

26G-ISMS26 **Structural Basis for Activation of *Neisseria Meningitidis* Elongation Factor P with Arginine-32 Rhamnosylation by EarP**

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Protein glycosylation is a universal post-translational modification regulating many cellular processes. The only known protein arginine rhamnosyltransferase, EarP, specifically rhamnosylates Arg32 of elongation factor P (EF-P). We report a crystallographic study of *Neisseria meningitidis* EarP. EarP binds the entire beta-sheet structure of domain I of EF-P, forming numerous interactions that specifically recognize its conserved sequences. This recognition mechanism, which is both structure- and sequence-specific, sharply contrasts with those of other known glycosyltransferases that accept substrates with different sizes and/or sequences. A molecular dynamics simulation suggested that the rhamnose moiety should change its conformation during the reaction. These insights should facilitate the development of new EarP inhibitors that target only EarP-containing pathogenic bacteria.