Friday, November 30, 2012

Gordon College, Wenham, MA

Meeting Schedule:

12:30-1:00	Meeting Registration (KOSC- E on Campus Map)
1:00-1:10	Welcoming Remarks
1:10-2:00	**"Neurogenesis in adult brains: A hematopoietic connection?",** Barbara S. Beltz, Ph.D., Jeanne L. Benton and Paula G. Chaves da Silva, *Wellesley College, Wellesley, MA*
2:00-2:50	**"Printing at the micro and nano scale"**, Alexander Smetana, Ph.D., *NanoInk Inc.*
2:50-3:30	Coffee Break
3:30-4:20	**"Scanning Electron Microscopy-Based Techniques for the Large-Scale Visualization of Biomineralized Structures"**, James C. Weaver, Ph.D., *Wyss Institute, Harvard University, Boston, MA*
4:20-5:10	**"Integration of atomic force microscopy with optical spectroscopy"**, Pavel Dorozhkin, Ph.D., *NT-MDT Co., Zelenograd, Moscow*
5:10-6:15	Business Meeting
6:15-7:30	Dinner (Chairman's Room)
7:30-8:30	**Keynote: "Macro to Micro Functional Anatomy of Biosonar"**, Darlene R. Ketten, Ph.D., *Woods Hole Oceanographic Institute, Woods Hole, MA*
8:30-8:40	Closing Remarks

Abstracts & Bios

1:10PM - "Neurogenesis in adult brains: A hematopoietic connection?"

Barbara S. Beltz, Ph.D., Jeanne L. Benton and Paula G. Chaves da Silva, *Wellesley College, Wellesley, MA*

Abstract: New neurons are produced and integrated into circuits in the adult brains of many organisms, including crustaceans. In many crustacean species, the first-generation neuronal precursors reside in a niche exhibiting characteristics analogous to mammalian neurogenic niches. However, unlike mammalian niches where several generations of neuronal precursors co-exist, the lineage of precursor cells in crayfish is spatially separated allowing the influence of environmental and endogenous regulators on specific generations in the neuronal precursor lineage to be defined. Our studies also have shown that the first-generation neuronal precursors in the crayfish Procambarus clarkii are not self-renewing. A source external to the neurogenic niche must therefore provide cells that replenish the first-generation precursor pool, because although these cells divide and produce a continuous efflux of second-generation cells from the niche, the population of first-generation niche precursors is not diminished with growth and aging. In vitro studies show that cells extracted from the hemolymph, but not other tissues, are attracted to and incorporated into the neurogenic niche, a phenomenon that appears to involve serotonergic mechanisms. Developmental and ultrastructural studies also have confirmed a close relationship between the blood system and nervous systems. We have therefore proposed that, in crayfish, the hematopoietic system may be a source of cells that replenish the niche cell pool. Our studies establish decapod crustaceans as model systems in which the processes underlying adult neurogenesis, such as stem cell origins and transformation, can be readily explored. Studies in diverse species where adult neurogenesis occurs will result in a broader understanding of fundamental mechanisms underlying this process, and as well as evolutionary aspects of stem cell biology.

Bio: Barbara Beltz is Allene Lummis Russell Professor in Neuroscience at Wellesley College, Wellesley, MA. She received her B.A. degree from Mount Holyoke College and M.A. and Ph.D. degrees from Princeton University. Barb joined the faculty at Wellesley in 1987, following postdoctoral training in the Neurobiology Department at Harvard Medical School. At Wellesley, she teaches undergraduate courses in cell and developmental biology and neuroscience. Her research interests focus on serotonergic influences during neuronal development, regulatory mechanisms controlling life-long neurogenesis, and the relationships between the innate immune system and the nervous system.

For most of her Wellesley career, Dr. Beltz has worked with Jeanne Benton, Senior Research Associate at Wellesley College. Together they have published over 25 papers in leading journals. Ms. Benton has used a variety of approaches ranging from immunocytochemistry to electrophysiology in her studies.

Paula Chaves da Silva is a Ph.D. student at the Universidade Federal do Rio de Janeiro, Brazil, working in the laboratory of Dr. Silvana Allodi. She has spent the past year in the Beltz lab supported by a fellowship from the Brazilian government, returning to Brazil at the end of November to finish her Ph.D. work in 2013. She has expertise with immunocytochemical, scanning and electron microscopy, and other imaging techniques.

