**Debaraj Mukherjee**

Professor | Chemical Sciences

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**RESEARCH AREA**

Organic Synthesis, Medicinal Chemistry, Natural Product Synthesis and Isolation, Carbohydrates Chemistry, Photoredox Chemistry

**FOCUS**

* My laboratory is mainly engaged in the development of novel methods for O-/C-/N-glycosylation, nucleoside synthesis, synthesis of oligosaccharide mimetics, and carbohydrate-fused bicyclic systems containing medium-ring to macrocyclic of promising therapeutic potential, non-infringing routes for the synthesis of carbohydrate-based active pharmaceutical ingredients (APIs).
* Transition metal and/or photo-redoxed catalyzed C-C bond formation, C-H activation and elucidation of novel mechanism is another thrust area in which we are actively involved.
* Another aspect of my group focuses on the generation of natural product-inspired small molecule-based leads in the areas of cancer, neurodegenerative disease, and antiviral and antimicrobial chemotherapeutics.

**FUNDED PROJECTS**

* A Novel Approach to the Construction of N-alkylated Hydroxylaminolnterglycosidic Linkages from glycal epoxides: Application in the synthesis of esperamicin-calicheamicin cores. (SERB, PI)
* Exploiting chemical ecology for IPM: Deciphering the phyto-semio-chemicals involved in Insect-Plant interactions of major crop pests of North East Region-India. (DBT, CoPI)
* Discovery of Antivirals for COVID19 and other diseases. (CSIR-FBR, PI)
* Repurposing of antiviral drugs for covid-19 drug. (CSIR-HCP, PI)
* Synthesis of Dapagliflozin and sofosbuvir by novel glycosylation (SERB, PI)
* Setting up a small molecule compound library screening platform for human serine protease TMPRSS2 and SARS-CoV2 RdRp. (ICMR, Co-PI)
* Discovery of anticancer Leads from Carbohydrate precursors using MCR (SERB, PI)

**MAJOR ACHIEVEMENTS**

* Joined as an editorial board member Chemistry & Biodiversity, Wiley.
* Received ACCT (I) Excellence in Carbohydrate Research Award-2024 sponsored by PfP, Houston, Texas, USA.
* Joined as an editorial board member Journal of Carbohydrate Chemistry (JCC), Taylor & Francis in 2023 for five years.
* Received “**CSRI Bronze Medal-2023”** by the Chemical Research Society of India.
* Received **"2020 Professor D.K. Banerjee Memorial Lecture Award”** at Pfizer Symposium organized by Indian Institute of Science, Bangalore, February 2020.
* Received **“Resource Person Award”** at Natural Products in Holistic Healthcare organized by IIT (BHU), Varanasi, December 2020
* Received **Dr.****H C Srivastava Memorial Award-2019** by the ACCTI Executive Committee membersinthe International Carbohydrate Conference (CARBO-XXXIV) organized by the University of Lucknow, 2019.
* Received the DST **Boyscast fellowship** for exchange program with Professor. **David Crich**, Wayne State University, USA (**Nov2011-Nov2012**).
* Supervised 16 PhD students who are currently associated with Industry, Academica as faculties such as in IIT, CSIR-IICT, CSIR-IIIM, Central University.

**PUBLICATION &PATENTS**

**Patents as Principal-Inventor**

* A process for the preparation of n4-hydroxycytidine and its derivatives. **Patent granted US 2024/0239832 A1, 2024.**
* Pyranose-based 2-deoxy -2-iodo nucleoside and its use as Anti-viral agent. Patent filed IN202411022366, 2024.
* Synthesis of Gliflozins via Palladium-Catalyzed Stereoselective Oxidative Coupling of

Glycals with Aryl Halides. Patent filed IN202211009236/ **US app. patent No. US18/558298**

Canada (CA3219218), Europe (EP22798794.8), Australia (AU2022268749)2023.

