The goal of computer-aided cryptography is to develop tools that help the rigorous design and analysis of cryptographic constructions. Over the years, the focus of computer-aided cryptography has expanded from analysis of cryptographic protocols in the symbolic model to include new goals. Most notably, these goals include analyzing cryptographic primitives and protocols in the computational model, and reasoning about implementations. In this talk, I will illustrate how existing techniques from program verification and program synthesis can be used for achieving a number of goals in computer-aided cryptography.