

Letter to the Editor

PALGA, the nationwide histo- and cytopathology data network and archive. A role for digital pathology?

Sir,

With interest we have read the article of Casparie et al. on the Dutch PALGA system [1]. The paper certainly makes clear what a unique system PALGA is and what role PALGA could play in biobanking. From our point of view, one important issue with regard to national storage is however not addressed, which is the incorporation of digital images. Besides the fact that including digital macroscopic images as are currently often taken would be useful, we believe that the future of the Pathology slide archive is a digital one. Digital technology would allow to faster prepare clinicopathological conferences, creates greater flexibility in location of clinicopathological conferences, allows faster consultation of colleagues (in house or remote), allows concurrent access to slides, circumvents misplaced or damaged slides and deterioration in slide quality over time, and could save archiving space. Next, it also is favorable for research purposes such as quicker (remote) revision of patient series, as well as analysis of tissue microarrays [2–7] and other digital images analysis applications [8–10]. Further, it endorses development of digital applications for virtual microscopy teaching of students. Lastly, this approach could be the stepping stone for upfront digital diagnostics in the future.

Advances in scanning technology nowadays allow high throughput scanning of slides at a resolution that creates an acceptable alternative for classical microscopy, and costs for mass storage have come down sufficiently to enable storing the massive number of large image files at reasonable cost. Software for managing a digital image archive and integration with present patient information management systems is available as well. We have therefore started a project to prospectively start scanning all the slides that we produce in the lab. The local infrastructure comprises two high speed slide scanners (Aperio, Vista, CA, USA) connected to a server that takes care of the management and the storage of the images. The images are transferred through a regular network connection

(100 Mbit) to a Network Attached Storage (NAS) location (Sun Microsystems, Santa Clara, CA, USA) composed of a first line 6 Terrabyte (TB) space on fast hard disks and expandable 120 TB robotic tape storage to take care of images after that. Dedicated hierarchical storage management software handles transparent image transfer between tape, hard disks (and vice versa) and workstations when requested.

In view of the advantages of this digital approach to the pathology slide archive, we expect that soon other pathology labs will follow this initiative. Although local storage systems could be interfaced to allow transfer of images between labs, a complicated network of local storage area networks systems may not be the most cost-effective approach, and a central digital archive hosting all images of all Dutch labs (keeping just low resolution thumbnails locally) may be preferred. This naturally requires that image retrieval speed from a central NAS should be similar to that from local storage, which may be an issue. As digital images can (and to our opinion should) be regarded as pathology data just like text and retrieval codes, we feel PALGA should in the future play a coordinating role within The Netherlands in central storage of digital images linked to pathology reports. As PALGA endorses research [1] next to optimally providing historical pathology data for patient care, one can easily imagine the advantages of instant on-line retrieving digital images from all over The Netherlands for research purposes over the traditional painful approach of plundering local slide archives to be sent through mail.

P.J. van Diest, C. Visser and A. Huisman

References

- [1] M. Casparie, A.T. Tiebosch, G. Burger, H. Blauwgeers, A. van de Pol, J.H. van Krieken and G.A. Meijer, Pathology data-banking and biobanking in The Netherlands, a central role for PALGA, the nationwide histopathology and cytopathology data network and archive, *Cell. Oncol.* **29** (2007), 19–24.

- [2] L.M. Veenendaal, O. Kranenburg, N. Smakman, A. Klomp, I.H. Borel Rinkes and P.J. van Diest, Differential Notch and TGFbeta signaling in primary colorectal tumors and their corresponding metastases, *Cell. Oncol.* **30** (2008), 1–11.
- [3] K. Agelopoulos, C. Kersting, E. Korsching, H. Schmidt, A. Kuijper, C. August, P. Wülfing, J. Tio, W. Boecker, P.J. van Diest, B. Brandt and H. Buerger, Egfr amplification specific gene expression in phyllodes tumours of the breast, *Cell. Oncol.* **29** (2007), 443–451.
- [4] J. Korbelik, M. Cardeno, J.P. Maticic, A.C. Carraro and C. MacAulay, Cytology microarrays, *Cell. Oncol.* **29** (2007), 435–442.
- [5] M. Wolf, H. Edgren, A. Muggerud, S. Kilpinen, P. Huusko, T. Sørli, S. Mousses and O. Kallioniemi, NMD microarray analysis for rapid genome-wide screen of mutated genes in cancer, *Cell. Oncol.* **27** (2005), 169–173.
- [6] M.M. Vleugel, R. Bos, H. Buerger, P. van der Groep, O.R. Saramäki, T. Visakorpi, E. van der Wall and P.J. van Diest, No amplifications of hypoxia-inducible factor-1alpha gene in invasive breast cancer: A tissue microarray study, *Cell. Oncol.* **26** (2004), 347–351.
- [7] M.M. Weiss, E.J. Kuipers, C. Postma, A.M. Snijders, D. Pinkel, S.G. Meuwissen, D. Albertson and G.A. Meijer, Genomic alterations in primary gastric adenocarcinomas correlate with clinicopathological characteristics and survival, *Cell. Oncol.* **26** (2004), 307–317.
- [8] M.C. Osterheld, S. Andrejevic Blant, L. Caron, R. Braunschweig, G. Dorta, H. Bouzourene and A. Mihaescu, Digital image DNA cytometry: A useful tool for the evaluation of malignancy in biliary strictures, *Cell. Oncol.* **27** (2005), 255–260.
- [9] R. Chamgoulov, P. Lane and C. MacAulay, Optical computed-tomographic microscope for three-dimensional quantitative histology, *Cell. Oncol.* **26** (2004), 319–327.
- [10] A. Gerger, P. Bergthaler and J. Smolle, An automated method for the quantification and fractal analysis of immunostaining, *Cell. Oncol.* **26** (2004), 125–134.