Organic Chemistry, Synthetic Chemistry, Nanoscience and Immunology

Xuefei Huang

Associate Professor

(b. 1973)

B.S., 1994
University of Science and Technology of China;

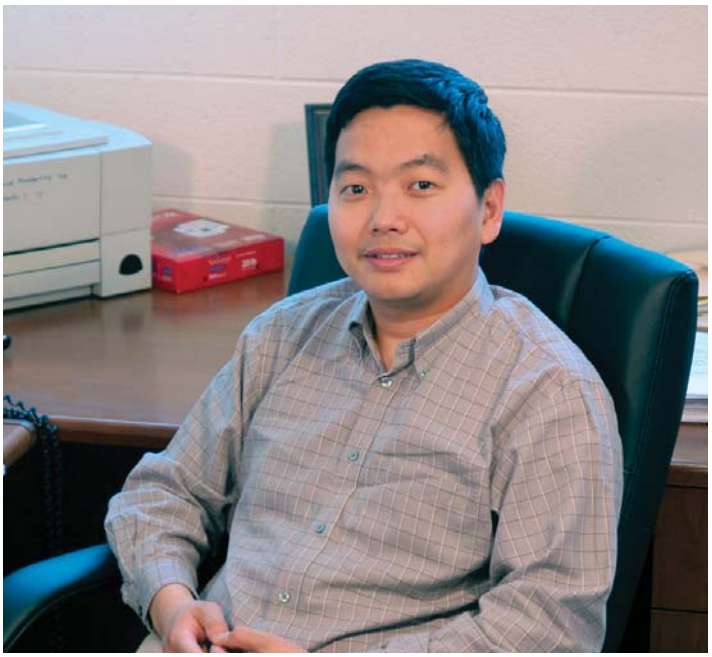
M.A. 1995, M.Phil., 1998,
Columbia University;

Ph.D., 1999,
Columbia University;

Assistant Professor,
University of Toledo,
2002-2006;

Associate Professor,
University of Toledo,
2006-2008;

517-355-9715,
ext. 329



Selected Publications

Iterative One-Pot Oligosaccharide Synthesis, Huang, X., Huang, L., Wang, H., Ye, X.-S., *Angew. Chem. Int. Ed.* **2004**, *43*, 5221-5224.

Highly Efficient Syntheses of Hyaluronan Oligosaccharides, Huang, L.; Huang, X., *Chem. Eur. J.* **2007**, *13*, 529-540.

Four Component One-Pot Synthesis of the Tumor-Associated Carbohydrate Antigen Globo-H Based on Preactivation of Thioglycoside Donors, Wang, Z.; Zhou, L.; El-boubbou, K.; Ye, X.-S.; Huang, X. *J. Org. Chem.* **2007**, *72*, 6409 - 6420.

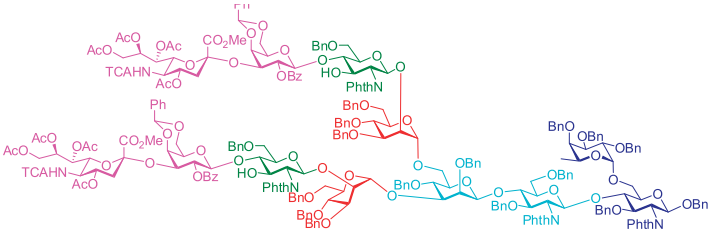
Magnetic Glyco-nanoparticles: A Unique Tool for Rapid Pathogen Detection, De-contamination and Strain Differentiation, El-Boubbou, K.; Gruden, C.; Huang, X., *J. Am. Chem. Soc.* **2007**, 129, 13392-13393.

Cowpea Mosaic Virus Capsid, a Promising Carrier towards the Development of Carbohydrate Based Antitumor Vaccines, Miermont, A.; Barnhill, H.; Strable, E.; Lu, X.; Wall, K. A.; Wang, Q.; Finn, M. G.; Huang, X., *Chem. Eur. J.* **2008**, *14*, 4939-4947.

Pre-activation Based One-pot Synthesis of an α-(2,3)-Sialylated Core-Fucosylated Complex Type Bi-antennary N-Glycan Dodecasaccharide, Sun, B.; Srivinasan, B.; Huang, X., *Chem. Eur. J.* **2008**, *14*, in press

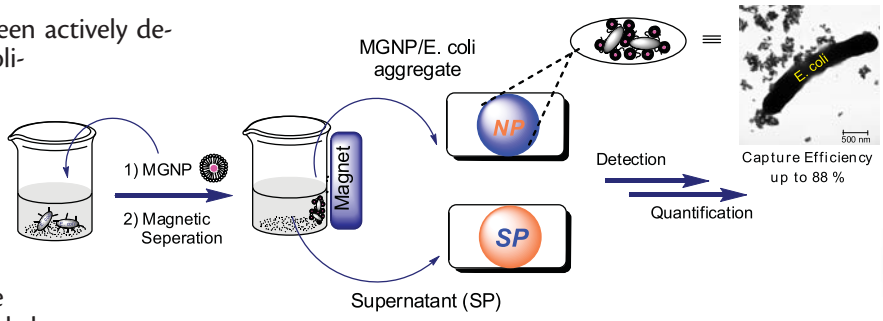
The major emphasis of our research is on chemistry and biology of carbohydrates. Carbohydrates play important roles in many biological processes such as inflammation, tumor metastasis, bacterial and viral infections. Detailed understanding of many of these processes is still lacking. Building on our strength in synthetic chemistry, we take a multi-disciplinary approach to study this important class of molecules. Our research encompasses several areas including synthetic organic chemistry, nanoscience and immunology.

In the synthetic chemistry area, we have been actively developing novel methodologies for assembling oligosaccharides. Traditional carbohydrate synthesis is quite tedious and time-consuming. We have designed two one pot methods, by which multiple glycosylation reactions can be performed sequentially in one reaction flask without intermediate purification. This significantly expedites the overall synthetic process. One of the methods we developed, the pre-activation based iterative one-pot method, has achieved higher synthetic efficiency in several syntheses compared to the automated solid phase based method. The one pot methods we developed are being applied to total synthesis of a wide range of complex oligosaccharides.



A tumor associated carbohydrate antigen assembled by the pre-activation based one-pot method

In our nanoscience program, the unique combination of magnetic nanoparticles and diverse carbohydrate bioactivities prompts us to investigate magnetic glyco-nanoparticles (MGNP). Many pathogens use mammalian cell surface carbohydrates as anchors for attachments, which subsequently results in infection. We demonstrated that using MGNPs, we can not only rapidly detect pathogens such as *Escherichia coli* (*E. coli*), but also remove them through a simple magnet induced separation. Moreover, the response patterns of pathogens to MGNPs can be utilized to readily decipher the identity of the pathogen. This provides an exciting new avenue for pathogen decontamination and diagnostic applications.



In the immunology area, we are actively studying the possibility of developing carbohydrate based anti-tumor vaccines. It is well known that many tumor cells have unique carbohydrate patterns expressed on the cell surface. Immunotherapy targeting these carbohydrates is a promising approach for cancer treatment. However, the low immunogenecity of carbohydrates presents a formidable challenge. We are investigating novel methods for the enhancement of carbohydrate immunogenicity. We discovered that by displaying carbohydrate antigens such as Tn in an ordered manner on the surface of the cowpea mosaic virus (CPMV) capsid, very high antibody responses were generated. We will continue to study the therapeutic potential of this unique approach.