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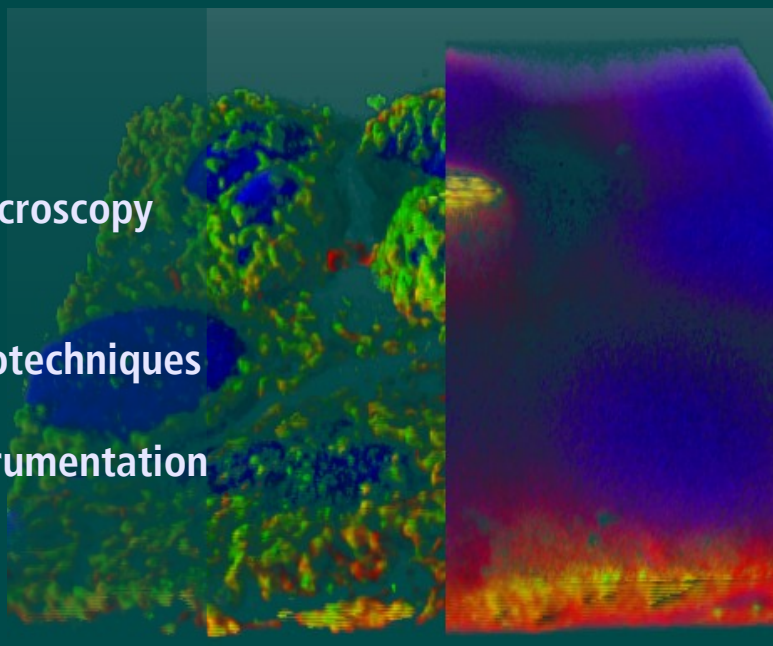
# Practical Course in Advanced Microscopy in Zürich

## 16. - 21. 1. 2011

Modules:

- High Resolution Light Microscopy
- Life Cell Microscopy
- Fine Structure Preparation in Electron Microscopy
- Immuno Electron Microscopy
- Correlative Microscopy
- TEM and SEM Tomography Including Cryotechniques



Industry day: Latest developments in instrumentation and technique

Organized by:
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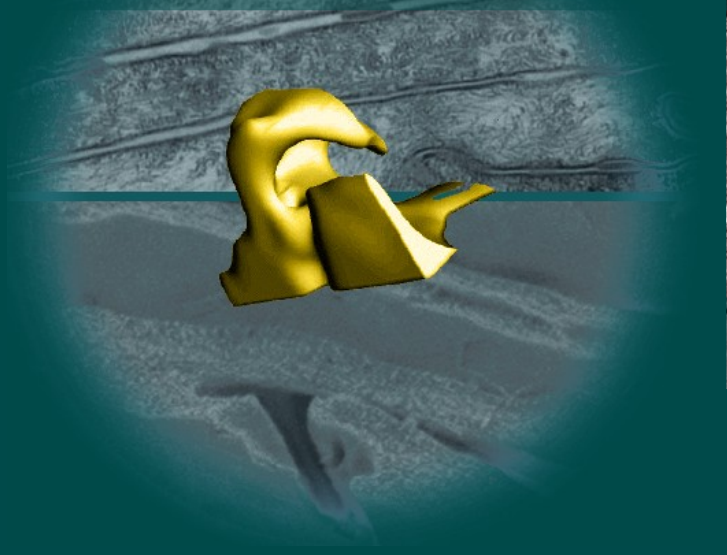
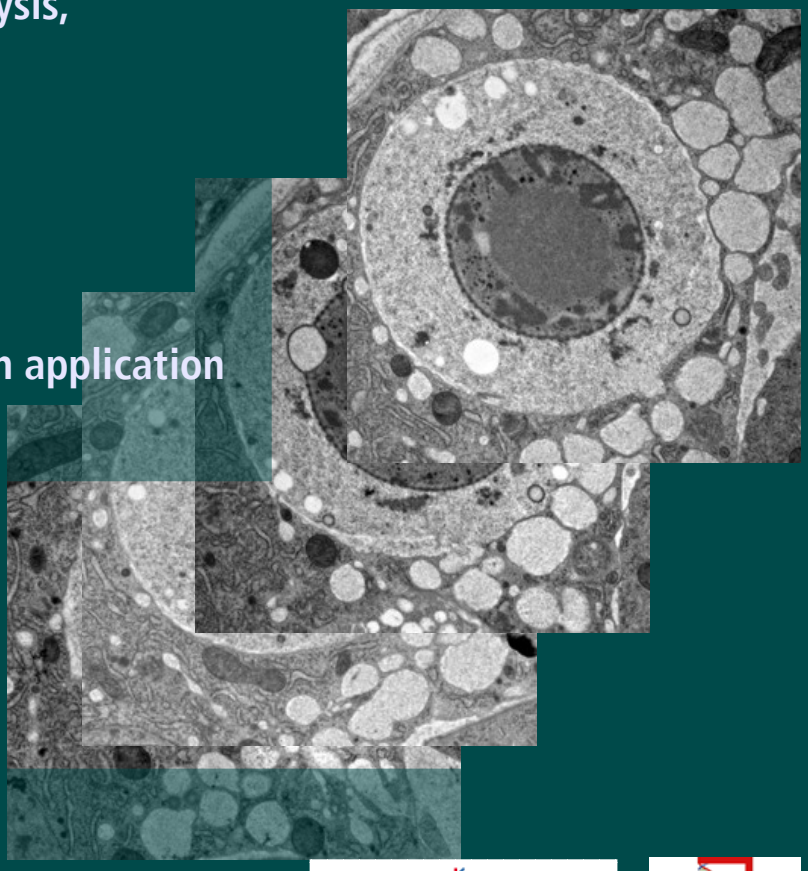
Center for Microscopy and Image Analysis,
University of Zürich
Roger Wepf
Electron Microscopy, ETH Zürich
Gabor Csucs
Light Microscopy Centre, ETH Zürich

