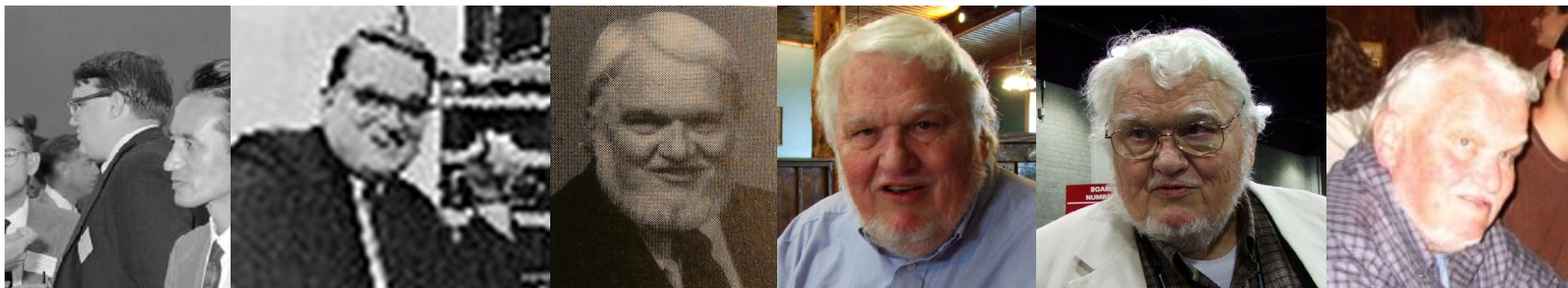


CNS*2010 Workshop

Hightthroughput 3D microscopy and high-performance computing for multi-scale modeling and simulation of large-scale neuronal circuits

Workshop in memory of Bruce H. McCormick (1928–2007)



1960

c. 1960

c. 1998

2005

2006

2007

July 30, 2010

Organizers: Yoonsuck Choe, John Keyser, and Louise C. Abbott

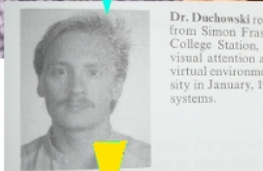
Brain Networks Laboratory

Texas A&M University

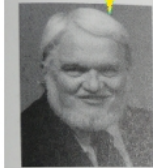
Our Common Goal

- Image the **entire** brain's neuronal and vascular network at microscopic detail (down to 10s of nanometers).
- Computationally analyze the structure.
- Infer brain function from the architectural blueprint.
... and do useful stuff!

The Network that Connects Us



Dr. Duchowski received his Ph.D. from Simon Fraser University in 1978. He is currently an Associate Professor at Simon Fraser University. His research interests include visual attention and virtual environments. He was a keynote speaker at the Society for Neuroscience meeting in January, 1998.



CNS*98

Bruce McCormick is a Professor of Scientific Visualization at the University of Illinois at Chicago. His research interests include scientific visualization and neural networks. He is currently a Professor of Physics at the University of Illinois at Chicago, and at the University of Computer Science.



- Student, collaborator, colleague of ...
- Methods inspired/inspired-by/related-to those of ...

Bruce McCormick, our HUB!

Three Themes of the Workshop

- Microscopy: High-throughput, high-resolution
- Reconstruction: Novel algorithms and methods
- Structure to function

*... for mapping the neuronal and vascular networks in the
brain*

1. High-throughput Microscopy

Method	Resol. (x/y)	Resol. (z)	Volume	Modality	Time
All-Optical Hist.	0.5 μm	1 μm	1 cm^3	Fluorescence	\sim 900 hours
KESM	0.3–0.6 μm	0.5–1 μm	1 cm^3	Bright field, Fluorescence*	\sim 100 hours
Array Tomography	\sim 0.2 μm	0.05–0.2 μm	\sim 100 ³ μm^3	Fluorescence, EM	N/A
SBF-SEM	\sim 0.01 μm	\sim 0.03 μm	\sim 500 ³ μm^3	EM	N/A
ATLUM	\sim 0.01 μm	0.05 μm	\sim 2.15 ³ mm^3	EM	N/A

- A table from Choe et al. (2008).
- Happy to announce that all methods are represented in this workshop!
- Methods as well as impact/commercialization of these methods.

2. Novel Reconstruction Algorithms and Methods

- Processing large data sets.
- Vector-based tracing.
- Use of eye-tracking for tracing.

3. From Structure to Function

- Large-scale physiological recordings to accompany/inform reconstructed brain architecture.
- Issues in computational simulation of whole-brain-scale circuits.

Advertisements

- Springer book: We will be editing a book on the workshop topic. More announcements to follow (via email).
- IJCNN 2011: International Joint Conference on Neural Networks has special track on computational neuroscience. San Jose, CA, July 31–August 5, 2011.
- ASIM 2010: Advancing Substrate-Independent Minds, San Francisco, CA, August 16–17, 2010 (details TBA: contact Randal Koene).

Acknowledgments

- 3Scan (Todd Huffman)
- Organization for Computational Neuroscience

References

Choe, Y., Abbott, L. C., Han, D., Huang, P.-S., Keyser, J., Kwon, J., Mayerich, D., Melek, Z., and McCormick, B. H. (2008). Knife-edge scanning microscopy: High-throughput imaging and analysis of massive volumes of biological microstructures. In Rao, A. R., and Cecchi, G., editors, *High-Throughput Image Reconstruction and Analysis: Intelligent Microscopy Applications*. Boston, MA: Artech House. In press.