

Applications of Synthetic Biology in Medical Field

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DESCRIPTION

Synthetic biology is an evolving technology that uses the principles of physics, chemistry, mathematics, and biology. Synthetic biology is the technology enabler that could be applied across all fields such as agricultural, food, health, chemical, and industrial manufacturing sectors. Synthetic biology aims to produce functional devices, systems and organisms with novel and beneficial functions on the origin of catalogued and standardized biological building blocks. Although they were primarily constructed to explicate the dynamics of simple processes, designed devices now contribute to the understanding of disease mechanisms, provide novel diagnostic tools, enable economic production of therapeutics and permit the design of novel approaches for the treatment of cancer, immune ailments and metabolic disorders, such as diabetes and gout, as well as a range of infectious syndromes.

Synthetic biology covers the engineering of biological systems with structures and functions not found in nature to process information, manipulate chemicals, create energy, maintain cell environment and improve human health. Synthetic biology strategies contribute not only to progress our understanding of disease mechanisms, but also provide novel diagnostic tools. Procedures based on synthetic biology allow the design of novel approaches for the treatment of cancer, immune diseases metabolic disorders and infectious diseases as well as the production of cheap drugs. The potential of synthetic genome, utilizing an expanded genetic code that is designed for definite drug synthesis as well as delivery and activation of the drug *in vivo* by a pathological signal, was already pointed out during a lecture

delivered at Kuwait University in 2005 of two methodologies to synthetic biology, top-down and bottom-up, the last is more relevant to the progress of personalized medicines as it provides more flexibility in constructing a partially synthetic cell from basic building blocks for a desired task. Over the past years, synthetic biology applied to higher eukaryotes, such as mammalian cells, has rapidly evolved from the improvement of simple gene switches and gene networks to complex and to therapy-oriented circuits. Currently, mammalian synthetic biology provides approaches for gene- and cell-based therapies with an extensive range of applications, such as artificial insemination, personalized medicine and the treatment of cancer, metabolic and immune ailments.

Synthetic biology uses interchangeable and standardized “bio-parts” to make complex genetic networks that comprise sensing, information processing and effector modules: these permit robust and tunable transgene expression in response to a change in signal input. The rise of this field has coincided closely with the emergence of regenerative medicine as a distinct discipline. Unlike synthetic biology, regenerative medicine uses the natural capabilities of cells to make trophic factors and to produce new tissues as they would in normal improvement and tissue maintenance. synthetic biology methods are applied to the problem of regeneration, has the potential considerably to improve our ability to help the clinical need. The combination of Synthetic Biology and translational tissue-engineering methods could enhance the field of personalized medicine, not only from a regenerative medicine perspective, but also to provide frontier tools for building and transforming the research landscape in the field of *in vitro* and *in vivo* ailment models.

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