P1' position of tripeptidomimics on activity of angiotensin-converting enzyme inhibitors. *Bioorganic and Medicinal Chemistry Letters*, 19(15).  
<https://doi.org/10.1016/j.bmcl.2009.05.079>
26. Chopra, M., Gupta, R., Gupta, S., & Saluja, D. (2008). Molecular modeling study on chemically diverse series of cyclooxygenase-2 selective inhibitors: Generation of predictive pharmacophore model using Catalyst. *Journal of Molecular Modeling*, 14(11).  
<https://doi.org/10.1007/s00894-008-0350-8>
27. PUBLISHED ARTICLE - Counterfeit Medicines - The Global Hazard, **Saurabh Dahiya, Anil K. Mishra, Roop. K. Khar, Madhu Chopra and Aruna Chhikara**, *Pharmainfo. net*, Vol. 6 Issue 4, 2008
28. Sarkar, M., Varshney, R., Chopra, M., Sekhri, T., Adhikari, J. S., & Dwarakanath, B. S. (2006). Flow-cytometric analysis of reactive oxygen species in peripheral blood mononuclear cells of patients with thyroid dysfunction. *Cytometry Part B - Clinical Cytometry*, 70(1).  
<https://doi.org/10.1002/cyto.b.20082>
29. Mishra, A. K., Chopra, M., & Jain, V. (2005). Convenient route for synthesis of bifunctional chelating agent: 1-(p-aminobenzyl)ethylenediaminetetramethylphosphonic acid-folate conjugate (Am-Bz-EDTMP-folate). *Chemistry Letters*, 34(8).  
<https://doi.org/10.1246/cl.2005.1098>
30. Chopra, M., & Mishra, A. K. (2005). Ligand-based molecular modeling study on a chemically diverse series of cholecystokinin-B/gastrin receptor antagonists: Generation of predictive model. *Journal of Chemical Information and Modeling*, 45(6).  
<https://doi.org/10.1021/ci050257m>
31. Kumari, S., Kalra, N., Mishra, P., Chuttani, K., Mishra, A., & Chopra, M. (2004). Novel <sup>99m</sup>Tc radiolabeled quinazolinone derivative [Qn-In]: Synthesis, evaluation and biodistribution studies in mice and rabbit. *Nuclear Medicine and Biology*, 31(8).  
<https://doi.org/10.1016/j.nucmedbio.2004.03.014>
32. Mishra, A. K., Panwar, P., Chopra, M., Sharma, R. K., & Chatal, J.-F. (2003). Synthesis of novel bifunctional Schiff-base ligands derived from condensation of 1-(p-nitrobenzyl)ethylenediamine and 2-(p-nitrobenzyl)-3-monooxo-1,4,7-triazaheptane with salicylaldehyde. *New Journal of Chemistry*, 27(7). <https://doi.org/10.1039/b300621m>
33. Radiolabeling and biological evaluation of a non-peptidic compound from Terminalia Chebula (Harar) for CCK expressing tumours. Krishana Chuttani, Pushpa Mishra, **Madhu Chopra**, Puja Panwar, Rakesh Kumar Sharma and Anil Kumar Mishra, *Indian Journal of Nuclear Medicine*, 2003, **18 (1&2)**, 19-24.
34. Ahluwalia, V. K., Chopra, M., & Chandra, R. (2000). A convenient synthesis of novel pyrimidine analogues of o-hydroxy chalcones and pyrano [2,3-d]pyrimidines and their biological activities. *Journal of Chemical Research - Part S*, (4).

35. Synthesis of Some New Pyrazolo[3,4-d]pyrimidines and Pyrazolo[3,4-c]pyrazoles." V.K.Ahluwalia, Aruna Dahiya & **Madhu Bala**, *Indian J. of Chem.*, 1996, **35B**, 848.
36. A Facile One Pot Synthesis of Some New Derivatives of Pyrano[2,3-d]pyrimidines as Potential Antibacterial and Antifungal Agents". V.K.Ahluwalia & **Madhu Bala**, *Indian J. of Chem.*, 1996, **35B**, 742.
37. Novel Synthesis of Thieno[2,3-c]pyrazoles and Thieno[2,3-d]pyrimidines." V.K.Ahluwalia, Aruna Dahiya & **Madhu Bala**, *Indian J of Chem.*, 1996, **35B**, 715.

