

Taiwan develops carbohydrate-based cancer vaccine

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Singapore: A research team led by Academia Sinica President, Dr. Chi-Huey Wong, and associate research fellow, Dr. Chung-Yi Wu of the Genomics Research Center (GRC) have developed vaccine candidates against prostate cancer and the pathogen that causes meningococcal meningitis, and have made further progress in understanding the connection between molecule of interest SSEA4 and the spread of cancer cells.

Cell surfaces are coated by sugar structures (glycans), which often differ on normal human cells and on bacteria or diseased cells (such as cancer cells). The differences in these sugar structures help disease cells to evade attacks from host immune systems and make diseases more deadly. They can also be exploited to develop anti-bacterial/anti-cancer vaccines, or used as early cancer detection tools; therefore, identifying and understanding these molecules has become an important topic in glycoscience research.

Prostate cancer is the most common cancer for men in developed countries such as the US. As the fatality rate increases gradually every year, prevention and treatment for the prostate cancer are urgently needed. In 2005, Dr. Hakomori discovered that the amount of RM2 antigen increases as prostate cancer progresses; therefore, RM2 antigen is an excellent biomarker for prostate cancer staging and a good target for developing prostate cancer vaccine. The research team from the GRC is the first ever to successfully synthesize this complex glycan molecule and further attach it to carrier protein CRM197 to create a prostate cancer vaccine candidate, which was combined the previously developed glycolipid adjuvant C34 for vaccine tests in a mice animal model.

The research team also synthesized the capsular sugars of the important but problematic *Neisseria meningitidis* (meningococcus bacteria) Serogroup W135 and then used them to synthesize vaccines and test them on mouse models using the same strategy as with the prostate vaccine research above.

The results showed that the vaccines successfully induced antibodies to neutralize the sugar structures. The vaccines then were further examined to demonstrate the bactericidal activity of various lengths of sugars, and the results showed that the length as short as tetrasaccharide (with 4 sugars) could sufficiently induce bactericidal activity. The effectiveness of this synthesized vaccine may revolutionize the requirement of high biosafety level for current *Neisseria meningitidis* vaccine production, in which the necessary polysaccharides are acquired from pathogenic bacteria and often exist as mixtures of

many components. This study also provides a new approach to obtain the necessary polysaccharides by synthesis to create a molecular vaccine that is homogeneous, more consistent, and better quality controlled.