2014

NANOSMAT-USA 2014
May 19–22, 2014
Houston, TX
www.nanosmat-usa.com

European Light Microscopy
May 20–23, 2014
Oslo, Norway
www.mn.uio.no/ibv/elmi2014

66th Inter/Micro
June 2–6, 2014
Chicago, IL
www.mcri.org/home/section/101-915/inter-micro-2014

Gordon Research Conference on Imaging Science
June 8–13, 2014
Stonehill College, Easton, MA
www.osa.org/en-us/meetings/global_calendar/

SCANDEM 2014
June 11–13, 2014
Linköping University, Sweden
www.scandem2014.se

EBSD-2014
June 17–19, 2014
Carnegie Mellon University, Pittsburgh, PA
www.microbeamanalysis.org/topical-conferences/EBSD-2014/welcome

EMC 2014: 56th Electronic Materials Conference
June 25–27, 2014
Santa Barbara, CA
www.mrs.org/56th-emc

MMC 2014: MICROSCIENCE
June 30–July 3, 2014
Manchester Central, UK
www.mmc2014.org.uk

Microscopy & Microanalysis 2014
August 3–7, 2014
Hartford, CT
www.microscopy.org

2015

Microscopy & Microanalysis 2015
August 2–6, 2015
Portland, OR
www.microscopy.org

2016

Microscopy & Microanalysis 2016
July 24–28, 2016
Columbus, OH
www.microscopy.org

2017

Microscopy & Microanalysis 2017
July 23–27, 2017
St. Louis, MO
www.microscopy.org

2018

Microscopy & Microanalysis 2018
August 5–9, 2018
Baltimore, MD
www.microscopy.org

More Meetings and Courses
Check the complete calendar near the back of this magazine.

Carmichael's Concise Review

We See Through Cells Every Day

Stephen W. Carmichael
Mayo Clinic, Rochester, MN 55905

carmichael.stephen@mayo.edu

Typically when we think of cells we envision opaque (or at best translucent) membrane-bound structures. However recently in a study of the developing avian cornea, Robert Young, Carlo Knupp, Christian Pinali, Kenneth Png, James Ralphs, Andrew Bushby, Tobias Starborg, Karl Kadler, and Andrew Quantock found a surprisingly large proportion (20%) of the volume is made up of cells. The cornea is where light enters the eye. It also provides the majority of the focusing power (the lens is for "fine tuning" of focus). If this study in birds also applies to primates, then we could be looking through many cells all the time!

The microscopic structure of the cornea is well known. It is an avascular specialized connective tissue assembled as a remarkably ordered array of superimposed collagenous lamellae, made of collagen fibrils, essential for optical transparency. It also must be biomechanically stable to restrain ocular pressure. In addition to immunocytochemistry and other conventional methods, Young et al. used volume-scanning electron microscopy to examine the ultrastructure of the cornea in three dimensions and in larger tissue volumes than were previously possible. The tissue volume was gradually decreased from the surface by two different methods: a focused ion beam essentially milled down the surface, or ultrathin sections were removed with an ultramicrotome. Scanning electron micrographs taken after each ultra-thin removal could be reconstructed for examination and analysis. The two different methods revealed unique features of the fibroblasts of the cornea, which are called keratocytes (Figure 1).

The surprising finding was that the volume of the cornea occupied by cells relative to extracellular matrix was 20%, higher than expected. The additional

