

# Experiences in enabling digital pathology for research in Victoria

Steve Quenette<sup>1</sup>, David Morrison<sup>2</sup>, Anne Thompson<sup>3</sup>, Mike Rebbechi<sup>4</sup>

<sup>1</sup>Victorian Partnership for Advanced Computing, Carlton Victoria Australia, [steve@vpac.org](mailto:steve@vpac.org)

<sup>2</sup>Victorian Partnership for Advanced Computing, Carlton Victoria Australia, [davidm@vpac.org](mailto:davidm@vpac.org)

<sup>3</sup>Victorian Cancer Biobank, Carlton, Victoria, Australia, [anne.thompson@cancervic.org.au](mailto:anne.thompson@cancervic.org.au)

<sup>4</sup>AARNet, Carlton, Victoria, Australia, [mike.rebbechi@aarnet.edu.au](mailto:mike.rebbechi@aarnet.edu.au)

## INTRODUCTION

The Victorian Cancer Biobank (Biobank) is a not-for-profit large-scale tissue-banking facility built on the expertise of four Consortium member tissue banks located at Austin Health, Melbourne Health, Peter MacCallum Cancer Centre and Southern Health. Following the successful application to the Victorian Government for \$7M in funds through a Science, Technology and Innovation (STI) grant the four founding members, together with Cancer Council Victoria as the Lead Agency, formed a Consortium. The Biobank aims to provide high quality clinically annotated biospecimens to researchers in academia and industry within Australia and internationally.

An operational model has been established that integrates a multi-site collection system with a centrally managed application process to streamline access to biospecimens by researchers in academia and industry. The collection system uses a “hub and spokes” structure where 22 private and public hospitals form the spokes around four Consortium member sites. Tissues, blood and derived biospecimens are processed and stored at the four hub sites. Once the Biobank Access Committee has ensured that biospecimens will be used for ethically approved research, Central Operations staff at the Cancer Council Victoria coordinate the dispatch of biospecimens from the four storage sites. To support the coordination of the application, approval and dispatch process and enable the inventory at each site to be viewed centrally, a web-based informatics system is being implemented.

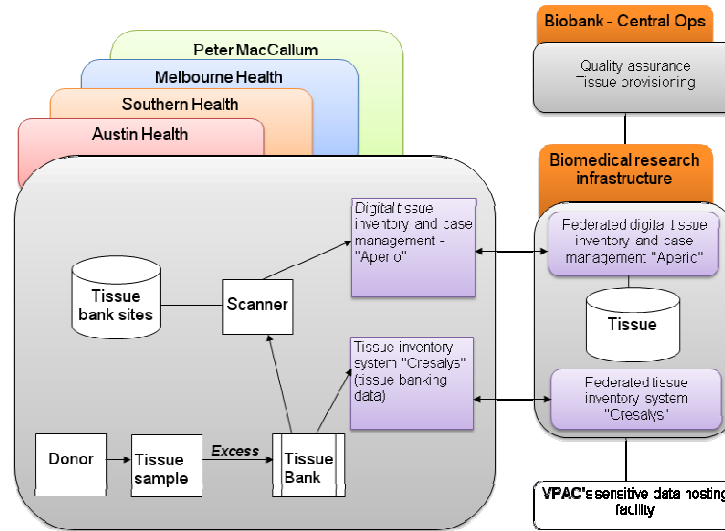
In 2008, as part of the Victorian Cancer Action Plan, the Biobank received additional funding to support translational research. Part of these funds are being used to deploy a pathology digital imaging systems across the member sites. This system will ensure that the required high quality biospecimens are available to researchers by enabling digital images of tissue sections associated with samples stored by the Biobank to be reviewed for quality assurance purposes. In addition researchers will be able to view samples online prior to applying for access and the digital imaging equipment will be available as a shared resource to molecular pathologists and researchers at each of the four Consortium member sites and associated sites using immunohistochemistry for gene expression analysis in tissue and tissue microarray sections.

