

# **CACAO: Linking Evidence-based Functional Annotations to Education**

**Brenley Kathleen McIntosh**

Texas A&M University, Department of Biochemistry & Biophysics, 300 Olsen Blvd., MS2128, College Station TX 77883 USA

([brenleymcintosh@gmail.com](mailto:brenleymcintosh@gmail.com))

A significant obstacle to analysis of gene function on genomic scales is the lack of experimentally supported functional information available in forms amenable to data mining and comparative analysis. The Gene Ontology (GO) provides a system for organizing this information, but capturing the experimental literature is overwhelming, even for genome databases with professional biocurators curating information from well-studied model organisms. Thus, efforts to enlist the broader scientific community in increasing the coverage and specificity of literature-based functional annotations have been attempted. Such community annotation initiatives often suffer from low throughput due to lack of participation. Here, we describe the CACAO (Community Assessment of Community Annotation with Ontologies), which provides an incentive to join the community annotation efforts by linking functional annotation to education. Teams of students at campuses around the world compete over multiple rounds to add, review and refine functional annotations that comply with the standards of the GO Consortium. During each round, teams have one week to find scientific papers, analyze experiments and add functional annotations to our website, GO-NUTS (<http://gowiki.tamu.edu>) and are given points for each complete annotation. During the second week of a round, teams review and challenge other teams' annotations, performing peer review of the student's understanding of the experiments cited as well as an opportunity to steal points for identifying and correcting errors. The CACAO competition has now been incorporated into molecular biology, chemistry, bacteriology, genetics and cell biology courses at twenty-two campuses and has created thousands of functional annotations for hundreds of species. Thus, CACAO provides a solution to the problem of community participation. A large fraction of the annotations are suitable for incorporation in the corpus of annotations deposited with the GO consortium and are being propagated to major database resources such as UniProt via EcoliWiki. We will describe the competition, how we assess of the quality of the annotations and how we deal with the large numbers of annotations created by the competition.

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