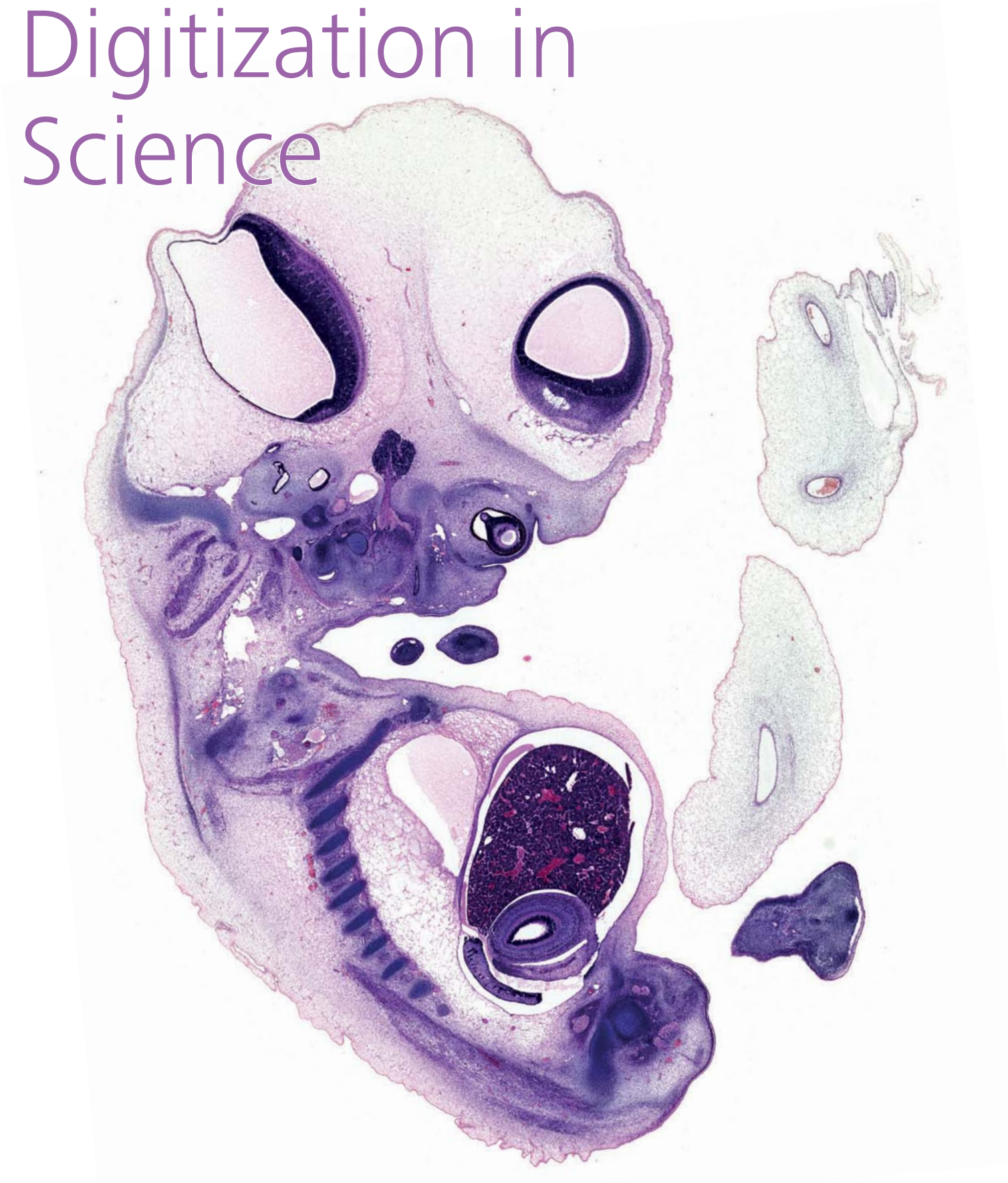
Global | Old archives digitally archived

Digitization in Science



Sagittal cross-section through a human embryo with a crown-coccyx length of 17.5 mm; thickness: 10 µm; staining: Delafield's hematoxylin technique and eosin gold orange (H & E)

Digitization is impacting every facet of our lives. Science is no different. Digitization is changing how we handle scientific knowledge. Generating and disseminating scientific knowledge is easier than ever. Digital storage and analytical instruments make it possible to quickly structure and analyze large, complex quantities of data and make them available to a broad audience.

