

## **Some Grand Challenges in Synthetic Biology\***

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Biology is replete with systems that accomplish amazing tasks. These systems are always complex and in all but a very small fraction of cases, poorly understood. A classic method of understanding a system is to create a synthetic system that mimics essential and defining aspects of the biological system, something that may be broadly termed “synthetic biology”. A good example is the recent effort to create an artificial cell. Successful synthetic biological work not only helps illuminate the biological system that inspired it, but invariably leads to additional non-biological applications. Synthetic biological systems tend to defy disciplinary categorization, typically requiring a mix of biology, chemistry, physics, technique development, and engineering. Synthetic biological systems also require a very broad toolkit. X-ray methods are certainly part of the toolkit, but only a part. True grand synthetic biological challenges will require decades of effort from many scientists – anything else is aimed too low.

Posing grand synthetic biological challenges, and outlining plausible strategies to attack the challenges, sharpen goals and catalyze ideas. I will pose several examples of grand challenges in synthetic biology in the hopes of stimulating young scientists.

\* This talk was inspired by one I gave to the National Research Council a number of years ago.