**Research Papers Communicated (recent)**

38. Combined Comparative Molecular Field Analysis and molecular docking studies of Histone Deacetylase6 (HDAC6) inhibitors. *Journal of Molecular Graphics and Modelling*, under revision.
39. Apoptosis inducing effect of Sitosteryl oleate isolated from *Boerhaavia diffusa* on human glioblastoma (U-87) cells, Rakhi Srivastava, Daman Saluja, B. S. Dwarakanath and Madhu Chopra\* under submission

**Conference Organization/ Presentations (in the last three years)**

**Organization of a Conference**

1. Convener and organizing Secretary 8<sup>th</sup> **Workshop on Bioinformatics and Molecular Modeling in Drug Design**, at ACBR, 15-17 March, 2018
2. Convener and organizing Secretary 7<sup>th</sup> **Workshop on Bioinformatics and Molecular Modeling in Drug Design**, at ACBR, 23-25 March, 2017
3. Registration- In- Charge, **Annual symposium on frontiers of biomedical research**, ACBR, 14-16 April 2014 and October 2015, 2016.
4. Convener and organizing Secretary 6<sup>th</sup> **Workshop on Bioinformatics and Molecular Modeling in Drug Design**, at ACBR, 21-23 January, 2016
5. Convener and organizing Secretary 5<sup>th</sup> **Workshop on Bioinformatics and Molecular Modeling in Drug Design**, at ACBR, 21-23 March, 2013.
6. Convener and organizing Secretary 4<sup>th</sup> **Workshop on Bioinformatics and Molecular Modeling in Drug Design**, at ACBR, 18-20 January, 2012.
7. Invited Resource Training Person at Workshop entitled, "**Bioinformatics and its applications in Drug Designing**", held at Kumaun University Nainital during 22-23 March 2011.
8. Convener and organizing Secretary 3<sup>rd</sup> **Workshop on Bioinformatics and Molecular Modeling in Drug Design**, at ACBR, 24-26 February 2011.
9. Drug Design and Development Using Pharmacophore Modeling and Virtual Screening at **Delhi Technological University** 23 February 2011.
10. Convener and organizing Secretary 2<sup>nd</sup> Workshop on Bioinformatics and Molecular Modeling in Drug Design December, at ACBR, 22-24<sup>th</sup> 2009.

**Invited Lectures**

**25 (last seven years)**

1. Computer Aided Drug Design Strategies, 28<sup>th</sup> August 2017, at **Bioinformatics and Computational Biology workshop at IIT, New Delhi**.
2. Computer Aided Drug Design, 26<sup>th</sup> July 2017, National Faculty Development Programme on "**Recent Trends in Applied Science Teaching (FDP-RTAST)**" from 21<sup>st</sup> - 27<sup>th</sup> July, 2017 organized by Rajguru College of Applied Sciences, New Delhi
3. Process of Drug Discovery and Development: Inventing drugs through use of Computational methods Drug Design and Development, 3<sup>rd</sup> October 2016, **Bioinformatics and Computational Biology workshop at IIT, New Delhi**.
4. "Synergistic effect of HDAC inhibitor (Panobinostat) and Topoisomerase inhibitors on cervical cancer at **Drug Discovery & therapy World congress**, July 22-25, 2015, **Boston, USA**
5. HDAC inhibitor and Topoisomerase inhibitors show synergistic effect on HeLa cells, **Global cancer Summit, 18-20**



