Building a global alliance of biofoundries

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Building a global alliance of biofoundries


Biofoundries provide an integrated infrastructure to enable the rapid design, construction, and testing of genetically reprogrammed organisms for biotechnology applications and research. Many biofoundries are being built and a Global Biofoundry Alliance has recently been established to coordinate activities worldwide.

Over the past 5 years, research institutions around the world have been establishing biofoundries to expand their biotechnology development capacities. However, the existence of these biofoundries is not yet widely known within the biotechnology or broader biological research community.
Foundry1, which for example can process over 2000 DNA throughput, current exemplars include the Edinburgh Genome insights into the complexity of living systems. In terms of reprogramming of living cells for biotechnology and biomedical establishment biodesign rules that can be applied for the efficient manufacturing process engineering. One aspirational goal is to commercialization of engineering/synthetic biology and biomanufacturing/synthetic biology industry as well as accelerating the enhancement the design process. Other goals include building a robust engineering/synthetic biology industry as well as accelerating the commercialization of engineering/synthetic biology and biomanufacturing project engineering. One aspirational goal is to establish biodesign rules that can be applied for the efficient reprogramming of living cells for biotechnology and biomedical applications. Such reprogramming will also allow fundamental insights into the complexity of living systems. In terms of throughput, current exemplars include the Edinburgh Genome Foundry1, which for example can process over 2000 DNA assemblies.

**Fig. 1** The Design-Build-Test-Learn (DBTL) biological engineering cycle. In simple terms the DBTL framework aims to fulfill particular design criteria for a synthetic biology application, which might for example be the production of a specific product at an optimal titer or the detection of a specific clinical biomarker using an engineered gut microbiome. The cycle begins with D (Design), which defines the desired target function/ specifications and involves the computational design of genetic parts, circuits, regulatory and metabolic pathways to whole genomes; B (Build) involves the physical assembly of those designed genetic components; T (Test) involves the prototyping and testing of the assembled genetic designs in living cells (also called “chasses”) at different scales, which also includes comprehensive analytical measurements (“omics”) of specific cellular components. This can also include testing components in cell-free extract systems; L (Learn) is the application of modeling and computational learning tools, which uses the data obtained in T to inform the design process. Iterations of the DBTL cycle results in genetic designs that aim to fulfill the design specifications established in D. In the figure the DBTL cycle is depicted around an imagined biofactory or biorefinery where many products will be produced using more sustainable and circular economic processes forming the future infrastructure for a global bioeconomy. (Credit: Christopher Johnson, DOE Agile BioFoundry, Golden, CO, USA)
To achieve these objectives, the GBA will provide coordination between Alliance members and promote collective action and sharing of pre-competitive infrastructure, open standards, protocols, best practices, bio-parts, and data where possible. This will also involve exploring standardized legal tools to reduce the transaction costs of sharing including the OpenMTA. The GBA will also allow increased visibility about the role and importance of biofoundries by reporting on success stories and positive impacts. Other activities will involve the exchange of sustainable business models, as well as approaches to lowering transaction and operational costs and expanding user bases; and personnel exchanges, including developing teaching and training programs for researchers and users of biofoundry facilities. The GBA will actively and transparently engage a broad range of stakeholders including policy makers, industry, public funding and government agencies, as well as civil society to continually improve GBA activities and practices.

To strengthen the coordination and collaboration within the GBA, the Alliance will also explore opportunities to tackle a globally relevant, societally impactful grand challenge (e.g., directly addressing one of the UN sustainable development goals) with each biofoundry bringing its unique strengths and capabilities to the problem. GBA members will also explore bilateral collaborations on smaller-scale projects (e.g., biofoundry performance testing and benchmarking). The benefits of the GBA are anticipated to be analogous to those experienced by the synthetic yeast genome Sc2.0 project, in which internationally distributed participant teams share a common scientific and engineering biodesign goals.

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N.H. and P.S.F. conceived the idea of a commentary and all authors contributed to the writing and/or editing of the article.

Additional information
Competing interests: Nathan J. Hillson has financial interests in TeselaGen Biotechnologies Inc. and Ansa Biotechnologies Inc. All other authors declare no competing interests.

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