Pseudomonas aeruginosa, a Gram-negative opportunistic pathogen, causes severe nosocomial infections in individuals with conditions such as cystic fibrosis and severe burns.[6] The mortality rate for *P. aeruginosa*-induced pneumonia exceeds 30%, while septicaemia caused by *P. aeruginosa* can result in fatality rates of 80−90%. Eradicating *P. aeruginosa* is increasingly challenging due to its resistance to many antibiotics, highlighting the urgent need for new therapies. The World Health Organization (WHO) has identified *P. aeruginosa* as the high priority pathogen requiring a development of new antimicrobial agents. While several vaccine candidates have entered clinical trials, their effectiveness was insufficient, hence there is currently no approved vaccine for *P. aeruginosa*.

Lipopolysaccharide (LPS) is a major surface antigen of these bacteria. LPS contains well exposed on the surface O antigen and is a crucial virulence factor of *P. aeruginosa.* Thus, O antigens are considered potential vaccine antigens. There are 20 major serotypes (O1−O20) of *P. aeruginosa* identified to date. A heptavalent LPS vaccine candidate Pseudogen (the serotypes O1, O2, O3, O5, O6, O10, and O11), and an octavalent O-antigen conjugate vaccine candidate Aerugen (the serotypes O1, O2, O3, O4, O5, O6, O11, and O12) showed great potential in clinical trials, but showed insufficient effectiveness. Moreover, they were prepared from natural isolated O antigens. Synthetic oligosaccharide-based vaccines are free from bacterial contaminants and aid in the identification of key epitopes, providing an attractive alternative in the process of developing an effective vaccine against *P. aeruginosa*.

The project aims to achieve several key objectives. At first the glycosylation methods and controlled amine functionalization techniques will be developed to efficiently synthesize *P. aeruginosa* O-antigen-derived oligosaccharides for further vaccine development. Then an oligosaccharide comprehensive library corresponding to the O-antigens of *P. aeruginosa* serotypes O2, O5, O10, and O19 will be created. This library will vary in length and sequence of oligosaccharides to cover a wide range of potential vaccine candidates (**tasks of Chinese scientists**). The immunogenicity of the synthesized oligosaccharides will be tested to identify those that elicit a strong immune response - the crucial step for discovering the most promising vaccine candidates. Simultaneously, the project will investigate how selected oligosaccharide-based glycoconjugates are processed and presented by antigen-presenting cells of immune system. Understanding these pathways will help in designing effective glycoconjugate vaccines. Native O-antigens of *P. aeruginosa* O2, O5, O10, and O19 serotypes will be used to generate monoclonal antibodies specific to these antigens. These monoclonal antibodies will be instrumental in precisely elucidating the structure-immunogenicity relationship of the oligosaccharide antigens (**tasks of Polish scientists**).

This interdisciplinary project bridges the fields of carbohydrate chemistry, glycobiology, and immunology. International collaboration between chemists, who provide well-defined carbohydrate antigens, and glycolbiologists and immunologists, who are specialists in glycobiology, adaptive immunity, and antibody development, is essential for the project's success. The ultimate goal is to develop a synthetic oligosaccharide conjugate vaccine against *P. aeruginosa*, which could also serve as a valuable reference for immunogenicity investigation of other bacterial carbohydrate antigens.