**November, 2015** at Indian Institute of Science, JN. Tata Auditorium, **Bengaluru.**

6. "Pharmacophore based virtual screening and docking to identify novel lead compounds as potential Histone Deacetylase (HDAC) inhibitors" at Indo-US conference on **Molecular modelling and informatics in Drug Design 3<sup>rd</sup>-6<sup>th</sup> Nov 2014** at National Institute of Pharmaceutical Research (NIPER), Mohali Punjab.
7. "Pharmacophore-based virtual screening and docking studies to develop Histone Deacetylase (HDAC) Inhibitors" lecture in National workshop on medical bioinformatics, **December 13, 2013, MDU, Rohtak.**
8. "Computer aided drug design: Strategies to discoveries", Lecture in National workshop on advances in computer aided drug design & discovery, **18-19 Oct. 2013**, Rameesh Institute Greater Noida
9. "Lead identification using pharmacophore modeling and docking as virtual screening approaches" 5<sup>th</sup> Bioinformatics Seminar cum hands-on training 2013 on Multi-Criteria Drug Design, **21-22 August 2013**, at Jamia Hamdard.
10. Lecture at Chemistry Biology Interface, **May 2013**, held at Dyal Singh College, Delhi University.
11. Basics of Bioinformatics and structure based drug design in National Seminar cum workshop on applications of Bioinformatics in Life Sciences at Jiwaji University on **08-09<sup>th</sup> March 2013**
12. Lead Identification Using Pharmacophore Modeling & Virtual Screening in Symposium on Bioinformatics at DRDE Gwalior, during **22-24, August 2012**
13. "Protein Homology modeling and structure based drug Design", at Computational biology workshop at **Miranda House, January 2012.**
14. "*Computational Drug Design and Development*" at workshop entitled *Computational. Chemistry for Chemistry Educators* at **Miranda House, 23-24, Nov, 2011**
15. Mechanism Based Drug Design and Development Using Computational Methods, Workshop at **Acharya Narendra Dev College, 4 March 2011.**
16. Mechanism Based Drug Development: Using Computational Methods for Developing Target Based Therapeutics at National Conference on Recent **Advances in Pure and Applied Chemistry**, ACBR, Delhi, 28-29 December 2010
17. Drug Design and Development Using Pharmacophore Modeling and Virtual Screening at **Delhi Technological University, 23 February 2011.**
18. Drug Design And Development Using Pharmacophore Modeling And Virtual Screening at **International Conference & Exhibition on Analytical & Bioanalytical Techniques 2010: Pharmaceutical R & D Summit**, Hyderabad, November 1-3 2010.
19. Drug Design and Development Using Computational Methods, Workshop on **Bioinformatics** at Maharishi Dayanand University Rohtak, 15<sup>th</sup> September 2010
20. Drug Design and Development Using Computational Methods, **Training Programme in Bioinformatics and Drug Design**, at IIT Delhi 30<sup>th</sup> August 2010.
21. Mechanism Based Drug Development: Using Computational Methods for Developing Target Based Therapeutics, **Workshop on INMAS-DU Collaboration**, 20<sup>th</sup> August 2010, at INMAS, Delhi.
22. Drug Design & Development - Modeling at National Workshop on Computational Science, held at the Department of Physics & Astrophysics & DUCCC, University of Delhi. 1-7, July 2010
23. Drug Design And Development Using Pharmacophore Modeling And Virtual Screening at National **Conference on Medical Biotechnology vision -2020**, April 16-18, 2010
24. Design And Development Of Cyclooxygenase-2 Inhibitors Using Pharmacophore Modeling And Virtual Screening at International Conference **on Trends in Drug Discovery and Development (T3D-2010)**, 5-8 January 2010, Department of Chemistry, University of Delhi.
25. Mechanistic study of Inhibition of human cervical tumour cell growth by Etoricoxib, a highly selective COX-2 inhibitor at **World Cancer Congress (WCC-2009)**, 12-14 January 2009, Kottayam Kerala.

