

Tips on how to build a better home for biological parts

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Researchers at the Virginia Bioinformatics Institute (VBI) at Virginia Tech have compiled a series of guidelines that should help researchers in their efforts to design, develop and manage next-generation databases of biological parts. The stakes are high: the concept of biological parts is essential if methods developed in other fields of engineering are to be applied to biology.

If successful, this approach will result in significant productivity gains for the biotechnology industry. The findings of the research, published in the Public Library of Science's open-access journal *PLoS One*, arose from a systematic analysis of the Registry of Standard Biological Parts, the most well developed collection of biological parts currently available to the synthetic biology research community.

Jean Peccoud, associate professor at the Virginia Bioinformatics Institute, remarked: "Our research group is very interested in providing the wider research community with design automation tools that will facilitate the engineering of biological systems. We needed to take a close look at the Registry of Standard Biological Parts in order to understand how GenoCAD™, the platform we are developing to build and verify complex genetic constructs, should interface with this important community resource.

In this process, we came to understand that repositories of biological parts represent a new generation of bioinformatics databases that pose a number of original and very interesting challenges." He added: "We

believe that articulating the issues associated with these resources will help improve existing databases of biological parts. It will also assist in the development of new collections of parts for specialized applications such as bioenergy or biodefense."

The Registry of Standard Biological Parts is a publicly available resource and the focal point of the annual International Genetically Engineered Machine (iGEM) competition. iGEM undergraduate students engineer novel biological systems starting from BioBricks, the parts documented in the Registry of Standard Biological Parts. The BioBrick is an emerging standard for DNA fragments that facilitates the assembly of biological parts into more complex devices and systems by using a standardized fabrication process. The entire collection of parts associated with the Registry is distributed to all teams enrolled in the iGEM competition. The iGEM participants are expected to return the designs they made to the Registry at the end of the competition.

The new study by VBI researchers not only examined the information content of the Registry database but also the collection of publicly available DNA sequences or clones (BioBricks) that are used to make the biological devices and systems. The analysis of the Registry database and the associated DNA clones identified several key needs where improvements could be made. These included the following: (a) to distinguish basic parts and composite parts that can be broken down into smaller parts; (b) to set curation standards to document the sequences of basic parts by associating them with entries in bioinformatic or bibliographic databases; (c) to define and implement quality control standards that ensure the integrity of DNA clones; and (d) to provide editorial policies that could help build registries of biological parts with high-value and high-quality content.

Peccoud concluded: "The Registry of Standard Biological Parts has been a pioneering experiment for the synthetic biology community and

lessons should be learned to improve this resource and design the next-generation registries of biological parts. This bottom-up approach to biology raises a number of challenging theoretical questions. Defining what is a biological part, for example, remains a problem that the entire synthetic biology community needs to solve. In this respect, recent initiatives led by the BioBrick foundation and others to organize forums that define technical standards for biological parts appear to be very timely and laudable."

Source: Virginia Tech

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