

ROLE OF OMERO AS AN INTEROPERABILITY AND ANALYSIS PLATFORM FOR THE STRUCTURAL SCIENCES LEARNING CENTER UNIVERSITY AT BUFFALO

A NOVEL MULTI-SCHOOL APPROACH TO THE SCIENCE AND LEARNING OF HUMAN STRUCTURE

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THE HYPOTHESIS

- ✘ An image is *a self organizing set of data* which uniquely represents all of the genes, and all of the molecules and all of the cells in that scene at one point in time.
 - ✘ As a self-organizing piece of data the image can only uniquely have the phenotype which it presents. *An image is what it is for very specific reasons.*
 - ✘ Those reasons are the relationships amongst the genomics, and epigenomics, and proteomics, and metabolomics, and all the “omics” which go into making that image.
 - ✘ A high resolution image is a window onto the *relationships* amongst all of the genes, and all of the molecules and all of the cells in the scene at one particular point in time.

THE PROCESS

- ✘ Development of an ontology that represents the entities and relationships of the structures in the image
 - ✘ “An ontology is, simply put, a controlled structured vocabulary consisting of general terms (such as “image” or “tissue” or “microscope”) that are designed to represent the types of entities in the domain of reality that the ontology has been devised to capture.”¹
 - ✘ Engineer the ontologies needed to span the scale of imaging from the molecular to the macroscopic
 - ✘ Use of OMERO to allow interoperability of image processing algorithms being applied to the image data from a wide variety of sources

¹ Smith B, Arabandi S, Brochhausen M, Calhoun M, Ciccarese P, Doyle S, *et al* Biomedical imaging ontologies: A survey and proposal for future work. J Pathol Inform 2015;6:37.

THE PROCESS continued...

- × The ontological strategy is to integrate OME image meta data into OBI (Ontology for Biomedical Investigation) as an upstream structured logic and Quantitative Histopathology Image Ontology (QHIO) as a downstream algorithmic structured logic
- × Use OMERO's superior ability of structuring metadata for images but also incorporate logic for those metadata which aligns with upstream and downstream ontology logic
- × The ultimate goal is have OMERO become ontologically enabled

OMERO ROLL-OUT

- ✘ Initial roll-out of OMERO includes installation of the server running on a virtual instance of Ubuntu hosted by Eucalyptus
- ✘ Eucalyptus is an open-source Amazon Web Services compatible software for developing cloud-based computing environments
- ✘ Eucalyptus is running on hardware in the Center for Computational Research (CCR) at the University at Buffalo
- ✘ This takes advantage of the CCR's resources to permit instance/server scaling as the user base grows