2:00PM - "Printing at the micro and nano scale",

Alexander Smetana, Ph.D., *NanoInk Inc.*

Abstract: Study of biomolecular interactions at the nanoscale and microscale have led to a better understanding of the functioning of biological systems. Since most biomolecules interact at the nanoscale, understanding their interactions requires delving into the nanoscale. Even intercellular interactions occur at the nanoscale. We have developed a novel technology, Tip Based Lithography, which enables the deposition of biomolecules at the microscale and nanoscales. Tip based lithography utilizes a nanoscale tip to transfer materials onto the surface at biologically friendly conditions. Utilizing this technology, we can decorate microfabricated devices with proteins and DNA. We demonstrate the miniaturization of diagnostic assays that require a single drop of blood to test. We also show the ability to manipulate the environment of the cell at the single cell level. Here we can dictate the cell shape bound to the surface, the polarization of the cell, and even deliver agents uniquely to a cell and its neighbor to study their effects while keeping the environment nearly identical.

Bio: Dr. Alexander B. Smetana is a Senior Applications Scientist at NanoInk, Inc. His role at NanoInk is to develop materials science applications for the tip-based micro/nanolithography tools in the Nanofabrication Systems Division. This has included printing conductive polymers, catalysts for carbon nanotubes, nanoparticles, and functionalizing devices at the micro/nano scale. Before he began working at NanoInk, Al worked with Pt nanoparticles for flash memory devices as a postdoc for Prof. Chen Wai at the Air Force Research labs in Dayton, OH. He received his Ph. D. at Kansas State University under the direction of Prof. Ken Klabunde in Materials Science for investigating gold, silver, and alloy nanomaterials for spectroscopic and microbial studies.

3:30PM - "Scanning Electron Microscopy-Based Techniques for the Large-Scale Visualization of Biomineralized Structures"

James C. Weaver, Ph.D., Wyss Institute, *Harvard University, Boston, MA*

Abstract: There has been significant progress in recent years aimed at pushing the spatial resolution limit of scanning electron microscopes. Many of these endeavors have been driven by advances in the field of nanotechnology and the need to investigate the morphological features of sub-micron size materials. While scanning electron microscopy is indeed a powerful tool for investigating objects at length-scales that are prohibitive using standard optical microscopy techniques, SEMs are also extremely useful in characterizing the micro- and macro-scale architectures of transparent, highly reflective, or morphologically complex materials. In this presentation, three scanning-electron microscopy imaging techniques (wide-field, polychromatic, and stereo) will be introduced and applied to the imaging of a wide range of biological structural materials across length scales covering more than 5 orders of magnitude (less than 10μm to greater than 10cm). The talk is intended for a broad audience and is likely to appeal to anyone interested in microscopy, structural biology, materials science, and vertebrate and invertebrate biodiversity.

Bio: James Weaver received his Bachelor's degree in Aquatic Biology and Ph.D. in Marine Science from the University of California, Santa Barbara. Working at the interface between zoology and materials science, his main research interests focus on investigating structure function relationships in hierarchically ordered biological composites. He has played critical roles in the development of various model systems for the study of a wide range of biomineralization processes and is an internationally recognized scanning electron microscopist. With a strong history of national and international academic and industrial collaborations, he has coauthored more than 45 journal articles in the biological, physical, and geological sciences.

4:20PM - "Integration of atomic force microscopy with optical spectroscopy"

Pavel Dorozhkin, Ph.D., *NT-MDT Co., Zelenograd, Moscow*

Abstract: We will demonstrate capabilities of Atomic Force Microscopy integrated with various optical microscopy and spectroscopy techniques: Confocal Raman/Fluorescence/Rayleigh microscopy, Scanning Near-field Optical Microscopy (SNOM), Tip Enhanced Raman Microscopy and others. AFM and optical techniques provide complimentary information about sample structure, its physical and chemical properties. Results will be demonstrated for various types of samples: polymer blends, pharmaceutical tablets, graphene, nanowires and nanotubes, solar cells, silicon devices, hard disk drives etc. Tip Enhanced Raman Scattering (TERS) is a technique utilizing a special AFM probe (nano-antenna) to localize light at the nanometer scale area near the probe apex. When scanning the sample with respect to the probe, the obtained optical (Raman or fluorescence) maps have lateral resolution which is not limited by the light diffraction. TERS and other tip assisted optical techniques (tip enhanced fluorescence, scattering SNOM etc.) will be discussed. The successful TERS results achieved due to deep integration of AFM with confocal Raman microscopy will be demonstrated – with lateral resolution down to 15 nm.

