Ratmir Dedra

Ratmir Derda received his undergraduate degree in Physics from Moscow Institute of Physics and Technology in 2001 and Ph.D. in Chemistry from the University of Wisconsin-Madison in 2008, under the supervision of Laura L. Kiessling. From 2008 to 2011, he was a postdoctoral researcher at Harvard University working under the supervision of George M. Whitesides and Donald E. Ingber. He joined the University of Alberta in 2011 as an Assistant Professor in Chemistry. In 2012, he became a principal investigator at the Alberta Glycomics Centre. His notable awards include the Young Investigator Award from the Boulder Peptide Society (2014) and Canadian Rising Star in Global Health (2011).

The Derda Lab centers on the development and mechanistic investigation of chemical transformations of genetically-encoded (GE) substrates. We employ genetically-encoded chemical libraries to attack unsolved problems in molecular recognition to aid the discovery of new therapeutics, biomaterials and molecular diagnostics. Access to billions of genetically-encoded molecules developed by our group allows to explore ligand-receptor interactions that would be difficult to explore using systematic rational analysis. An example of such “difficult” or so-called “undruggable” targets that we study are proteins that recognize carbohydrates. Conceptually similar molecular recognition problems that we are interested in are recognition of ice in water, functional mimicry of ice-crystals by organic molecules and heterogeneous nucleation driven through such mimicry.

Aside from ligand discovery, synthesis of GE-libraries offers exciting challenges in synthetic chemistry. Development of synthetic transformations that act on not one but a million or a billion reactants at once calls for developments of new paradigms in monitoring of the reaction progress, characterization of the yield, kinetics, and selectivity of these reactions. We believe that development of quantitative physical-organic methods for characterization of billion-scale reactions will offer strategies for exploring the fundamental physical principles the drive chemical reactions. For example, the role of ground-state conformational preferences and solvent effect in macrocyclization reactions are understood only for structurally simple substrates. We develop strategies that could quantify and characterize these properties in peptides and peptide-derived substrates using the tools of genetic selection.