**Poster Presentation by Students**

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**Research Projects (Major Grants/Research Collaboration)**

- **Creation of Bioinformatics Infrastructure Facility (BIF) at ACBR**, Institutional Project Coordinator: Madhu Chopra. Since 2006- 2012 Rs. 50 lacs; Approved for next plan period 2012-2017; 2013-14 Rs. 6.40 lakhs; Rs. 0.60 L 2014-15; **2015-16** : Rs. 8.50 lakhs .
- **Biodegradable** nanoparticle based drug delivery Systems, Sanctioned by UGC, PI- Aruna Chhikara, Co-PI – Madhu Chopra, Rs. **7 lakhs**
- DU-DST Purse grant phase II, sanctioned Rs. 1.5 crore to ACBR, co-investigator with other faculty members.
- UGC-SAP project, Sanctioned Rs. 1.5 Crore to ACBR, Co-investigator with other faculty members.
- “Development of Anticancer Therapeutics: Targeting drug loaded nanocarriers to CD44, A Hyaluroan Receptor” Sanctioned by University of Delhi under DST-PURSE scheme, **Rs. 12.89 Lakhs**, 2009-september 2013, Madhu Chopra (PI)
- Structure Based Design, Synthesis and Evaluation of Histone Deacetylase Inhibitors as Potent Antitumour Agents, Sanctioned by DBT, **Rs. 11.68 Lakhs**, June **2009-2011**, Madhu Chopra (PI), Anil Mishra & Aruna Chhikara (Co-PI)
- Delhi University Special Grant for Research Work, **Rs. 2.5 Lakhs, 2008, 2009, 2010, 2011, 2012**
- Biodegradable Nanogels as Potential Drug Delivery Carriers for Development of Target Specific Chemotherapeutic Agents Dr. Aruna Chhikara (PI), Madhu Chopra (CO-PI), Sanctioned **from UGC , 2008 (Rs. 6 lakhs)**
- Isolation, Chemical Characterization and Biological evaluation of Potential Anticancer Agents From *Boerhavia diffusa* Project Proposal sanctioned by **ICMR (Rs. 11 Lakhs)**, October 2006. Dr. Madhu Chopra (PI), Dr. Daman Saluja (CO-PI)
- Computer-Aided Design of Novel NSAIDs as Selective Cyclooxygenase-2 (COX-2) inhibitors to target tumors: Pilot Study for Synthesis and Preliminary Activity for its Anti-tumor Potential Investigators: Dr Madhu Chopra (PI) & Dr. Daman Saluja (CO-PI) Sanctioned by **DBT, 2005-2009 (Rs. 30 + 7 Lakhs** (Extension for one year)
- Synthesis and Evaluation of <sup>99m</sup>Tc-Ciprofloxacin Analogues for Infection Imaging. Project Proposal sanctioned by **INMAS, DRDO ( Rs. 8 Lakhs)** Dr. Madhu Chopra (PI) , Dr. Daman Saluja (CO-PI) & Dr. A. K. Mishra , INMAS (CO-PI)
- Design, Synthesis and Evaluation of non Peptidic CCK-B receptor Specific Antagonists for targeting CCK-B receptor expressing Tumours. Dr. Madhu Chopra (Principal Investigator), Prof. Vani Brahmachari & Dr. Anil Mishra. Sanctioned **by DST (Rs. 18 Lakhs)**

#### Mentoring following projects:

- Design and development of novel inhibitors of AKR1C1 as potential late candidates in treatment of breast, cervical and endometrial cancers; PI Dr. Priyanke Verma. Sanctioned by MOHFW **2016-19**, Rs. 30 Lakhs

#### COLLABORATIVE PROJECTS

- Development of Radiopharmaceutical for targeted drug Delivery with **Dr. Anil K. Mishra**, INMAS.
- Collaboration with **Dr. Krishana Dalal, AIIMS** “ Estimation of the level of Cartilage Oligomeric Matrix protein (COMP) in Osteoarthritis and Designing of an Inhibitor to control the progression of Osteoarthritis”
- Collaboration with prof. Veena Agarwal, Department of Botany, University of Delhi
- Ms. Ruby Gupta, visited to **Prof. J. R. Dimmock** Laboratory as GSEP Scholar At Drug Design and Discovery Group, University of Saskatchewan, Saskatoon, Canada (December 2009-August 2010)
- Computational design and prediction of activity of novel opioid receptor antagonists and antitensin converting enzyme inhibitors with **Dr. Santosh Pasha, IGIB**.

