CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

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Project Number

S0423

Project Title

Synthesis and Biological Evaluation of a Glycoprotein as Antibacterial Agent

Abstract

Objectives/Goals

The purpose of this project was to synthesize cell surface carbohydrates found on both bacterial and human cell walls as modified glycoconjugates to assist in the inhibition of bacterial binding to human cells and eliminating bundle forming pili. They will serve as receptors, meant to inhibit localized adherence of the bundle forming pili of bacteria such as mutant Enteropathogenic Escherichia Coli.

Methods/Materials

The synthesis included the incorporation of the N-benzoyl lactosamine with 8-methoxycarbonyloctyl linker for its attachment to the protein (BSA). The synthesis of the glycoprotein involved the preparation of the monosaccharide components followed by their attachment to each other and finally to the carrier protein. Two key building block intermediates given the names acceptor and donor monosaccharide respectively were synthesized and joined together via a glycosylation reaction to obtain the protected disaccharide. The glycoprotein that was synthesized was then put through the first of a two part biological testing. The first of which, included testing whether the formed glycoprotein would disrupt an already colonized group of E-Coli. This was done through a MIC (Minimum Inhibitory Concentration) test. The second part of the biological testing is currently underway and tests the binding efficiencies of the glycoprotein to the E-Coli (EPEC)and if the glycoprotein prevents EPEC from colonizing and damaging the host cell.

Results

The accuracy with respect to structure of the product obtained was confirmed with NMR results. Furthermore, the accuracy of the product achieved with respect to molecular weight was achieved through mass spectrum analysis. The mass spectrum of the desired compound was estimated to be around 638 mass units. Mass spectrum of the compound synthesized showed the final official mass of 638.37 mass units confirming the great accuracy of the product. The MIC test showed that the glycoprotein does not disrupt already colonized bacteria. This, although, was expected for the glycoprotein was designed to inhibit the binding of the EPEC to the host cell (currently under testing), essentially to prevent colonization from ever occurring, not to disrupt already colonized bacteria.

Conclusions/Discussion

In conclusion, the desired glycoprotein was synthesized with great accuracy. The first of the two part biological testing has been completed and the second part is currently underway.

Summary Statement

The goal of the project was to synthesize a modified cell surface carbohydrate as a glycoprotein to act as a means by which to prevent EPEC (Enteropathogenic Escherichia Coli) from attaching to a host cell.

Help Received

Supervision of Optimer Pharmaceuticals Chemistry and Biology Departments.