

# Workshop on Quantitative Microscopy: Digital imaging of whole slides, image analysis, and stereology

## September 8<sup>th</sup> – 12<sup>th</sup>, 2009



### Location

University of Washington School of Medicine at South Lake Union, 815 Mercer Ave. Seattle, Washington, USA

### Participants

1. Comparative Pathology Program, Department of Comparative Medicine
2. Center for Lung Biology, Division of Pulmonary and Critical Care Medicine, Department of Medicine
3. Visiopharm A/S, Agern Allé 3, DK-2970 Hørsholm, Denmark
4. Olympus America, Inc (OAI)

### Workshop Faculty

Dallas M. Hyde

Jens Randel Nyengaard

Hans Jørgen G. Gundersen (Tentative)

Lise Lyck

Lars Pedersen

Charles Frevert

**For more information, please contact:** Charles W. Frevert, DVM, ScD,  
Phone: 206-221-0364  
E-mail: [cfrevert@u.washington.edu](mailto:cfrevert@u.washington.edu)

### Workshop Goals

1. Participants will learn how to design and conduct studies for stereology and image analysis. Participants are encouraged to bring a problem that requires a stereological solution to the workshop.
2. Participants will learn the theories behind the use of stereology to accurately measure specific histological and/or histopathological features in an organ.
3. Participants will learn the theories behind the use of image analysis to accurately measure specific histological and/or histopathological features in tissue sections.
4. Participants will be exposed to digital imaging on several state-of-the-art imaging platforms including the Olympus NanoZoomer Digital Pathology Virtual Microscope.
5. Participants will work with to newCAST/VisioMorph Image Analysis Software in practical exercises in stereology and image analysis. The use of VisioMorph software for automated image analysis of digital images will be discussed.
6. Participants will work with the faculty to develop protocols for analysis of their own digital images that will be generated during the workshop.

**TENTATIVE COURSE SCHEDULE (*Subject to change*)**

**Participants please bring:** A laptop, calculator with square root function, a pair of scissors, a sharp kitchen paring knife and a metric ruler.

**REGISTRATION AND RECEPTION - September, 7<sup>th</sup> 2009**

12:00 to 17:00 **Registration**  
18.30 - **Get-Together-Dinner**

**THEORETICAL AND PRACTICAL STEREOLOGY****TUESDAY - September, 8<sup>th</sup> 2009**

10.00 - 10.45	<b>Lecture:</b> Definition of probes, sampling and basic statistics	HG/DH
10.45 - 11.30	<b>Lecture:</b> Volume estimation, Cavalieri principle	DH
11.30 - 12.30	<b>Exercise:</b> Volume estimation	DH
12.30 - 14.00	<b>Lunch</b>	
14.00 - 14.45	<b>Lecture:</b> The fractionator principle (systematic sampling)	HG/JN
14.45 - 15.45	<b>Exercise:</b> The fractionator	JN
15.45 - 16.15	<b>Coffee</b>	
16.15 - 17.00	<b>Lecture:</b> The disector, counting and sampling in 3D	JN
17.00 - 18.00	<b>Exercise:</b> Number estimation	JN
18.30 -	<b>Dinner</b>	

**WEDNESDAY - September, 9<sup>th</sup> 2009**

09.00 - 09.45	<b>Lecture:</b> Length and Surface, IUR	JN
09.45 - 10.45	<b>Exercise:</b> Length estimation	DH
10.45 - 11.15	<b>Coffee</b>	
11.15 - 12.00	<b>Lecture:</b> Estimation via ratios, multilevel sampling design	DH
12.00 - 13.00	<b>Lecture:</b> How many animals, blocks, sections?	HG/JN
13.00 - 14.00	<b>Lunch</b>	
14.00 - 15.00	<b>Demonstration:</b> Computer-assisted stereology	LL
15.00 - 15.15	<b>Coffee</b>	
15.15 - 16.00	<b>Lecture:</b> More disector sampling, including connectivity	JN
16.00 - 17.00	<b>Exercise:</b> Connectivity	DH/JN
19.00 -	<b>Dinner</b>	

**THURSDAY - September, 10<sup>th</sup> 2009**

09.00 - 09.30	<b>Lecture:</b> Vertical sections	JN
09.30 - 11.00	<b>Exercise:</b> Surface from vertical sections – bananametry	JN
11.00 - 11.15	<b>Coffee</b>	
11.15 - 12.00	<b>Exercise:</b> Length from vertical projection – roots	JN
12.00 - 13.00	<b>Lunch</b>	
13.00 - 13.45	<b>Lecture:</b> Tissue deformation, slicing, sectioning, tools and gadgets	JN
13.45 - 14.30	<b>Lecture:</b> Sampling and Sizing of particles	HG/JN
14.30 - 15.00	<b>Coffee:</b> Stereology evaluation	JN
15.00 - 16.00	<b>Exercise:</b> The nucleator	DH
16.00 - 16.45	<b>Exercise:</b> Point sampled intercept	DH

