

From: CU-Boulder 2013 iGEM Team

To: iGEM Headquarters

## **Our Proposal**

Thanks in large part to iGEM and the BioBricks foundation, the parts that make BioBrick assembly possible are now readily available. However, the lack of accessibility to quality protocols that maximize the potential of these parts has become problematic. We believe that the process of developing effective methods and protocols for the variety of techniques that are required for BioBrick assembly could be greatly expedited by creating a forum that promotes collaboration within this discipline. Fortunately, the platform for this forum is already in place: iGEM and the Registry of Standard Biological Parts. The 2013 CU-Boulder iGEM team would like to propose to iGEM headquarters the expansion of the Parts Registry and medal requirements to include not only parts, but methods and protocols as well. We believe that having dependable, well-tested protocols is just as important as having well characterized parts. Utilizing the Parts Registry's existing infrastructure should help streamline integration of this proposal, and we are committed to assisting iGEM in the implementation of these changes.

## **Justification**

When our team began working in the lab to develop our project last June, most of our team had very little experience with the techniques involved with BioBrick assembly, and our early results were discouraging. Even relatively basic procedures such as preparing competent cells and performing chemical transformations were largely ineffective. We quickly realized that if our project was to have any success, we needed to develop reliable protocols for performing these techniques. We found that there are a large number of protocols available from various sources, and our searches enlightened us to several key issues:

1. There is no single location where one can find a large number of effective protocols.
2. Almost all protocols have minimal documentation, often resulting in vague instructions with little or no justification for their methodology.
3. It is nearly impossible to find a protocol that has been validated by multiple parties.

With some valuable guidance from our advisors, a significant amount of our first month of lab work was devoted solely to testing the effectiveness of a number of protocol variations so that we could conquer the basic techniques and move forward with our project.

We suspected that we were not the first iGEM team to encounter these struggles, so we decided to ask this year's iGEM teams about their experiences with protocol reliability. This survey yielded 62 responses from teams from each major region. A staggering 79% reported that their team had at least minor difficulties with protocol reliability in this year's competition (survey results are provided in the appendix). This brings the quality of existing protocols into question and suggests that a considerable amount of time and effort is expended toward "reinventing the wheel" not only this year, but every year if these results are representative. If the Registry were expanded to include protocols, it would allow future teams to validate and improve the efficacy of these central techniques by contributing to the experience section of existing protocols, or by submitting their own. In the near future, iGEM teams would have an improved ability to perform all of the procedures essential to BioBrick assembly and will be able to focus their efforts solely on developing their projects, without being derailed by unreliable protocols.

To provide an idea of what we think this should look like, we submitted one of the protocols we developed this summer to the registry as a false part (the link is provided in the appendix). We provided the link to this part in the survey that we sent out to iGEM teams in order to gauge interest for this idea. 93% of teams thought that it would be useful if the registry had protocols like this available. The documentation for this protocol includes the standard format which lists the materials needed and provides step-by-step instructions, as well as a tabulated form and a GoPro video that documents the entire process. With your approval, we have several other protocols we would like to submit to provide a foundation for this section of the registry. We also have documented experiments for several of these protocols, which investigate the significance of various parameters. These can be added to the experience section to provide an example of how useful this section can be for improving protocol justification.

We acknowledge that there are several online forums that have attempted to accomplish a similar goal, including one that is endorsed by iGEM – *OpenWetWare*. However, the maintenance for this forum and several other similar forums has been non-existent for a number of years. So, how is our proposal different and why will it succeed where others have failed? We have identified several key factors that we believe will contribute to the success of this project:

1. A very specific focus.
2. An incentive system.
3. A forum with a proven track record.

*OpenWetWare* was a very ambitious project, a central hub for synthetic biologists that provided a forum for the collection of lab notebooks and protocols, the creation of blogs and online courses for synthetic biology. This type of forum requires a large time commitment in order to maintain, and relies upon contributions from visitors of the site. These obligations were perhaps too demanding to be realistic. Narrowing the focus to protocols alone will improve the chances of contribution by minimizing the ambiguity of expectations surrounding participation. By utilizing the infrastructure of the Parts Registry, very little upkeep will be needed beyond what is currently required to maintain the Registry. Lastly, with an incentive for contribution via the iGEM competition, the expectation for contribution becomes a more realistic possibility.

## **Implementation**

To implement this proposal, we suggest that protocol submission be treated exactly as part submission up to the point of adding the part to the registry. This is a process that has been proven to work, and that all parties involved are comfortable with. This will also streamline integration by utilizing the pre-existing infrastructure with only two minor changes necessary. First, there will need to be an option for “Protocol” added to the “Part Type” dropdown menu that is a required field when adding a new part to the registry. Second, a “Protocols” menu item will need to be implemented on the main page of the registry so that teams are able to access this specific subset of “parts”, which allows easy access to a central location for all submitted protocols. We believe adhering to the existing submission process provides the best opportunity for this to be successful, and also makes this transition as seamless as possible.

Lastly, we suggest that the bronze and silver medal requirements are amended to allow protocols to be an option for fulfilling these requirements. Specifically:

1. Document at least one new standard BioBrick part or protocol used in your project and submit it to the registry. (Bronze)
2. Document the characterization of this protocol or improve the documentation of an existing Protocol and enter this information into the registry. (Silver)

77% of the respondents to our survey felt that future iGEM teams would be likely to contribute to protocols in the registry if this was an option for fulfilling basic medal requirements. Making these small adjustments would provide an incentive structure that encourages teams to contribute and collaborate toward our goal of ultimately improving the quality of the protocols that are used by all future iGEM teams.