Bio: Dr. Pavel Dorozhkin is currently a head of applications and product management division at NT-MDT. Pavel Dorozhkin graduated with honors from Moscow Institute of Physics and Technology in 1999. He received Ph.D. in Institute of Solid State Physics (Chernogolovka, Russia) in 2004 in the field of spectroscopy of individual semimagnetic quantum dots. While working in research (1999 – 2005), Pavel Dorozhkin was a visiting scientist in National Institute of Materials Science (Tsukuba, Japan) for about 3 years - investigating electrical and mechanical properties of semiconductor nanowires and carbon nanotubes. He also worked in Wurzburg University, (Germany) in the field of spectroscopy or quantum dots at helium temperatures and high magnetic fields. He has co-authored about 40 scientific papers, made about 40 oral conference presentations and headed a number of government research projects.

In 2005, Pavel Dorozhkin joined NT-MDT and became a head of spectroscopy division being in charge of designing AFM-Raman and Scanning Near-field Optical Microscopy (SNOM) instrumentation. Presently, as a head of applications and product management division, he is in charge of NT-MDT equipment integrating AFM with optical techniques (Raman & fluorescence microscopy, Tip Enhanced Raman Microscopy, SNOM etc.). He also develops new applications of NT-MDT equipment in various areas of science and industry.

7:30PM - Keynote: "Macro to Micro Functional Anatomy of Biosonar"

Darlene R. Ketten, Ph.D., *Woods Hole Oceanographic Institute, Woods Hole, MA*

Abstract: Although microchiropteran bats and odontocete cetaceans operate in radically different media, both have sophisticated sonar capabilities and evident similarities in their ability to detect and analyze ultrasonic signals. This paper compares the similarities and differences of head, pinnal, and cochlear cytoarchitecture and its implications for ultrasonic encoding and acuity amongst these groups through the use of three-dimensional models obtained via conventional and micro CT imaging of intact heads and temporal bones. Whole head data reveal cetacean fatty pinnal analogues with configurations that mirror those of bats and have similar wavelength functional relationships. Inner ear anatomy was also fundamentally similar with notable parallels in fenestral placement and ratios, membrane dimensions, and neural density and distribution across bats and dolphins with common cochlear types. Specialist ears are present in both groups, suggesting that like some CF-CM bats, one or more odontocete species have cochleae with specialized basilar membrane "foveal" regions. Cochlear specializations in both groups are primarily linked to peak spectra of signal, expanded frequency representation, and may enhance tuning in adjacent ear segments by generating standing wave phenomena.

Bio: Darlene Ketten is a neuroanatomist and marine biologist specializing in hearing and imaging of hearing loss. She received a B.A. from Washington University (Biology and French), M.S. from M.I.T. (Biological Oceanography), and Ph.D. from The Johns Hopkins Medical Institutions (Neuroanatomy and Experimental Radiology). She currently holds joint appointments as a Senior Scientist in Biology at Woods Hole Oceanographic Institution and as Assistant Clinical Professor in Otology and Laryngology at Harvard Medical (http://csi.whoi.edu). Her research focuses on modeling underwater hearing mechanisms of marine mammals and biosonar of bats and dolphins. Her work comprises micro to gross techniques, particularly CT and MRI. She has completed medical specialty accreditation courses in Otopathology, Neuroradiology, Veterinary Pathology, and Forensic Pathology and is a Fellow of the Acoustical Society of America (ASA) and is a member of the Radiology Society of North America (RSNA), the American Military Surgeons of the United States (AMSUS), the Explorer's Club, IEEE, and the Association for Research in Otolaryngology (ARO). Dr. Ketten has over twenty years experience in the combined fields high resolution radiology, auditory system modeling, underwater acoustics, and head and neck pathology. She has over 100 peer reviewed publications and case studies as well as authoring specialist review articles and chapters on imaging, diagnostics of auditory system pathology, and hearing mechanisms.

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