Qualitative data collection has turned into quantitative data collection, making research results more reliable and more conclusive. Communication technologies are taking collaboration between research teams to a whole new level. Globally networked research projects are no longer the exception to the rule: they are now the norm. Digitization has changed the sciences from the ground up. The Microscopy business group was at the forefront of the evolution in digitization and has now developed a system for virtual microscopy.

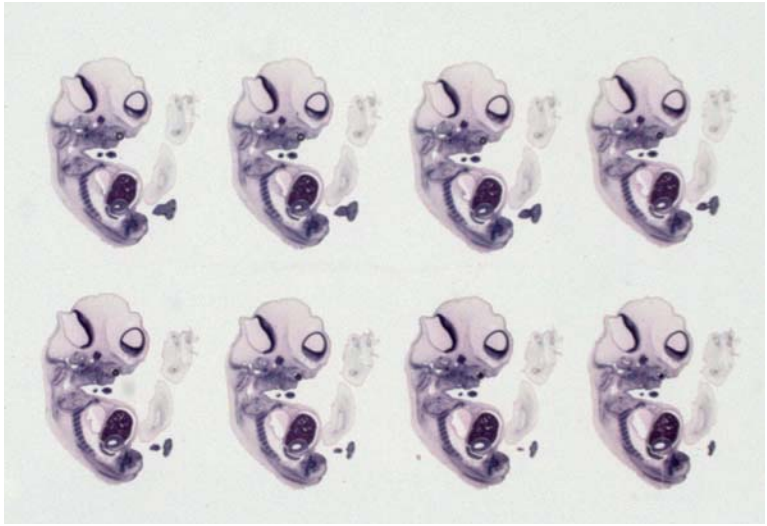
ZEISS Axio Scan.Z1 digitizes quickly and, being a highly automated system, processes a large number of samples using a multitude of recording modalities, underscoring the broad application range of the system. This system is now being used to digitize historical collections of embryological specimen slides with the goal of ultimately making them available to researchers and the general public.

> "Over the years collection slides have been lost, misplaced, damaged or their histology stains degenerated never to be seen again." Dr. Mark Hill