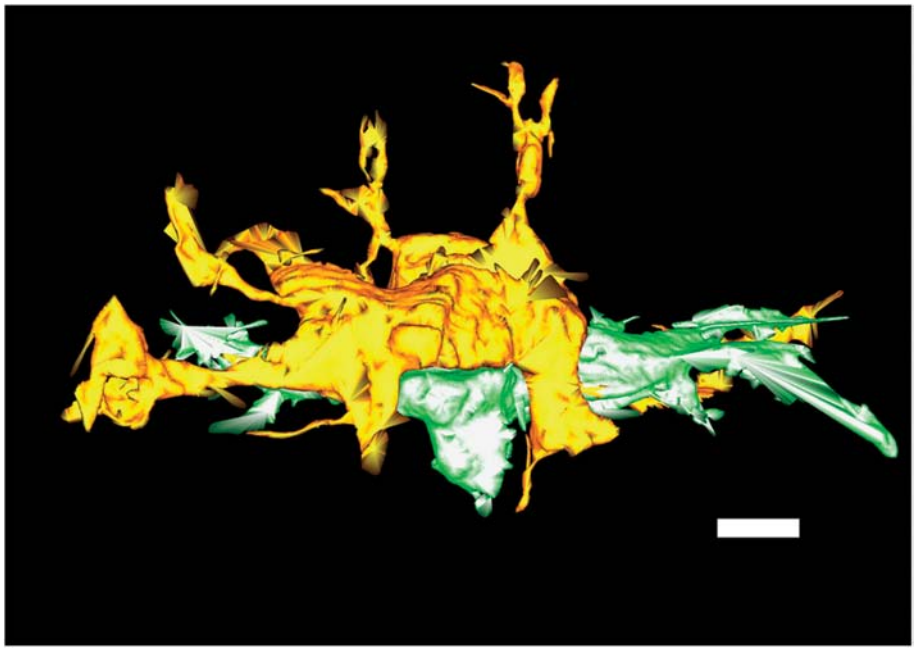


Figure 1: 3D reconstruction of two keratocytes in embryonic chick corneal stroma at day 12 of development, obtained by 3View® serial block face scanning electron microscopy and IMOD segmentation. The cells and their processes exhibit orthogonal alignment in common with collagen fibrils (not shown in this image) in the developing extracellular matrix. Bar = 1 µm.

doi:10.1017/S1551929514000546

OLYMPUS

RADIUS

Future of EM Software: Control - Create - Share

The times they are a changing constantly - and now it's time for all-new EM software: RADIUS controls your complete EM environment including microscope, stage and cameras - all with one piece of software. Never before has it been this easy to capture images in perfect quality, handle and process live or stored data in the same way, and share results at the touch of a button.

RADIUS is designed for today's most interesting applications, and is also fully prepared for the technologies of tomorrow. Compatible with the latest user interaction technology, RADIUS is future-proof. Check out the future of EM software.

For further information: info.osis@olympus-sis.com, www.soft-imaging.net

volume is apparently due to an extensive network of cellular processes that could not be fully appreciated using other methods. During development it appears as though relatively spherical cells are flattened as collagen is deposited, and as that happens the keratocytes extend long slender processes into the growing stroma. Young et al. showed that these tubular membrane extensions travel more than 30 microns from the main body of the cell. They also showed that these extensions were rich in actin, which is reminiscent of filopodia. These filopodia are much longer than usually described, but this study on fixed specimens could not provide evidence of motion. Young et al. propose that they be called "keratopodia" because they appear to be unique structures that have a cornea-specific function in orienting and organizing collagen into lamellae, crucial for transparency. Keratopodia permit a system of cell-matrix associations to be maintained at sites distant from the main secretory machinery of the cell during a period when collagen bundles increase and grow to fill the extracellular space. It will be interesting to see if similar structures exist within other tissues that form highly organized matrices.

References

[1] RD Young et al., *Proc Nat Acad Sci* 111 (2014) 687–92.

[2] The author gratefully acknowledges Drs. Robert Young and Andrew Quantock for reviewing this article.