## Conclusion

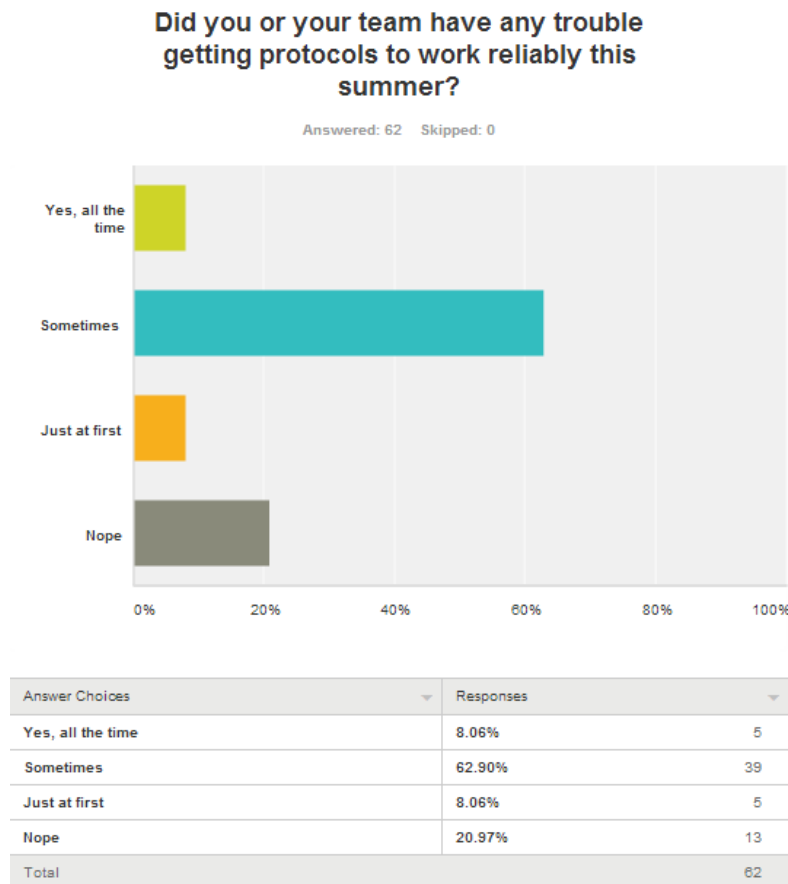
We believe that expanding the Registry of Standard Biological Parts as well as the medal requirements of the iGEM competition to include protocols is in the best interests of future iGEM teams and to the field of synthetic biology as a whole. We hope that you will strongly consider our proposal and we are happy to assist you in the design and implementation of this proposal. We would also be proud to submit the protocols that we established this summer to provide the foundation for a protocols section within the registry. Thank you for your time, as well as your efforts toward the development of the iGEM competition, which has made all of this possible.

## Appendix

The link to the protocol that we uploaded to the registry:

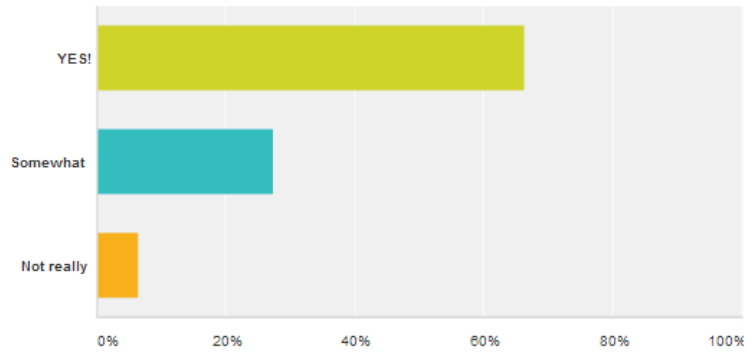
[http://parts.igem.org/wiki/index.php?title=Part:BBa\\_K1188007](http://parts.igem.org/wiki/index.php?title=Part:BBa_K1188007)

The results of the survey we conducted:



Would you or your team find it useful if the iGEM registry included a section for protocols? Like this one --> [http://parts.igem.org/wiki/index.php?title=Part:BBa\\_K1188007](http://parts.igem.org/wiki/index.php?title=Part:BBa_K1188007)

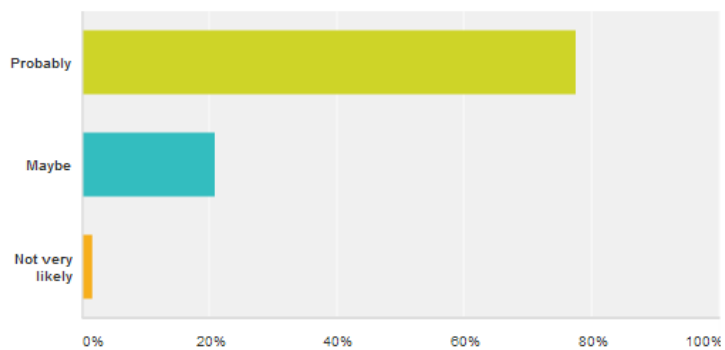
Answered: 62 Skipped: 0



Answer Choices	Responses
YES!	66.13% 41
Somewhat	27.42% 17
Not really	6.45% 4
Total	62

Do you think future iGEM team's would contribute to protocols in the registry if this was an option for completing bronze or silver medal requirements? (i.e. Improve documentation for an existing part OR protocol.)

Answered: 62 Skipped: 0



Answer Choices	Responses
Probably	77.42% 48
Maybe	20.97% 13
Not very likely	1.61% 1
Total	62