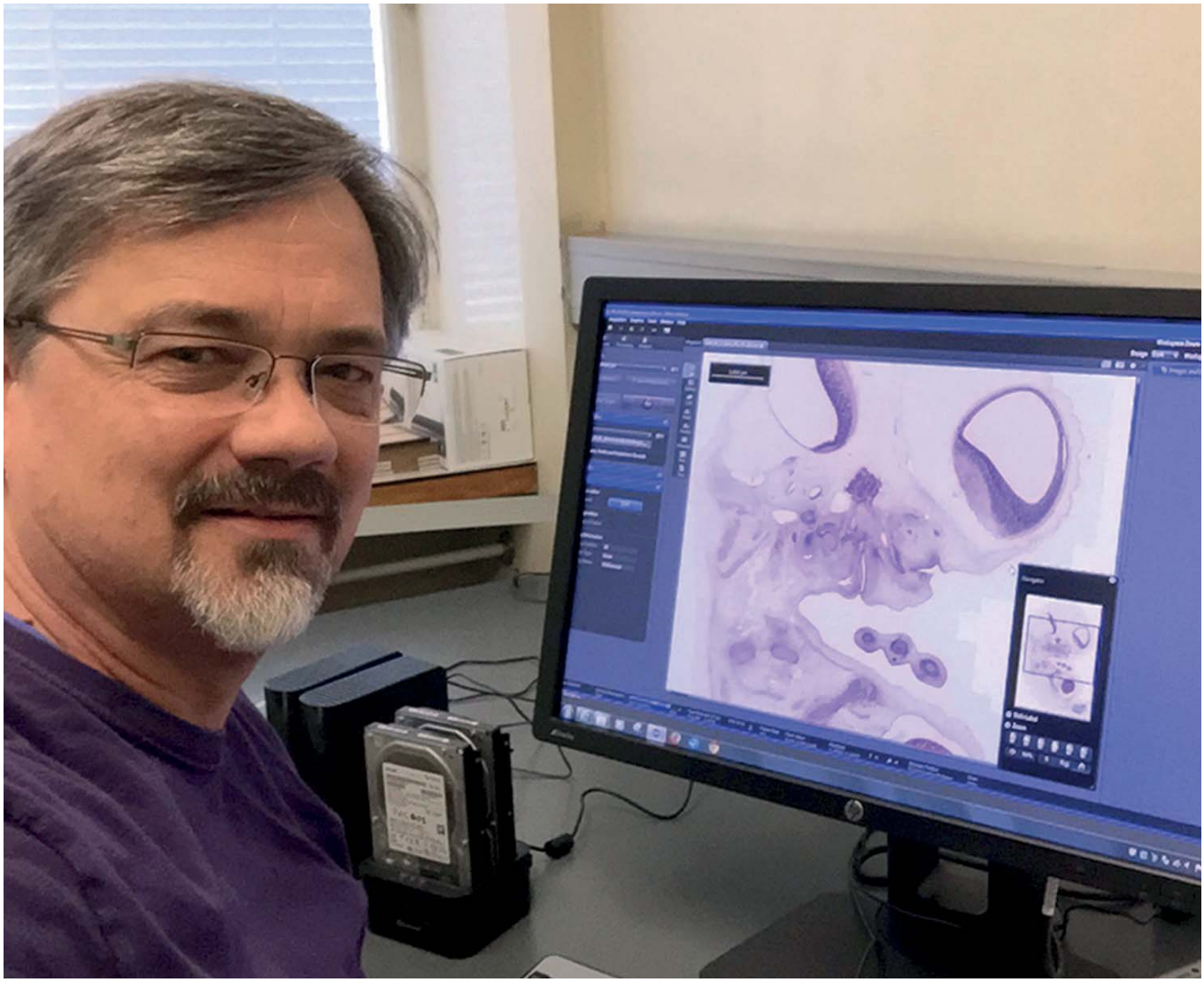
The project

The goal of the Digital Embryology Consortium is to preserve and protect the large collections of specimen slides from human embryology, make them available to both researchers and the public online for free and thereby protect the valuable original specimens. Many of the historic collections are almost 100 years old. The members of the consortium are: the UNSW Australia, the University of Göttingen (Blechschmidt Collection), the Natural History Museum in Berlin (Hubrecht Collection), the Ruhr University Bochum (Hinrichsen Collection), Complutense University of Madrid (Madrid Collection), the University of British Columbia (Perry-Arey-Milligan Collection), the National Museum of Health and Medicine (Carnegie Collection) and Kyoto University (Kyoto Collection). Dr. Mark Hill from the School of Medical Sciences at the UNSW Australia had the idea for this enormous project. Hill wrote: "Over the years collection slides have been lost, misplaced, damaged or their histology stains degenerated never to be seen again. Scanning will preserve these collections as they now stand against future losses." The project is funded by a grant to the UNSW Foundation. Hill has been in constant contact with different institutes and the curators of various museums to gain their support for this project. On 8 April 2015, the members of the consortium met in Göttingen to finally celebrate the start of this project.

Key elements for the success of this project are the scanner and data management. Once Hill had tested slide scanners from different providers (Leica, Coherence, Olympus and ZEISS), he ultimately chose the ZEISS Axio San.Z1. Ease of use, the size of the microscope slides, the resolution, throughput, file format and transportability were all key factors in Hill's decision. There were a lot things going for the ZEISS system. In addition to its resolution, the digital slide scanner scored big by making it possible to use different sizes of microscope slides. Historical slides are quite larger than the ones used today and are not compatible with every slide scanner on the market. For example: special mounting frames are being pro-duced for the Kyoto Collection that will



Overview image of a typical 2"x3" microscope slide with serial sections taken from the Blechschmidt Human Embryology Collection, Göttingen, Germany



Dr. Mark Hill in the new scanner room of the Blechschmidt Collection in Göttingen, Germany. The monitor shows the scan of a sagittal cross-section through a human embryo

