New Digital Research Infrastructure Organization White Paper submission

Faculty of Dentistry, McGill University

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This paper covers the experience and needs of diverse members of research community working in the areas of dental medicine and oral health.

Introduction

Professors at McGill Faculty have research programs focused in four fields i) Pain and the Neurosciences; ii) Mineralized Tissues and Extracellular Matrix Biology; iii) Biomaterials, Nano-biotechnology and Tissue Engineering; iv) Population Oral Health including clinical, community (rural, remote, and Indigenous) and health-care services research, as well as oral epidemiology studies. Many of the research programs are inter-sectoral and multi-disciplinary in nature and have significant computational components. In general, members of the Faculty of Dentistry use digital infrastructure for the following applications: 1) data organization and storage, including clinical records and research databases containing data of different type which often requires e-linking; 2) image processing such as obtained from electron microscopy, confocal imaging, dynamic live cell imaging, magnetic resonance imaging and computed tomography; 2) computational modeling and complex data analysis. The goal of this paper is to describe the experience and ideas of our members on the questions posed by the New Digital Research Infrastructure Organization.

2. Current Issues.

Currently, members of the Faculty use computing tools at all infrastructure levels starting from personal resources such as computational tools or image analysis software installed on the laptop or desktop, to servers managed by individual laboratories or McGill IT, to the large scale

infrastructure and services such as Compute Canada HPC (High Performance Clusters) and Compute Canada Cloud used to store databases, install custom software, or host internal websites which cannot be installed on HPC.

While many resources for the common scientific projects are available, in general researchers note barriers in using these tools due to lack of the very specialized knowledge or time to invest in exploiting them. Often, there are no person who can train the researchers in utilizing the resources. Moreover, because there are many systems available, each with their own particularities, one has the relearn or remember how to use all systems, providing an additional barrier for all involved from the researcher to the systems administrator.

Resources relevant to a single project are often located in different physical locations. Therefore, data must be moved through the networks, which is a slow process and leads to duplication of data on many systems. Currently, there is limited possibility to manage integration between local and remote data with user-friendly data transfer software which works across different OS platforms.

Importantly, some tools common in other areas of medicine are not available for Dentistry. This includes electronic health records, web-patient portals and teledentistry real platforms. This leads to implementation barriers such as in exchange of data, data linkage and use of e-health in dental care.

2. The vision for a cohesive Canadian Digital Research Infrastructure

We envision the centralized Cloud resources accessible in one location, that would allow to link multiple data sources, including existing ones such as clinical data, phenotype data, genetics, omics, and imaging, as well as a possibility to link data obtained using any novel tool to the existing databases. Data access should allow for customized analysis of both cumulative and individualized data. The systems should be adaptable and flexible, customizable to allow most researchers to use them without spending additional resources on expensive systems or training. Importantly, the digital research infrastructure should include highly trained personnel as well as the hardware, so that the researchers can be provided a range of support starting from highly responsive technical support and regular training, to collaborative projects in which DRI personnel are expert members of the team.

Of specific importance and urgency to the field of Dentistry is incorporation of oral care with medical care to use tool such as standardized electronic health records. The close link between oral health and general health is well established now, and it is critical to work on incorporating oral prevention into primary care workflow.

3. How to bridge the gap

Build a database that allows linking different data relevant to the health of Canadians.

Develop adaptable protocols for data access and analysis

Invest in people proficient in supporting, promoting and developing this infrastructure and establish the accessible communication platforms for integration of DRI personnel in research projects, as well as using research projects for the development and testing DRI updates

Incorporate oral care within the general medical care electronic databases.