#### Awards and Distinctions

<ul style="list-style-type: none"> <li>• Research Associateship, C.S.I.R., New Delhi (April 1996- Oct. 1997)</li> <li>• Senior Research Fellowship, U.G.C., New Delhi (Jan. 1995- Dec. 1995)</li> <li>• Junior Research Fellowship, U.G.C., New Delhi (Jan. 1993- Dec. 1994)</li> </ul>
<b>Association With Professional Bodies</b>
<p>1. <i>Reviewing</i></p> <ol style="list-style-type: none"> <li>1. Journal of Chemical Information and Modeling (American Chemical Society)</li> <li>2. Biotechnology Progress, American Institute of Chemical Engineers (AIChE)</li> <li>3. Antiviral research (Elsevier)</li> <li>4. European Journal of Medicinal Chemistry</li> <li>5. Indian Journal of Biophysics and Biochemistry</li> <li>6. Project Reviewing for DBT, DRDO and ICMR.</li> </ol> <p>2. <i>Memberships</i></p> <ul style="list-style-type: none"> <li>• American Chemical Society Membership</li> <li>• LIFE MEMBER Indian Science Congress Association</li> <li>• LIFE MEMBER Indian Association for Cancer Research</li> </ul>
Other Activities

### Signature of Faculty Member

### List of publications APA format

40. Sinha, R., Singh, P., Saini, N. K., Kumar, A., Pathak, R., Chandolia, A., ... Bose, M. (2018). Methyl-accepting chemotaxis like Rv3499c (Mce4A) protein in Mycobacterium tuberculosis H37Rv mediates cholesterol-dependent survival. *Tuberculosis*, 109. <https://doi.org/10.1016/j.tube.2018.01.004>
41. Wasim, L., & Chopra, M. (2017). Synergistic anticancer effect of panobinostat and topoisomerase inhibitors through ROS generation and intrinsic apoptotic pathway induction in cervical cancer cells. *Cellular Oncology*. <https://doi.org/10.1007/s13402-017-0366-0>
42. Kumari, S., Chowdhury, J., Sikka, M., Verma, P., Jha, P., Mishra, A. K., ... Chopra, M. (2017). Identification of potent cholecystokinin-B receptor antagonists: Synthesis, molecular modeling and anti-cancer activity against pancreatic cancer cells. *MedChemComm*, 8(7). <https://doi.org/10.1039/c7md00171a>
43. Kapoor, H., Yadav, N., Chopra, M., Mahapatra, S. C., & Agrawal, V. (2017). Strong anti-tumorous potential of Nardostachys jatamansi rhizome extract on glioblastoma and In Silico analysis of its molecular drug targets. *Current Cancer Drug Targets*, 17(1). <https://doi.org/10.2174/1570163813666161019143740>

