

# Customizable Electronic Laboratory Online (CELO): A Web-based Data Management System Builder for Biomedical Research Laboratories

Christine Fong<sup>2</sup>, MS and James F. Brinkley<sup>1,2</sup>, MD, PhD

Departments of <sup>1</sup>Biological Structure and <sup>2</sup>Medical Education and Biomedical Informatics Structural Informatics Group, University of Washington, Seattle, WA

A common challenge among today's biomedical research labs is managing growing amounts of research data. In order to reduce the time and resource costs of building data management tools, we designed the Customizable Electronic Laboratory Online (CELO) system. CELO automatically creates a generic database and web interface for laboratories that submit a simple web registration form. Laboratories can then use a collection of pre-defined XML templates to assist with the design of a database schema. Users can immediately utilize the web-based system to query data, manage multimedia files, and securely share data remotely over the internet.

Traditional data management methods, such as typewritten documents and spreadsheets, are becoming inadequate for finding, organizing, analyzing, and sharing the large volumes of data generated by today's research lab. Although informatics solutions have been developed in response to these issues, deploying such systems can have high monetary and time costs, often requiring the expertise of a database and web programmer. We have designed the Customizable Electronic Laboratory Online (CELO) to address these drawbacks of existing lab management systems.

CELO is an open source informatics solution designed to allow multiple laboratories to share a single database and web server in order to distribute resource costs. Each laboratory can quickly generate a new website and database on the system for managing research data by simply completing a web registration form. Researchers with no database programming background can utilize a set of CELO database schema templates in order to design the model for representing their research data. CELO consists of five major components: Perl CGI scripts and libraries, a collection of XML database template files, a main database shared between all laboratories, a set of individual laboratory MySQL databases, and a set of laboratory filesystem directories (Figure 1). A client remotely interacts with the server using a typical web browser.

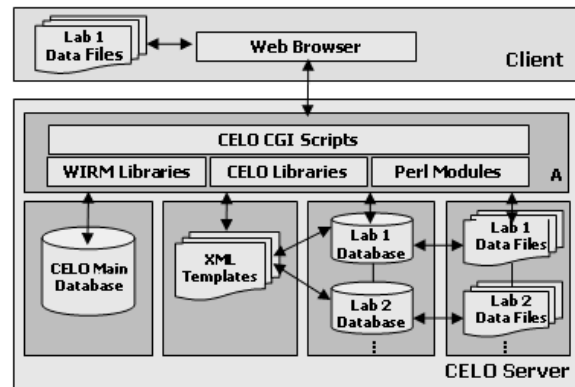


Figure 1. CELO System Architecture

We have performed an initial evaluation of CELO by generating four mock-up systems for real world research needs identified through our research collaborations. The systems include an eye image repository for a cataract research lab (Figure 2), experiment management systems for two separate human brain mapping laboratories, and a protein interaction database for organizing proteomics data. Our evaluation has demonstrated CELO's ability to efficiently build systems for basic research data management needs. We plan to perform further evaluation of CELO as used in practice.

Animal ID	Gene	Sex	Nim CAG repeats	Treatment	Day	Treated?	Age (months)	Image
1191	A	F	72	Crealine	0	No	1.3	
1191	A	F	72	Crealine	0	No	1.3	
1191	A	F	72	Crealine	0	No	1.3	
1191	A	F	72	Crealine	0	No	1.3	
1191	A	F	72	Crealine	7	No	1.6	

Figure 2. Eye Lab Image Repository

## Acknowledgments

Funded by NIH grants DC02310 and LM07714