Gonorrhea is the second most common sexually transmitted infection in the United States, with nearly 350,000 cases reported in 2013 by the Centers for Disease Control. Untreated infections can lead to pelvic inflammatory disease, infertility, gonococcal arthritis, and increased risk of contracting and transmitting HIV. Strains of *N. gonorrhoeae* with decreased susceptibility to extended-spectrum cephalosporins (ESC) have emerged, marking this pathogen as a major public health concern. Two strains exhibiting high-level ESC resistance have now been isolated, one in Japan (H041) and one in France (F89). Cephalosporin resistance in *N. gonorrhoeae* is conferred by mosaic *penA* alleles encoding penicillin-binding protein 2 (PBP2) variants containing several amino acid changes compared to wild type. Although H041 is classified as the first multidrug-resistant strain of *N. gonorrhoeae*, it does retain some susceptibility to ertapenem and meropenem, suggesting that discovery of new carbapenems is a viable approach to developing anti-gonococcal agents. The aim of this study is the design and synthesis of novel carbapenem-based compounds exhibiting greater PBP2 inhibition compared to known β-lactams. The Davies lab has solved a high-resolution crystal structure of a mutant PBP2 construct in complex with meropenem, allowing for design of ligands with enhanced complementarity to the altered binding pocket. From the molecular structures of meropenem and ertapenem, a virtual library of derivatives was designed employing functional group variation and isosterism. Each compound was docked to the PBP2 construct *in silico* to simulate the dynamics of binding. Using this data, and considering such factors as drug-like properties (ClogP, metabolism, toxicity, etc.) and tractability of synthesis, a group of lead compounds was identified. A facile synthetic route involving the reaction of thiols with \( p \)-nitrobenzyl-(4R,5S,6S)-3-(diphenyloxy)phosphoryloxy-6-[(1R)-1-hydroxyethyl]-4-methyl-7-oxo-1-azabicyclo[3.2.0]hept-2-ene-2-carboxylate was developed and adapted for the production of the selected compounds. The synthesized leads will be tested against PBP2 variants with a range of cephalosporin resistances.