**IMAGE ANALYSIS, DIGITAL IMAGING, AND PRACTICAL EXERCISES****FRIDAY - September, 11<sup>th</sup> 2009**

9.00 - 9.45	<b>Lecture:</b> Basic overview of microscopy and digital imaging	OAI
9.45 - 10.30	<b>Demonstration:</b> Whole slide digital imaging /virtual microscopy	OAI
10.30 - 10.45	<b>Coffee</b>	
10.45 - 11.30	<b>Workshop:</b> Participant applications: Hands-on scanning and microscopy. Generation of image material for afternoon exercises.	OAI
11:30- 12.00	<b>Lecture:</b> Basics of image analysis and segmentation	LAP
12.00 - 13.00	<b>Lunch</b>	
13:00 - 14.00	<b>Lecture:</b> Advanced image analysis: How to include structural and contextual information. Demonstration of VisioMorph.	LAP
14.00 - 15.00	<b>Exercise:</b> Design of image analysis protocols, part 1	LAP
15.00 - 15.15	<b>Coffee</b>	
15:15 - 16.45	<b>Exercise:</b> Design of image analysis protocols, part 2 (Participants images)	LAP

**SATURDAY - September, 12<sup>th</sup> 2009**

09.00 - 10.30	<b>Lecture:</b> Introduction to newCAST	LL
10.30 - 10.45	<b>Coffee</b>	
10.45 - 11.30	<b>Exercise:</b> Analysis of alveolar surface area	LL
11.30 - 12.15	<b>Exercise:</b> Analysis of alveolar number	LL
12.15 - 13.15	<b>Lunch</b>	
13.15 - 15.00	<b>Workshop:</b> Participant applications: Discussion of case examples	All
15.00 – 15:15	<b>Coffee</b>	
15.15 – 16.00	<b>Lecture:</b> New tools in stereology: The AutoDisector and Proportionator.	LL
16.00 - 16.45	Round up and discussion	All

**FACULTY OF TEACHERS**

Seattle, USA, September 7 – 9, 2009

**HYDE, Dallas M.**

California National Primate Research Center  
Hutchison Dr. and County Rd. 98  
University of California, Davis, CA 95616  
USA  
Phone: +1 530 752 0420  
Fax: +1 530 754 6228  
E-mail: [dmhyde@primate.ucdavis.edu](mailto:dmhyde@primate.ucdavis.edu)

**NYENGAARD, Jens Randel**

Stereology and EM Res. Lab. and MIND Center  
Building 1185  
Aarhus University  
DK - 8000 Aarhus C  
Denmark  
Phone: +45 8942 2955  
Fax: +45 8942 2952  
E-mail: [nyengaard@ki.au.dk](mailto:nyengaard@ki.au.dk)

**GUNDERSEN, Hans Jørgen G.**

Stereology and EM Res. Lab. and MIND  
Center  
Building 1185  
Aarhus University  
DK - 8000 Aarhus C  
Denmark  
Phone: +45 8942 2954  
Fax: +45 8942 2952  
E-mail: [stereo@ki.au.dk](mailto:stereo@ki.au.dk)

**LYCK, Lise**

Visiopharm A/S  
Ager Alle 3  
2970 Hørsholm  
Denmark  
Phone: (+45) 88 20 20 88  
Fax: +45 8820 2099  
E-mail: [ll@visiopharm.com](mailto:ll@visiopharm.com)

**PEDERSEN, Lars**

Visiopharm A/S  
Ager Alle 3  
2970 Hørsholm  
Denmark  
Phone: (+45) 88 20 20 88  
Fax: +45 8820 2099  
E-mail: [lap@visiopharm.com](mailto:lap@visiopharm.com)

**FREVERT, Charles W. Frevert**

Comparative Pathology Program  
Department of Comparative Medicine  
Room 315N  
University of Washington at South Lake Union  
Seattle, WA 98109  
USA  
Phone: 206-221-0364  
E-mail: [cfrevert@u.washington.edu](mailto:cfrevert@u.washington.edu)

**Estimated cost of the course:** \$950 USA

**Workshop Hotels in walking distance of South Lake Union**

<p>Courtyard Seattle Downtown Lake Union 925 Westlake Ave N Seattle, WA 98109 Cost per night: \$206.00 for single occupancy (Tax: 15.6%) <a href="http://www.courtyardlakeunion.com/">http://www.courtyardlakeunion.com/</a></p>	<p>Holiday Inn Seattle Center 211 Dexter Avenue North Seattle, WA 98109 Cost per night: \$119.00 for single occupancy, \$129 for double occupancy, (Tax: 15.6%) <a href="http://www.holidayinn.com/seattlewa">www.holidayinn.com/seattlewa</a></p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**Workshop will include:** 5 Days of lecture, course materials, 2 coffee breaks/day, lunch each day and one dinner.