



Course Syllabus: Foundations in Bioimaging - B 316

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| Division | Biological and Environmental Sciences & Engineering Division |
| Course Number | B 316 |
| Course Title | Foundations in Bioimaging |
| Academic Semester | Spring |
| Academic Year | 2016/2017 |
| Semester Start Date | 01/22/2017 |
| Semester End Date | 05/18/2017 |
| Class Schedule (Days & Time) | 01:00 PM - 02:30 PM Sun Wed |

| Instructor(s) | | | | |
|------------------------------|------------------------------------|--------------------------|-----------------------------------|--------------|
| Name | Email | Phone | Office Location | Office Hours |
| Satoshi Habuchi | Satoshi.Habuchi@kaust.edu.sa | +966128082483 | 4277, 2, Ibn Al-Haytham (bldg. 2) | |
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| Teaching Assistant(s) | |
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| Name | Email |
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| Course Information | |
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| Comprehensive Course Description | The course covers basic optics and spectroscopy, optical microscopy techniques, advanced fluorescence microscopy, and single-molecule imaging techniques. The course also introduces label-free optical imaging methods including Raman and infrared microscopy, and holographic microscopy. Introduction to advanced methods for manipulation of single cells and single molecules (optical and magnetic tweezers), correlative light and transmission/scanning electron microscopy (TEM and SEM) an <i>in situ</i> liquid TEM will be also provided. Students also present an assigned paper that is related to imaging/microscopy. |
| Course Description from Program Guide | This course provides a comprehensive overview of bioimaging techniques including fundamental concepts and applications, which allow biology students to design imaging experiments for their own research. The course covers basic optics and spectroscopy, optical microscopy techniques, advanced fluorescence microscopy, and single-molecule imaging techniques. The course also introduces label-free optical imaging methods including Raman and infrared microscopy, and holographic microscopy. Introduction to advanced methods for manipulation of single cells and single molecules (optical and magnetic tweezers), and correlative light and electron microscopy (CLEM) will be also provided, together with some concept about the newest in-situ transmission electron microscopy (TEM) for biological applications |
| Goals and Objectives | This course provides a comprehensive overview of advanced bioimaging techniques including fundamental concepts and applications, which allow biology students to design imaging experiments for their own research. |
| Required Knowledge | No prerequisite. |

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| Reference Texts | Principles of fluorescence spectroscopy (J. R. Lakowicz), Handbook of fluorescence spectroscopy and imaging (M. Sauer, J. Hofkens, J. Enderlein), Single particle tracking and single molecule energy transfer (C. Brauchle, D.C. Lamb, J. Michaelis Eds.), Optics (E. Hecht), Single molecule spectroscopy in chemistry, physics, and biology (A. Gräslund, R. Rigler, J. Widengren), Infrared and Raman Spectroscopic Imaging (R. Salzer, H. W. Siesler Eds.) |
| Method of evaluation | 20.00% - Attendance and Participation 30.00% - Presentation 25.00% - Midterm exam 25.00% - Final exam |
| Nature of the assignments | paper presentation |
| Course Policies | In accordance with the University policy and professional standards, the highest levels of academic integrity are expected in this class. The code of student conduct is strictly enforced. Academic dishonesty will result in reductions in grades and/or expulsions from this class and/or the University. |
| Additional Information | |

Tentative Course Schedule

(Time, topic/emphasis & resources)

| Week | Lectures | Topic |
|------|----------------------------------|--|
| 1 | Sun 01/22/2017 Wed 01/25/2017 | Fundamentals of Light Absorption and Fluorescence / Fundamentals of Optics |
| 2 | Sun 01/29/2017 Wed 02/01/2017 | Optical Microscopy Techniques / Fluorescence Microscopy |
| 3 | Sun 02/05/2017 Wed 02/08/2017 | Fluorescent Protein Technologies / Fluorophores and Labeling |
| 4 | Sun 02/12/2017 Wed 02/15/2017 | Fluorescence Correlation Spectroscopy / Single-Molecule Tracking |
| 5 | Sun 02/19/2017 Wed 02/22/2017 | Super-Resolution Fluorescence Microscopy / Midterm Exam |
| 6 | Sun 02/26/2017 Wed 03/01/2017 | Vibrational microspectroscopy (Raman Microscopy) |
| 7 | Sun 03/05/2017 Wed 03/08/2017 | Hands-on experiment (Raman Microscopy) / Vibrational microspectroscopy (IR Microscopy) |
| 8 | Sun 03/12/2017 Wed 03/15/2017 | Vibrational microspectroscopy (IR Microscopy) / Plasmonics |
| 9 | Sun 03/19/2017 Wed 03/22/2017 | Optical Tweezers / Electron Microscopy for Bioscience Researches |
| 10 | Sun 03/26/2017 Wed 03/29/2017 | Correlative Light and Electron Microscopy (CLEM) / <i>In-situ</i> Electron Microscopy (<i>In-situ</i> CLEM and TEM imaging of liquid specimens) |
| 11 | Sun 04/02/2017 Wed 04/05/2017 | Spring break |
| 12 | Sun 04/09/2017 Wed 04/12/2017 | Digital Holographic Microscopy / Presentation |
| 13 | Sun 04/16/2017 Wed 04/19/2017 | Presentations |
| 14 | Sun 04/23/2017 Wed 04/26/2017 | Presentations |
| 15 | Sun 04/30/2017 Wed 05/03/2017 | Presentations |
| 16 | Sun 05/07/2017 Wed 05/10/2017 | Presentations |
| 17 | Sun 05/14/2017 Wed 05/17/2017 | Presentations |
| 18 | | Final Exam |

Note

The instructor reserves the right to make changes to this syllabus as necessary.