Please find detailed information and an application form: www.zmb.uzh.ch/courses





CIMST

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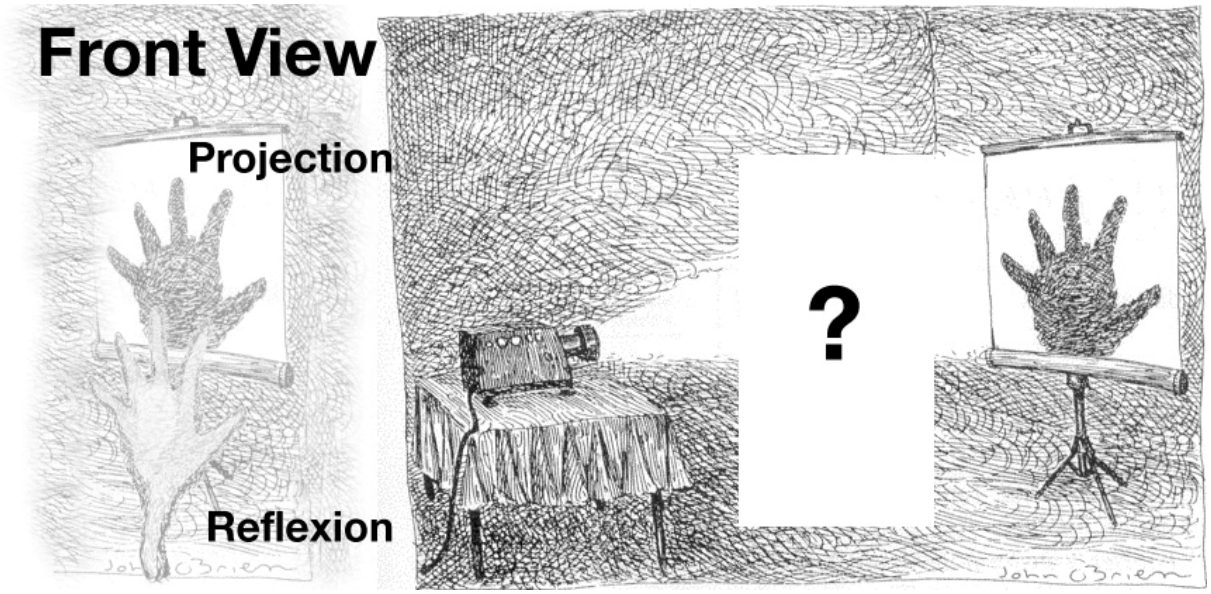
## Why 3D imaging?