44. Kumar, P., Wasim, L., Chopra, M., & Chhikara, A. (2017). Co-delivery of Vorinostat and Etoposide Via Disulfide Cross-Linked Biodegradable Polymeric Nanogels: Synthesis, Characterization, Biodegradation, and Anticancer Activity. *AAPS PharmSciTech*. <https://doi.org/10.1208/s12249-017-0863-5>
45. Yadav, N., Kumar, P., Chhikara, A., & Chopra, M. (2017). Development of 1,3,4-oxadiazole thione based novel anticancer agents: Design, synthesis and in-vitro studies. *Biomedicine and Pharmacotherapy*, 95. <https://doi.org/10.1016/j.biopha.2017.08.110>
46. Kumar, P., Behl, G., Sikka, M., Chhikara, A., & Chopra, M. (2016). Poly(ethylene glycol)-co-methacrylamide-co-acrylic acid based nanogels for delivery of doxorubicin. *Journal of Biomaterials Science, Polymer Edition*, 27(14). <https://doi.org/10.1080/09205063.2016.1207588>
47. Verma, P., Dalal, K., & Chopra, M. (2016). Pharmacophore development and screening for discovery of potential inhibitors of ADAMTS-4 for osteoarthritis therapy. *Journal of Molecular Modeling*, 22(8). <https://doi.org/10.1007/s00894-016-3035-8>
48. Wasim, L., & Chopra, M. (2016). Panobinostat induces apoptosis via production of reactive oxygen species and synergizes with topoisomerase inhibitors in cervical cancer cells. *Biomedicine and Pharmacotherapy*, 84. <https://doi.org/10.1016/j.biopha.2016.10.057>
49. Sharma, G., Kapoor, H., Chopra, M., Kumar, K., & Agrawal, V. (2014). Strong larvicidal potential of Artemisia annua leaf extract against malaria (*Anopheles stephensi* Liston) and dengue (*Aedes aegypti* L.) vectors and bioassay-driven isolation of the marker compounds. *Parasitology Research*, 113(1). <https://doi.org/10.1007/s00436-013-3644-4>
50. Behl, G., Sikka, M., Chhikara, A., & Chopra, M. (2014). PEG-coumarin based biocompatible self-assembled fluorescent nanoaggregates synthesized via click reactions and studies of aggregation behavior. *Journal of Colloid and Interface Science*, 416. <https://doi.org/10.1016/j.jcis.2013.10.057>
51. Behl, G., Sharma, M., Sikka, M., Dahiya, S., Chhikara, A., & Chopra, M. (2013). Gallic acid loaded disulfide cross-linked biocompatible polymeric nanogels as controlled release system: Synthesis, characterization, and antioxidant activity. *Journal of Biomaterials Science, Polymer Edition*, 24(7). <https://doi.org/10.1080/09205063.2012.723958>
52. Kumari, S., Chowdhury, J., Mishra, A. K., Chandna, S., Saluja, D., & Chopra, M. (2012). Synthesis and Evaluation of a Fluorescent Non-Peptidic Cholecystokinin-B/Gastrin Receptor Specific Antagonist for Cancer Cell Imaging. *ChemBioChem*, 13(2). <https://doi.org/10.1002/cbic.201100593>
53. Patra, M. C., Kumar, K., Pasha, S., & Chopra, M. (2012). Comparative modeling of human kappa opioid receptor and docking analysis with the peptide YFa. *Journal of Molecular Graphics and Modelling*, 33. <https://doi.org/10.1016/j.jm gm.2011.10.007>
54. Pasricha, R., Chandolia, A., Ponnann, P., Saini, N. K., Sharma, S., Chopra, M., ... Bose, M. (2011). Single nucleotide polymorphism in the genes of mce1 and mce4 operons of Mycobacterium tuberculosis: Analysis of clinical isolates and standard reference strains. *BMC Microbiology*, 11. <https://doi.org/10.1186/1471-2180-11-41>
55. Behl, G., Sharma, M., Dahiya, S., Chhikara, A., & Chopra, M. (2011). Synthesis, characterization, and evaluation of radical scavenging ability of ellagic acid-loaded nanogels. *Journal of Nanomaterials*, 2011. <https://doi.org/10.1155/2011/695138>
56. Chopra, M., Srivastava, R., Saluja, D., & Dwarakanath, B. S. (2011). Inhibition of human cervical cancer cell growth by ethanolic extract of Boerhaavia diffusa Linn. (punarnava) root.

*Evidence-Based Complementary and Alternative Medicine*, 2011.

