Synthesis of Tumor-Associated Carbohydrates (TACs) using Lewis Acid Catalysts

Cancer is a collection of diseases that result from uncontrolled cell division. The tumors are broadly classified as benign or malignant. Benign tumors are localized to a specific tissue, and thus, can be removed surgically with a limited chance for reoccurrence. On the other hand, malignant tumors undergo a process called metastasis to migrate to neighboring or distant tissues from the original site of occurrence. Since malignant tumors invade other tissues they are hard to detect and difficult to treat. According to the National Cancer Institute, 1.7 million cases of cancer were reported in 2014. Unfortunately, these numbers are on the rise and effective therapies against cancer are desired and extensively investigated. The tumor cells differ from normal cells with respect to certain genes, proteins and also various sugars (tumor-associated carbohydrates). The changes to the polymeric structure of the cell-surface carbohydrates upon the cancerous transformation of a cell are well-documented. These changes play a critical role in the metastasis of tumor cells. The identification of these biomarkers and their isolation or synthesis are vital to investigate methods for early diagnosis and effective treatments of cancer. The major bottleneck in advancing the research on TACs is the limited availability of these molecules in good quality and sufficient quantity. Chemical synthesis provides a solution by systematically building well-characterized molecules. However, most synthetic methods for making TACs are limited in terms of efficiency and scalability. Hence, there is a need to develop scalable & efficient protocols. Heterogeneous catalysis has a long history in synthetic chemistry and widely used industrially. This poster elaborates my efforts to develop new robust synthetic methodologies to synthesize TACs using heterogeneous Lewis acid catalysts.

Keywords: Cancer, Tumor-associated carbohydrates, Chemical synthesis, Catalysis