Complex arrays of interconnected pathways govern the behavior of many cellular processes, including those used to survive in hostile environments and to invade other organisms. How cells decide which processes to activate and which ones to deactivate is most often still unknown. What is known is that these decisions are often mediated by interlocking positive and negative feedback loops. These feedback loops are thought to dynamically coordinate complex cellular responses to different environmental signals. In this talk, I will discuss recent work where we have characterized the role of interlocking feedback loops in regulating a number of cellular processes. Starting with two simple systems involved in the regulation of antibiotic resistance in bacteria, I will show how interlocking feedback loops are used to shape the response and governing regulation of these systems. I will then extend these ideas to two more complicated systems involved in bacterial pathogenesis and the innate immune response.