

## Chapter 4.15

# Digital Pathology and Virtual Microscopy Integration in E-Health Records

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### ABSTRACT

In anatomic pathology, digital pathology integrates information management systems to manage both digital images and text-based information. Digital pathology allows information sharing for diagnosis, biomedical research and education. Virtual microscopy resulting in digital slides is an outreaching technology in anatomic pathology. Limiting factors in the expansion of virtual microscopy are formidable storage dimension, scanning speed, quality of image and cultural change.

Anatomic pathology data and images should be an important part of the patient electronic health records as well as of clinical datawarehouses, epidemiological or biomedical research databases, and platforms dedicated to translational medicine. Integrating anatomic pathology to the “healthcare enterprise” can only be achieved using existing and emerging medical informatics standards like Digital Imaging and Communications in Medicine (DICOM®<sup>1</sup>), Health Level Seven (HL7®), and Systematized Nomenclature of Medicine-Clinical Terms (SNOMED CT®), following the recommendations of Integrating the Healthcare Enterprise (IHE®).

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## **INTRODUCTION: WHAT IS DIGITAL PATHOLOGY?**

Several socioeconomic factors have accelerated the dissemination of information technology in anatomic pathology. The spread in the use of Internet, the presence of computers in doctor's offices, and the increasing demand of second opinion from the patient has facilitated the adoption of local, national, and international governmental initiatives to explore and adopt digital pathology and telepathology programmes, and to support the developing of patient electronic health (e-Health) records. Patient electronic health records (EHR) should contain a full range of data set, including the digital images of all types of imaging studies ever performed on the patient.

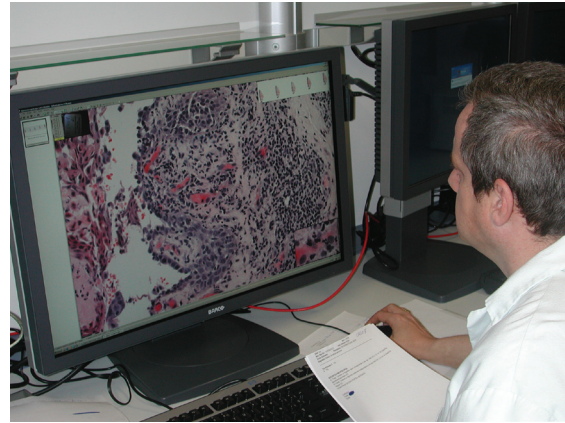
The concept digital pathology comprises the information technology that allows for the management of information, including data and images, generated in an anatomic pathology department. Anatomic pathology information system and digital imaging modalities are two main components of digital pathology.

Anatomic pathology information systems manage computerized orders of anatomic pathology examination of specimen collected from patients as well as the fulfilment of these orders.

In most anatomic pathology departments, images are more and more being used in a digital format. Photographic images are digitized during specimen macroscopic study and microscopic images during microscopy evaluation and molecular pathology documentation.

Nowadays most of the anatomic pathology departments using digital imaging in microscopy, which is the essential tool of pathologists, are equipped with imaging modalities producing only still images captured from a selected field under the microscope. The use of still microscopic images in the diagnostic process is time consuming and results in frustration for clinicians and pathologists. In the last 5 years, slide scanners have become very popular since they allow a complete digitization

*Figure 1. Using virtual microscopy systems, pathologists can review complete microscopy slides simulating the operation of an optical microscope.*



of tissue and cytology slides, a process termed whole slides imaging (WSI), to create digital slides. Since this disruptive innovation allows a realistic simulation of the work performed with the conventional optical microscope (Figure 1), it is known as virtual microscopy (Ferreira, 1997; Afework, 1998).

Conventional glass slides are fragile, and they are non permanent, since stain will fade over time, especially in immunofluorescence. Also, in cytology, it is not possible to distribute copies of the slides. These disadvantages of conventional slides can be overcome with digital slides, which also have additional advantages, like having lower magnification pictures with extraordinary quality, a dynamic map of the slide, tracking and playing back the path followed by the pathologist during the examination of the slide, images are permanently stored, and it is possible to make annotations that can also be recorded. Additional advantages of digital slides over glass slides are the possibility to distribute multiple copies on a DVD of exactly the same slide, and the high quality always on focus and well illuminated images that decreases eye fatigue, and other ergonomic advantages by reducing back and neck fatigue (Zeineh, 2005).

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