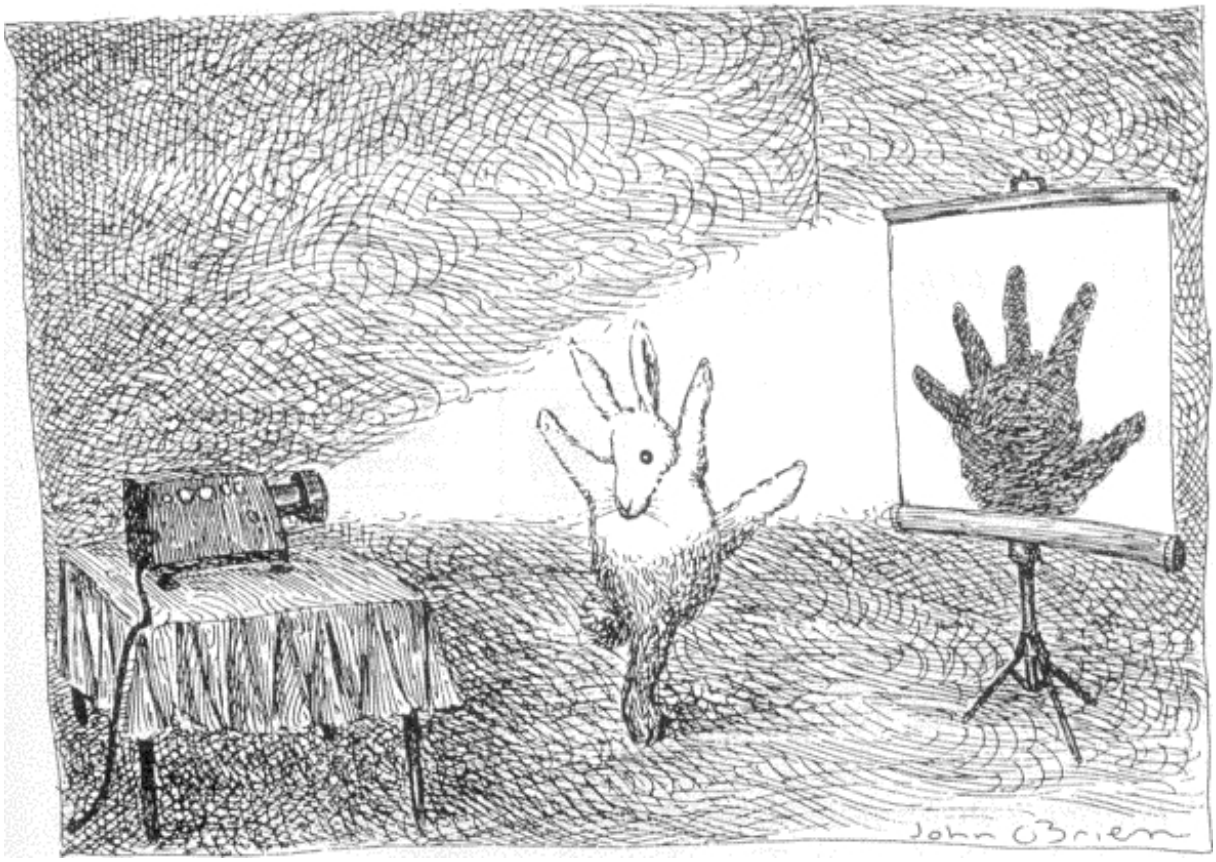
Any image we produce from an complex object of our environment, which is not perfectly crystalline organized – independent in size and material properties and independent of the imaging mode - remains a simple effigy („Ab-Bild“) usually represented in density or colour variations on a two dimensional plain (2D image).




This has even been recognized more than 100 years ago by then modern artist as e.g. by Claude Monet that a single image produced at one time-point can not capture the “real” object in size, shape and time dependent appearance – and of its “inner” character – so in our perception of natures “wholeness”. He therefore introduced “imaging in series” as a new art field, and was first laugh at for his exhibition in Paris showing 15 images of one an the same object – the Hey Stack (1891) – and did not stress the public at all but became very popular and successful after opening.

