Decades of molecular biology investigations and recent quantum leaps in genomic technologies have given us a blueprint of the cell, including a map of its signaling cables and main response actuators. We now face the monumental challenge of understanding how signals flow in these cables and deciphering cellular information transmission protocols. We also need to generate quantitative and predictive models of the pathways involved in different cellular responses, and to systematically trace their interconnections.

Our lab works at the interface of biology, engineering, and mathematics to address these challenges. A hallmark of our approach is the use of different cellular systems as specific testbeds to approach general questions about cellular logic, including signal encoding/decoding and the functions and implementations of feedback control. Our projects often involve rounds of iterations between computational and experimental investigations, powered by development of novel computational and experimental technologies.