* A process for tetrahydroanthracenes production from *streptomyces curacoi* (MTCC-25420) and anticancer activity thereof. Patent granted **WO 2023/067617 A1.**
* Indolylkojyl derivatives as inhibitors of invasion and metastasis in human mammary gland carcinomas. Patent granted **WO/2019/003237.**

**Significant Publications on Organic Synthesis as Corresponding Author**

* Das, R., Rai, D. R., Basumatary, J., Roy, B. G., Mukherjee, D\* Kundu, T\* “Photoinduced Excited-State Pd (0)-Catalysed Stereoselective *C*-Glycosylation of 1-Bromosugar with Quinoxalin-2(1*H*)-one.” **Chem. Eur. J.*,*** 2025, e202500882
* Sakandar, N., Haldar, R., Mukherjee, D\*. “NHC-catalysed synthesis of hydroxy methylene-bridged formyl-di-xylofuranose: access to tetrakis and spiro tricyclic xylofuranose.” **Org. Biomol. Chem.**, 2025, 23, 3824-3829
* Rasool, B.; Kundu, S.; Zargar, I. A.; Mukherjee, D\*. “DMSO–K2S2O8 mediated iodine-free conversion of glycal C-3 ether to 3-enopyranones: synthesis of furo[3,2-c] pyrans” **Chem. Commun.**, 2025,61, 137-140
* Rasool, B.; Zargar, I. A.; Kundu, S.; Mukherjee, D\*. “Peroxodisulfate-assisted synthesis of 2-thiocyanato glycals and their transformation to C-2-thio acrylo/aryl nitrile-substituted glycals” **Chem Commun.** 2024, 35, 635-648.
* Zargar, I. A.; Rasool, B.; Bappa, S. K.; Mukherjee, D\*. “Anomeric oxyacetamide assisted site-selective C-2 arylation and its application in O/S glycosylation of 2,3 eno-pyranoside” **Chem.Commun.** 2024, 60, 13040-13043.
* Zargar, I. A.; Rasool, B.; Sakandar, N.; Mukherjee, D\*. “Switchable reactivity of 2-benzoyl glycals towards stereoselective access of 1-3 and 1-1 S/O linked disaccharides” **Chem.Commun.** 2023, 59, 10448.
* Rasool, B.; Zargar, I. A.; Hussain, N.; Mukherjee, D\*. “Pd catalyzed synthesis of Hetero 1,2-Interlinked C-Disaccharides by Coupling of Iodo Glycals with Glycals” **Chem.Commun.** 2023, 59, 9090-9093.
* Bhardwaj, M.; Rasool, B.; Mukherjee, D\*. “Ni-catalyzed domino transformation of enopyranoses and 2-iodo phenols/anilines to pyrano cis fused dihydro-benzofurans/indoles” **Chem.Commun.** 2022, 58, 7038-7041.
* Madhubabu, T.; Kusunuru, A. K.; Yousuf, S. K.; Mukherjee, D\*. “Tandem regio- and diastereo-selective synthesis of halogenated C-vinyl glycosides from unactivated arylacetylenes” **Chem.Commun*.*** 2013**,** *49,* 11409-11411.
* Kumar, A.; Yousuf, S. K.; **Mukherjee, D\***. “Copper mediated highly stereoselective synthesis of C-glycosides from unactivated alkynes” **Chem.Commun*.*** 2013, *49,* 10154-10156.
* Hussain, N.; Bhardwaj, M.; Ahmed, A.; Mukherjee, D\*. “Synthesis of Sugar-Based Enones and Their Transformation into 3,5-Disubstituted Furans and 2‑Acyl-Substituted 1,2,3-Trideoxy Sugars in the Presence of Lewis Acids” **Org. Lett.** 2019, 21, 3034−3037.
* Bhardwaj, M.; Rasool, F.; Tatina, M. B.; Mukherjee, D\*. “Construction of Fused Oxabicyclic Scaffolds from Glycals and Styrenes via One-Pot Domino Transformations” **Org. Lett.** 2019, 21, 3038−3042.