He obviously fulfilled a turn from images as the masterwork, the unique “image”, of an object to describing the whole object by “capturing” a collection of individual aspects on independent images – a image series.

Claude Monet (1891): The Hey-stack image series – one of the first attempts to acquire the “whole” view




So imaging a complex structure under different viewing angle helps to identify the 3D Morphology of a structure of interest – which is one way to "capture" the "real" shape as been brought to perfection in "Tomography". In the computer such image tilt series can be reconstructed to a 3D model.

If it is not possible to change the viewing angle an additional way in structure research is to collect subsequent 2D images with different depth information throughout the specimen (serial-imaging) as has been brought to perfection in optical and mechanical serial section imaging. Such images series can then be reconstructed in the computer to a 3D model.

The reconstructed 3D models can be turned around in the computer to "see" the "real" morphology and learn more about its structural details than only in "one image".

Both approaches will be shown during the course either by using photons or electron for imaging three-dimensional complex structure at different resolution scale usually not accessible to our naked eye.

An alternative way not mentioned yet would be Holographic imaging, which we will not discuss during the course at all.

Even further precision in 3D is needed, because the single 2D images often appear to be real sharp 2D representation of the projection or the reflection properties of the complex three-dimensional structure (3D) represented in gradient pattern image point by image point (pixels). Even the lateral resolution of each individual measuring point (pixel) can be very high – the „collection depth" in the optical axis is very often completely neglected, which intuitively misleads the interpretation of these 2D images even more than just „one viewing angle" onto the 3D object.

We will show during the course that every 2D image we take with our microscope has not a infinitesimal sharp definition in the z-axis and that these image slides or ultrathin sections are themselves extended 3D "objects" – here we will show during the course that a correction of the so called point spread function or a tomographic approach help to get higher precision in the third axis and hence also in the lateral dimensions. Further enhancing the detailed description of a 3D object and turning 3D imaging to a real high resolution imaging research tool.

Furthermore we need to know more about our imaging „transfer" functions of our imaging devices and also about the limitation in space, dynamics and signal characteristic to get most out of our investigations and hence imaging technology and understanding our imaging systems get into our focus.

Exactly because of the different viewing angle and the z-resolution as an additional often forgotten dimension in image interpretation – we need real 3D imaging technologies to determine the „Z" information level and the resolution along the optical imaging axis.

Only if we are able to „look" at our object at different viewing angle and with a precise lateral as well as axial resolution we can deduce the structural details of our complex real 3D objects as accurate as possible for structure research investigations on the sub-cellular level.

Hope you will enjoy the excursion into 3D microscopy imaging technology and gain some deeper insights during the 3D microscopy course

***Have fun and good luck in viewing our complex world***

***Gabor Csúcs***

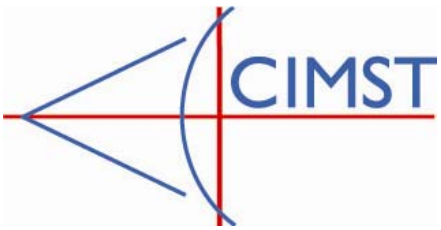
***Urs Ziegler***

***Andres Kaech***

***Roger Wepf***

# Support and participation

The support and participation of the following organisations and companies is greatly acknowledged:













# Location and Maps

## All lectures at University, Campus Irchel, Lecture Hall Y03G91

**Module 1: High resolution light microscopy**
Irchel building Y42 Floor H (details about labs will be provided on Sunday)

**Module 2: Life Cell Microscopy**
Hönggerberg HPM (details about labs will be provided on Sunday)

**Module 3: Fine structure preparation in electron microscopy**
University center at Gloriastrasse 30 (details about labs will be provided on Sunday)

**Module 4: Immuno electron microscopy**
Irchel building Y42 Floor H (details about labs will be provided on Sunday)

**Module 5: 3D Correlative Microscopy (CLSM/FIB-SEM)**
Work at microscopes: Hönggerberg HPM
Meeting point, Introduction and Image Processing: Hönggerberg HIT E 51
(details about labs will be provided on Sunday)

