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**Changing Chasses and Inventing Elements: Developing a Combined Systems Biology and Engineering Approach to Designing Complex Function in Cells**

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To meet the goal of creating reliable, predictable, efficient, and transparent methods to harness cellular capabilities for human benefit, it is necessary both to have standard libraries of elements from which useful pathways can be constructed and an understanding of the how host physiology and the environment impacts the functioning of these heterologous circuits. We show how variations in cellular and environmental context affect the operation of the basic central dogma functions underlying gene expression. Then we describe progress on creating a complete, scalable, and relatively homogeneous and designable sets of part families that can control central dogma function predictably in the face of varying configurations, genetic contexts, and environments. We show the challenges that arise in attempting this in applications such as a tumor destroying bacteria.