* Rasool, F.; Ahmed, A.; Hussain, N.; Yousuf, S.K.; Mukherjee, D\*. “One-pot Regio and Stereoselective Synthesis of C-Glycosyl Amides From Glycals Using Vinyl Azides as Glycosyl Acceptors” **Org. Lett.** 2018, 20, 4036-4039.
* Hussain, N.; Jana, K.; Ganguly, B.; Mukherjee, D\*. “Transformation of Substituted Glycals to Chiral Fused Aromatic Cores via Annulative π‑Extension Reactions with Arynes” **Org. Lett.** 2018, 20, 1572-1575.
* Rasool, F.; Mukherjee, D\*. “Pd-Catalyzed Regio- and Stereoselective C-Nucleoside Synthesis from Unactivated Uracils and Pyranoid Glycals” **Org. Lett.** 2017, 19, 4936–4939.
* Tatina, M. B.; Kusunuru, A. K.; Mukherjee, D\*. “Organo-zinc Promoted Diastereoselective C-Arylation of 1,2-Anhydrosugars from Arylboronic Acids” **Org. Lett.** 2015, 17, 4624–4627.
* Kusunuru, A. K.; Jaladanki, C. K.; Tatina, M. B.; Bharatam, P. V.; Mukherjee, D\*. “TEMPO-Promoted Domino Heck−Suzuki Arylation: Diastere oselective Cis-Diarylation of Glycals and Pseudoglycals” **Org. Lett.** 2015, 17, 3742–3745.
* Yousuf.S. K., Taneja.S. C., Mukherjee D\*.”Highly regio-and stereoselective one pot synthesis of carbohydrate based butyrolactones”. **Org. Lett.** 2011, 13, 576-579
* Yousuf.S. K., Taneja.S. C., Mukherjee D\*. “Domino Transformation of D-Glucal to Racemic-α-Substituted-α-Hydroxymethyl Furfuryl Derivatives” **Org. Lett.,** 2008, 10, 4831-4834.
* Bhardwaj, M.; Mukherjee, D\*. “Regio and Stereoselective One-Pot Synthesis of 2-Deoxy-3-thio Pyranoses and Their O-Glycosides from Glycals” **J. Org. Chem.** 2023, 88, 5676-5686.
* Sakandar, N.; Ahmed, A.; Zargar, I. A.; Mukherjee, D\*. “Base-Mediated Transformation of Glycals to Their Corresponding Vinyl Iodides and Their Application in the Synthesis of C-3 Enofuranose and Bicyclic 3, 4-Pyran-Fused Furanose” **J. Org. Chem.** 2023, 88, 8300-8309.
* Ahmad A.; Mukherjee, D\*. “Stereoselective Construction of Orthogonally Protected,N-O Interlinked Disaccharide Mimetics Using N-Substituted β- Aminooxy Donors” **J. Org. Chem.** 2022, 15, 1087-1092.
* S. K. Yousuf, S. C. Taneja, Debaraj Mukherjee\*.“Multi-component cascade transformation of D-glucal to furan appended triazole glycoconjugates” **J. Org. Chem.** 2010, 75, 3097-3100.
* Hussain, A.; Yousuf, S. K.; Kumar, D.; Lambu, M. R.; Singh, B.; Maity, S.; Mukherjee, D\**. “*Synthesis of benzannulated chiral macrocycles embedded in a carbohydrate template by intramolecular base free Sonogashira reaction on alumina support*”* **Adv. Synth. Catal.** **2012,** *354,* 933–1940.
* Zargar, I. A.; Hussain, N.; Mukherjee, D\*. “Conversion of glycals to 2,3-Di-Substituted-3-deoxy-glycals via N-(Glycosyloxy) acetamides assisted C-2-Alkenylation and C-3-Nucleophilic Substitution” **Chem. Asian J.** 2022, 17, e202200350.
* S. K. Yousuf, Debaraj Mukherjee\*, B. Singh, S. C. Taneja.“Cu-Mn Bimetallic catalyst for Huisgen [3+2]-cycloaddition”; **Green Chemistry,** 2010, 12,1568-1572