<https://doi.org/10.1093/ecam/nep223>

57. Pandey, V., Chopra, M., & Agrawal, V. (2011). In vitro isolation and characterization of biolarvicidal compounds from micropropagated plants of *Spilanthes acmella*. *Parasitology Research*, 108(2). <https://doi.org/10.1007/s00436-010-2056-y>
58. Mathur, R., Suman, S., Beaume, N., Ali, M., Bhatt, A. N., Chopra, M., ... Dwarakanath, B. S. (2010). Interaction and structural modification of topoisomerase II $\alpha$  by peptidyl prolyl isomerase, pin1: An In Silico study. *Protein and Peptide Letters*, 17(2). <https://doi.org/10.2174/092986610790226030>
59. Bansal, S., Ponnann, P., Raj, H. G., Weintraub, S. T., Chopra, M., Kumari, R., ... Parmar, V. S. (2009). Autoacetylation of purified calreticulin transacetylase utilizing acetoxycoumarin as the acetyl group donor. *Applied Biochemistry and Biotechnology*, 157(2). <https://doi.org/10.1007/s12010-008-8357-2>
60. Bansal, S., Ponnann, P., Raj, H. G., Weintraub, S. T., Chopra, M., Kumari, R., ... Parmar, V. S. (2009). Erratum: Autoacetylation of purified calreticulin transacetylase utilizing acetoxycoumarin as the acetyl group donor (Applied Biochemistry and Biotechnology) DOI:10.1007/s12010-008-8357-2). *Applied Biochemistry and Biotechnology*, 152(1). <https://doi.org/10.1007/s12010-008-8394-x>
61. Dahiya, S., Chuttani, K., Khar, R. K., Saluja, D., Mishra, A. K., & Chopra, M. (2009). Synthesis and evaluation of Ciprofloxacin derivatives as diagnostic tools for bacterial infection by *Staphylococcus aureus*. *Metallomics*, 1(5). <https://doi.org/10.1039/b908474f>
62. Chaudhary, S., Vats, I. D., Chopra, M., Biswas, P., & Pasha, S. (2009). Effect of varying chain length between P1 and P1' position of tripeptidomimics on activity of angiotensin-converting enzyme inhibitors. *Bioorganic and Medicinal Chemistry Letters*, 19(15). <https://doi.org/10.1016/j.bmcl.2009.05.079>
63. Chopra, M., Gupta, R., Gupta, S., & Saluja, D. (2008). Molecular modeling study on chemically diverse series of cyclooxygenase-2 selective inhibitors: Generation of predictive pharmacophore model using Catalyst. *Journal of Molecular Modeling*, 14(11). <https://doi.org/10.1007/s00894-008-0350-8>
64. Sarkar, M., Varshney, R., Chopra, M., Sekhri, T., Adhikari, J. S., & Dwarakanath, B. S. (2006). Flow-cytometric analysis of reactive oxygen species in peripheral blood mononuclear cells of patients with thyroid dysfunction. *Cytometry Part B - Clinical Cytometry*, 70(1). <https://doi.org/10.1002/cyto.b.20082>
65. Mishra, A. K., Chopra, M., & Jain, V. (2005). Convenient route for synthesis of bifunctional chelating agent: 1-(p-aminobenzyl)ethylenediaminetetramethylphosphonic acid-folate conjugate (Am-Bz-EDTMP-folate). *Chemistry Letters*, 34(8). <https://doi.org/10.1246/cl.2005.1098>
66. Chopra, M., & Mishra, A. K. (2005). Ligand-based molecular modeling study on a chemically diverse series of cholecystokinin-B/gastrin receptor antagonists: Generation of predictive model. *Journal of Chemical Information and Modeling*, 45(6). <https://doi.org/10.1021/ci050257m>
67. Kumari, S., Kalra, N., Mishra, P., Chutani, K., Mishra, A., & Chopra, M. (2004). Novel <sup>99m</sup>Tc radiolabeled quinazolinone derivative [Qn-In]: Synthesis, evaluation and biodistribution studies in mice and rabbit. *Nuclear Medicine and Biology*, 31(8). <https://doi.org/10.1016/j.nucmedbio.2004.03.014>

68. Mishra, A. K., Panwar, P., Chopra, M., Sharma, R. K., & Chatal, J.-F. (2003). Synthesis of novel bifunctional Schiff-base ligands derived from condensation of 1-(p-nitrobenzyl)ethylenediamine and 2-(p-nitrobenzyl)-3-monooxo-1,4,7-triazaheptane with salicylaldehyde. *New Journal of Chemistry*, 27(7). <https://doi.org/10.1039/b300621m>
69. Ahluwalia, V. K., Chopra, M., & Chandra, R. (2000). A convenient synthesis of novel pyrimidine analogues of o-hydroxy chalcones and pyrano [2,3-d]pyrimidines and their biological activities. *Journal of Chemical Research - Part S*, (4).