The Victorian Partnership for Advanced Computing (VPAC) and the Biobank have commenced working together on an innovative eResearch project that will integrate the inventory management and digital pathology systems and provide digital biobanking functionality that is not currently available. This work highlights the need for significant networking infrastructure to deal with the explosion of data from digital scanners alone.

## ENABLING DIGITAL BIOBANKING

At each Biobank site, excess tissue from consenting donors is contributed into a local tissue bank. The *Cresalys* software system manages this inventory. A digital scanner and supporting systems manufactured by *Aperio* are used to scan pathology tissue sections associated with samples that form the Biobank inventory. These images are stored centrally. The digital scanning equipment is also made available to researchers at each site to create images that are stored locally.

Both *Cresalys* and the case (meta) management software for *Aperio* are hosted by VPAC within its sensitive data facility. The Biobank utilizes this production quality health IT solution to provide tissue provisioning services to research, and undertake quality assurance of the biobanking inventory across the member sites. The systems federation occurs over a VPAC managed VPN between the four member sites and the Biobank. This utilizes technology, conventions and architecture that satisfy the culture, security and privacy concerns of four of Melbourne’s large health service providers. As the initiative is driven for research, the solution needs to satisfy the appropriate cost concerns.

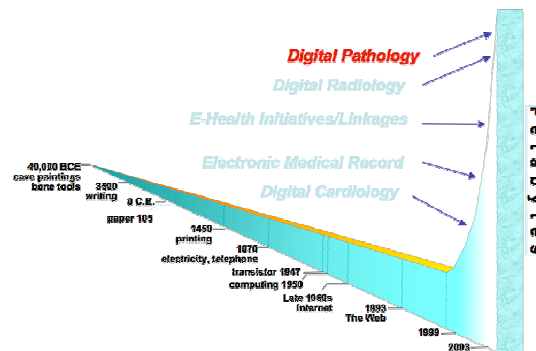


**Figure 2: Illustrates the data flow from the donor to the tissue bank and supporting software systems. The federation provides the platform for Biobank’s quality assurance and tissue provisioning services to research.**

Unfortunately, due to the significant network bandwidth required to transfer the image data to VPAC from the member sites, each site stores their data locally. Only the images associated to Biobank’s quality assurance practices will be transferred to VPAC by transporting hard-disks. This is an opportunity missed for research that crosses organizational boundaries.

### THE DATA OF DIGITAL PATHOLOGY

The major challenge of the transition to digital pathology is the dealing with the amount of data storage and data bandwidth required.



**Figure 1: The trend in data drivers over time and the digital pathology contribution to the “data explosion” [1].**

A typical slide of 20mm x15mm at 20X (.5micron/pixel) requires 1.2Gpixels of storage or 3.6GB. When compressed, this yields to about 200 to 500 MB per image. To put this into perspective, one year’s worth of digital imaging of clinical pathology at the Children’s Hospital of Philadelphia created 55,000 images [2]. That is approximately 30TB of data created per year.

Importantly, web based access to digital pathology images in the clinical setting will improve the clinical management of cancer patients in Victoria by replacing local review of microscope images of tissue sections on glass slides with collaborative remote web-based review of digital images by researchers and clinical pathologists.

### THE FUTURE

The reality is that few medical campuses have access to the bandwidth to support collaborative, data intensive research activities. Projects such as the BioBank will therefore will only be fully enabled by effective interconnection of health related research sites with the broader research and education community through AARNet. Unfortunately making this happen requires the provision of adequate tail links to the health campuses and the design and implementation of security

system and procedures that give health authorities the confidence to enable the connection of high bandwidth research tails to health networks.

Hence, in order to realise the benefits to translational research potential that the Biobank platform can provide, the Biobank has worked in collaboration with VPAC and AARNet to devise a cost effective high bandwidth network infrastructure across the partner sites for research purposes.

## **REFERENCES**

1. UC Berkeley, School of Information Management and Systems
2. Alexander R. Judkins, *Virtual Microscopy Clinical Interface Issues: The CHOP Experience*, Pathology Visions Conference, Oct 2008.