* **Significant publications on Medicinal Chemistry as Corresponding Author**
* Lambu, M. R.; Kumar, S.; Yousuf, S.K.; Sharma, D. K.; Hussain, A.; Kumar, A.; Malik, F.; Mukherjee, D\*. “Medicinal chemistry of dihydropyran based medium ring macrolides related to aspergillides: selective inhibition of PI3K-alpha” **J. Med. Chem*.*** 2013**,** *56,* 6122–6135.
* Sakandar, N.; Ahmed, A.; Bhardwaj, M.; Kumari, D.; Nandi, U.; Mukherjee, D\*. “A path from synthesis to emergency use authorization of Molnupiravir (EIDD-2801) as COVID-19 therapy.” **Bioorg. Chem.** 2024, 147, 107379.
* Kour, P.; Saha, P.; Bhattacharya, S.; Kumari, D.; Debnath, A.; Roy, A.; Sharma, D. K.; Singh, K.; Mukherjee, D\*. “Design, Synthesis, and Biological evaluation of 3, 3’-Diindolylmethane N-linked glycoconjugate as Leishmanial Topoisomerase IB inhibitor with reduced cytotoxicity” **RSC Med. Chem.** 2023, 14, 2100-2114.
* Manhas, R. S.; Mudabir, S.; Mir, B. K.; Ahmad, A.; Sharma, S.; Mahas, D.; Tiwari, H.; Kumar, A.; Nargotra, A.; Nandi, U.; Goswami, A.; Mukherjee, D\*. “Isolation and anticancer activity  evaluation of rare Bisaryl anthraquinone antibiotics  from novel S treptomyces  sp. strain of NW Himalayan region” **Chem. Biol. Interact.** 2022, 365, 110093.
* Gulati, H. K.; Choudhary, S.; Kumar, N.; Ahmad, A.; Bhagat, K.; Singh, J. V.; Singh, A.; Kumar, A.; Bedi, P. M. S.; Singh, H.; Mukherjee, D\*. “Design, Synthesis, Biological Investigations and Molecular Interactions of Triazole linked Tacrine Glycoconjugates as Acetylcholinesterase Inhibitors with Reduced Hepatotoxicity” **Bioorg. Chem*.*** 2021, 118*,* 105479
* Bhardwaj, M.; Chib, S.; Kaur, L.; Kumar, A.; Chaudhuri, B.; Malik, F.; Saran, S.; Mukherjee, D\*. “Conversion of Amino Acids to Aryl/Heteroryl ethanol metabolites Using Human CYP2D6-Expressing Live Baker’s Yeast as potential Anti-Depressant Agent” **RSC Med. Chem.** 2020, 11,142.
* Rassol, F.; Goswami, A.; Mukherjee, D\*. “Regiospecific Synthesis of Ring A Fused Withaferin A Isoxazoline Analogues: Induction of Premature Senescence by W-2b in Proliferating Cancer Cells” **Scientific Reports.** 2017, 7, 13749.
* Sharma, D. K.; Pandey, J.; Tamrakar, A. K.; Mukherjee, D\*. “Synthesis of heteroaryl/aryl kojic acid conjugates as stimulators of glucose uptake by GLUT4 translocation” **Eur. J. Med. Chem*.*** 2014, 85*,* 727-736.
* Rassol, F.; Goswami, A.; Mukherjee, D\*. “Regiospecific Synthesis of Ring A Fused Withaferin A Isoxazoline Analogues: Induction of Premature Senescence by W-2b in Proliferating Cancer Cells” **Scientific Reports*.*** 2017**,** *7,* 13749**.**
* Sharma, D. K.; Rah, B. A.; Lambu, M. R.; Hussain, A.; Yousuf, S. K.; Jamwal, G.; Ahmad, Z.; Chanauria, N.; Nargotra, A.; Tripathi, A. K.; Singh, B.; Goswami, A.; Mukherjee, D\*. “Design and synthesis of novel N,N’-glycoside derivatives of 3,3’-diindolylmethanes as potential antiproliferative agents” **Med. Chem. Commun*.***2012, *3,* 1082-1091.