

An Ontology-based Image Repository for a Biomedical Research Lab

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We have developed a prototype web-based database for managing images acquired during experiments in a biomedical research lab studying the factors controlling cataract development. Based on an evolving ontology we are developing for describing the experimental data and protocols used in the lab, the image repository allows lab members to organize image data by multiple attributes. The use of an ontology for developing this and other tools will facilitate intercommunication among tools, and eventual data sharing with other researchers.

The evolving Experiment Ontology (Figure 1), which is implemented in Protege (<http://protege.stanford.edu>), formalizes the data types associated with a biomedical experiment related to cataracts. Among these data types is a representation of digital slit lamp photos taken for several experiments. For example, images created during experiments investigating the SPARC protein's role in cataracts show the degree of cataract formation in experimental animals¹.

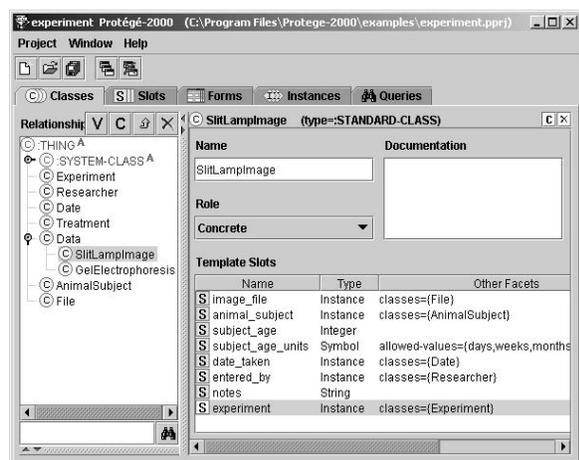


Figure 1: Ontology Design

The database schema for the image repository tool is based on the Experiment Ontology. The tool allows researchers to create instances of object types, such as Experiment, Animal Subject, Treatment, and Slit Lamp Image, modeled after the classes of the ontology. Object attributes, corresponding to the slots defined in the ontology, provide details about and link together the various

elements of the experiment. Data such as the slit lamp image files can then be associated with specific experiments, researchers or animal subjects. This design allows for querying of images by any combination of attributes such as the associated experiment, the ID of the animal subject, or the age of the animal subject (Figure 2). The Image Repository is implemented in WIRM (<http://wirm.org>), an open source experiment management system framework we initially created for managing brain mapping data.

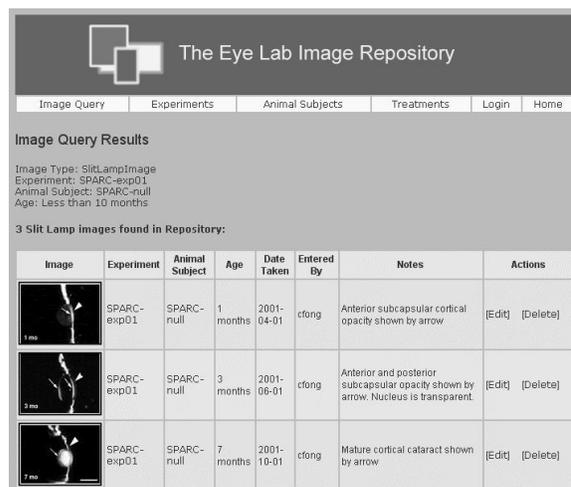


Figure 2: Image Repository Tool

In addition to enhancing the image repository, new tools based on the ontology will be developed for managing other types of data, for managing experimental protocols, for local data analysis, for sharing data, and for querying related shared databases on the Internet. Our longer term goal is to develop and generalize ontology driven methods for semi-automatically creating and sharing biomedical research data.

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1. Yan Q, Clark JI, Wight TN, Sage EH. Alterations in the lens capsule contribute to cataractogenesis in SPARC-null mice. J Cell Sci. 2002 Jul 1;115(Pt 13):2747-56.