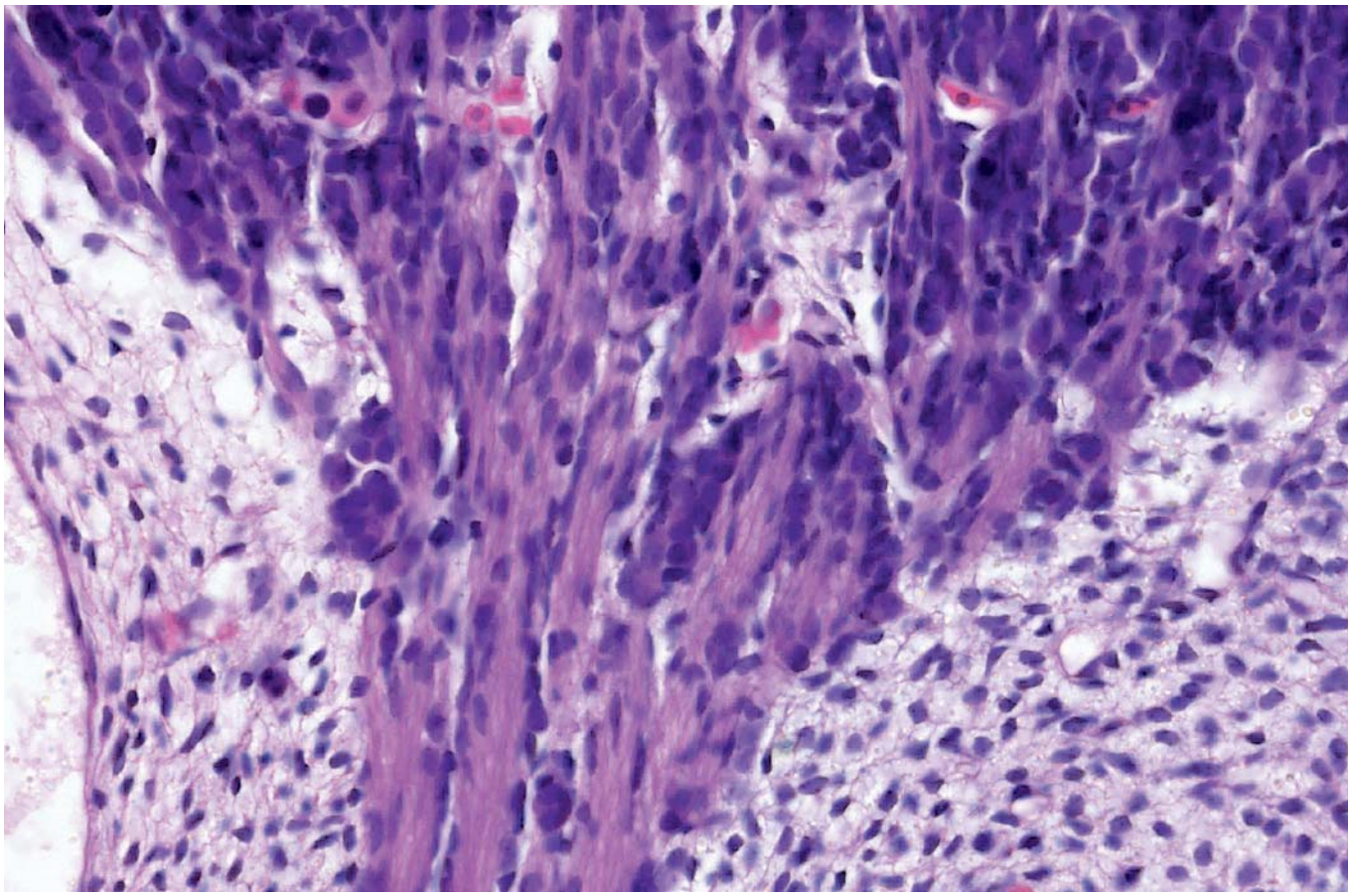
accommodate the special shapes of the slides in this collection, demonstrating the strengths of ZEISS Axio Scan.Z1. The system is also easy to transport and install when moving from one collection to the next. Special transport boxes, normally intended for demo systems, are being used.

Four consortium members and employees from ZEISS were at the launch event at the University of Göttingen. Consortium member Prof. Chistoph Viebahn gave the opening address. Dr. Thorsten Heupel, Product Manager for ZEISS Axio Scan.Z1, had already given a detailed, two-day introduction to the system. The Blechschmidt Collection in Göttingen is the starting point for the digitization project. The team from the Blechschmidt Collection digitized more than 4,000 slides and created more than 40 TB of data during the first round. Once they're finished, the system will be transported to the other consortium members. The project is scheduled for completion by the end of 2017. The data will be available online through the free software OMERO (an image database), which is compatible with the ZEISS image format.