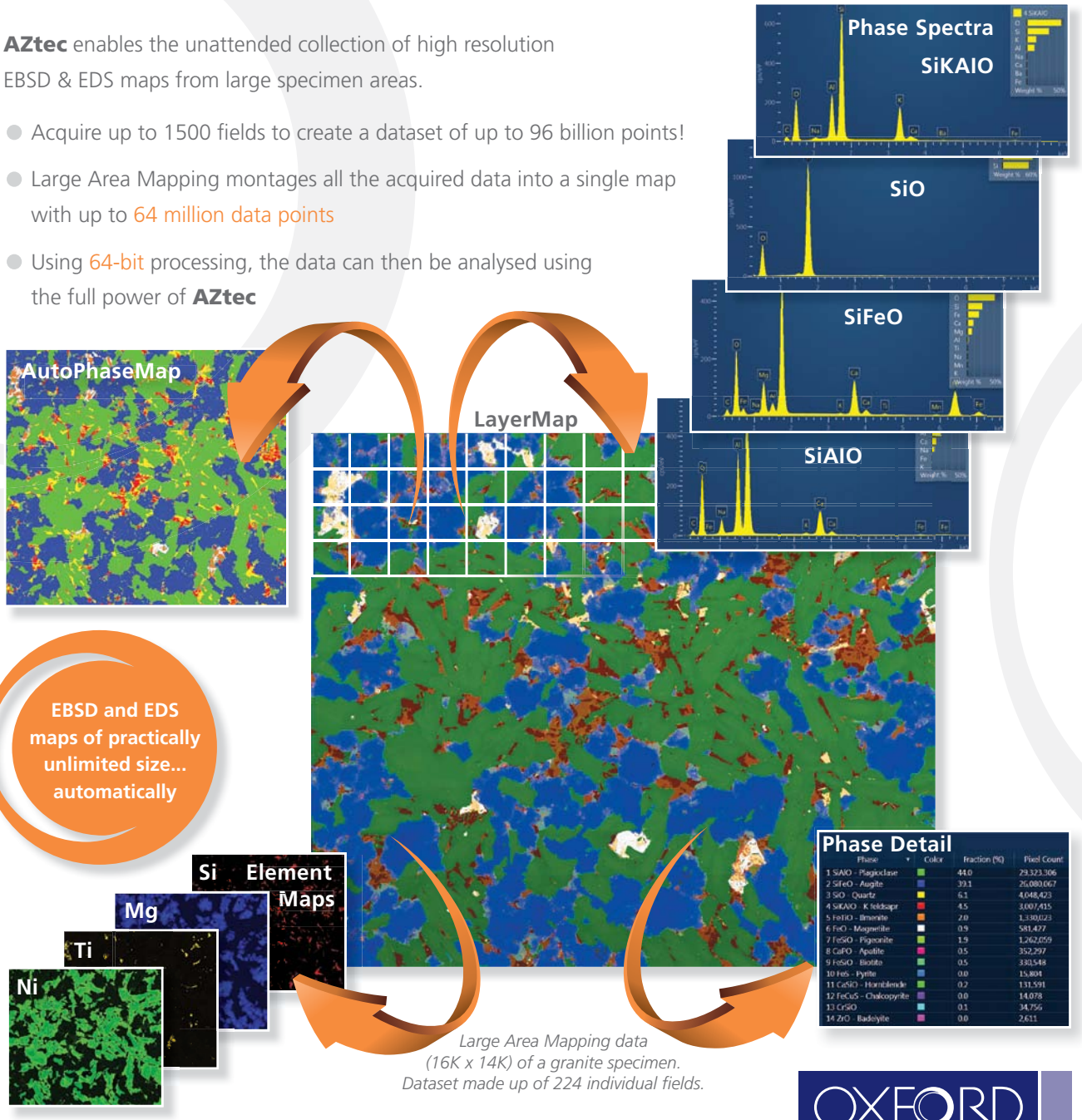
MT

AZtec® Large Area Mapping

See the big picture in nanoanalysis!

AZtec enables the unattended collection of high resolution EBSD & EDS maps from large specimen areas.

- Acquire up to 1500 fields to create a dataset of up to 96 billion points!
- Large Area Mapping montages all the acquired data into a single map with up to 64 million data points
- Using 64-bit processing, the data can then be analysed using the full power of **AZtec**



Large Area Mapping data (16K x 14K) of a granite specimen. Dataset made up of 224 individual fields.

www.oxford-instruments.com/AZtecLAM

OXFORD INSTRUMENTS

The Business of Science®