Benefits plain for all to see

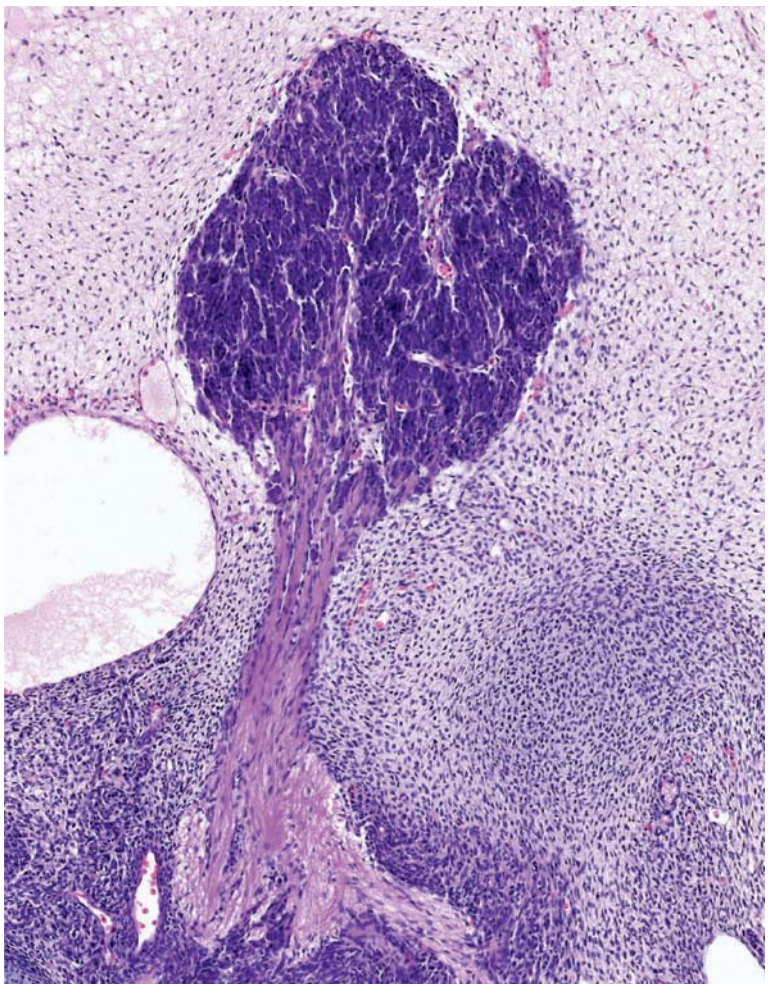
The benefits of digitization are obvious. The virtual slides can be examined just as if you were using a real microscope but no special instrument or even the actual slide is required. This protects slides and makes them available concurrently around the world, allowing examination by means of image analysis; furthermore, it supports data mining, which will also become more and more important in the future.

The German Research Foundation has already recognized how digitization can assist it and made the following announcement in a press release in March 2014: "Development of Standards for the Photographic Documentation of Permanent Microscope Slide Mounts in Precarious Mounting Media is just



Top: detailed view from image on right: region of origin of the maxillary nerve

Right: detailed view from image on page IV: trigeminal ganglion (above) with the exiting maxillary nerve (below)



Cover story photos: Blechschmidt Human Embryology Collection, Göttingen, Germany

one of 12 projects at museums, universities and non-university institutes which the German Research Foundation (DFG) is supporting with the aim of electronically indexing research collections, digitizing the objects and making them accessible online. The projects focus on different object categories, including herbaria, a historical skeletal collection, old book covers and a collection of historical musical instruments. They are of interest to a variety of research communities. The 12 projects will receive a total of 4.3 million euros in funding, as the DFG stated in a → **press release**. Having seen the benefit of and necessity for this process, there is also a growing interest in other countries to digitize every kind of specimen imaginable.

ZEISS Axio Scan.Z1 has been installed in the → **Natural History Museum** in London to support their endeavors. In addition to making collections accessible for performing basic research, virtual microscopy opens up new possibilities in telepathology, where the results from microscopes and the lab are digitally transferred to medical specialists for interpretation and diagnosis. ◪ *Rebekka Fredrich*