**Module 6: Array Tomography - 2D Correlative Microscopy**
Work at microscopes: Hönggerberg HPM
Meeting point, Introduction and Image Processing: Hönggerberg HIT E 51
(details about labs will be provided on Sunday)

**Module 7: CryoTEM Tomography and Stereo TEM (SEM)**
Work at microscopes: Hönggerberg HPM
Meeting point, Introduction and Image Processing: Hönggerberg HIT E 51
(details about labs will be provided on Sunday)

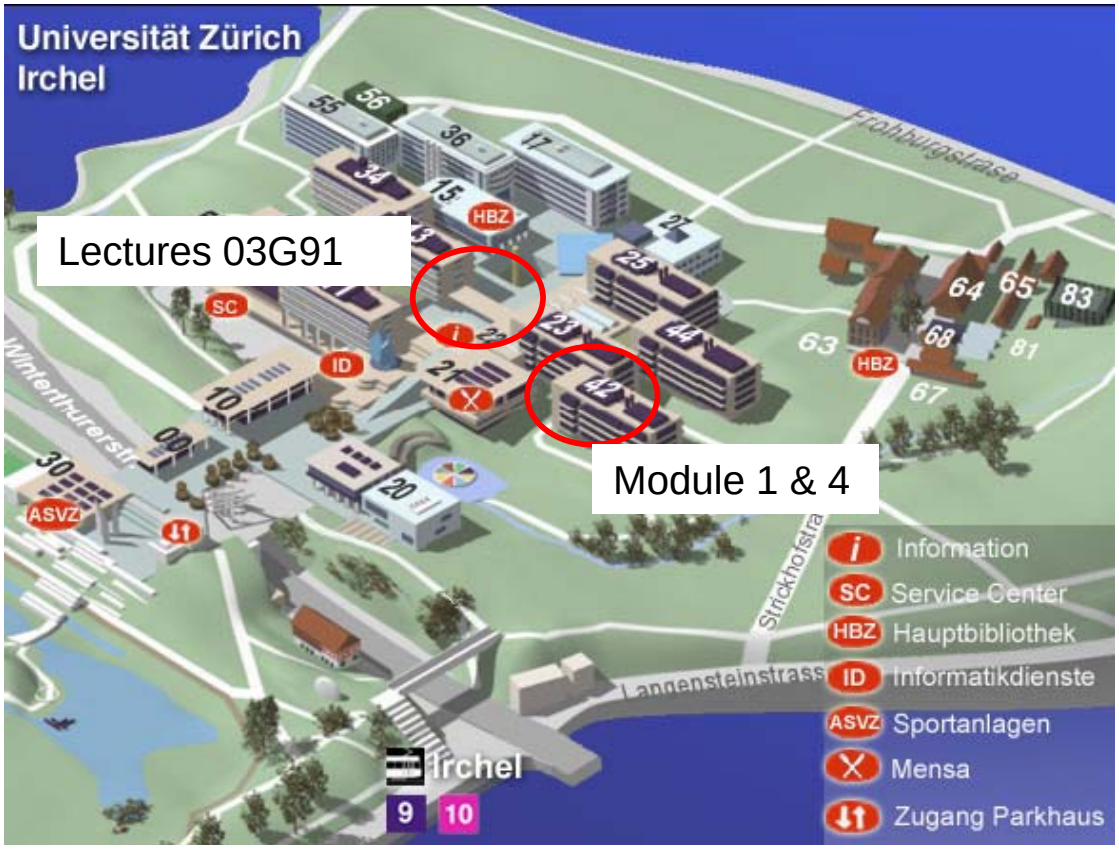
# University Irchel – Location and Maps

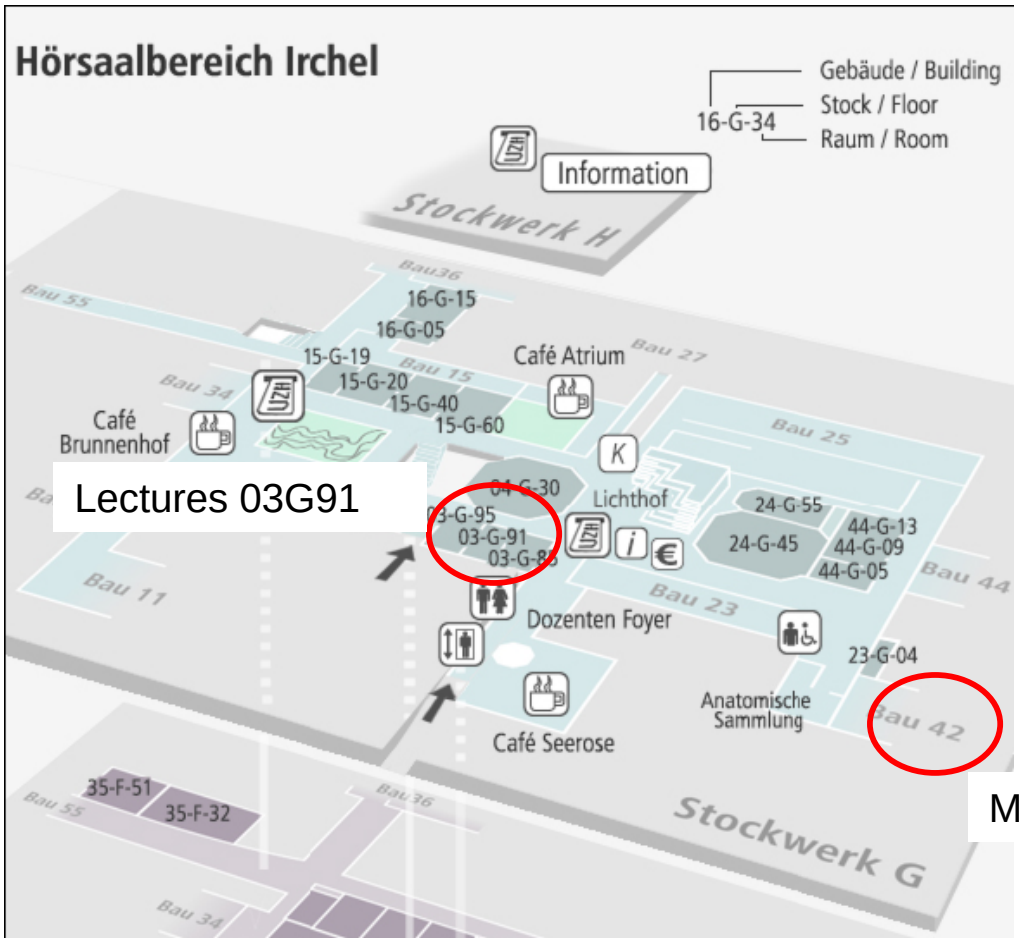
**You may travel by public transport**
from Zurich main station, tram stop *Bahnhofplatz*, tram No 10 (direction Oerlikon) to *Irchel*. Walk about 3 min. to the university main entrance.
from Zurich main station, tram stop *Bahnhofplatz* or *Bahnhofquai*, tram No 14 (direction Seebach) to *Milchbuck*. Walk about 6 min. to the university main entrance.

**You may travel by car**
Highway A1 from Winterthur or Airport Zurich Kloten towards Zürich-City. Take the left lane in the Schöneichtunnel. Follow the signs to the Irchel parking structure at the end of the tunnel.
Highway A1 from Bern/Basel towards Airport Zurich Kloten/St. Gallen, then towards Zürich-City. Take the left lane in the Schöneichtunnel. Follow the signs to the Irchel parking structure at the end of the tunnel.
Highway A3 from Chur/Luzern towards Bern/Basel, then towards Winterthur/St. Gallen. Exit *Tierspital* (animal hospital). Follow the signs to the Irchel parking structure.

**You may travel by taxi**
The transfer from Zurich Airport to the Irchel campus of the University of Zurich is particularly easy by taxi. There is a taxi stand at the Irchel next to one of the two main entrances. The transfer by taxi costs about CHF 60.- (return fare), which is about twice as much as the transfer by public transport.
We do not recommend to travel by taxi from other starting points than the airport.

# University Irchel – Location and Maps



ZMB Center for Microscopy and Image Analysis University of Zurich
EMEZ Electron Microscopy ETH Zurich
LMC Light Microscopy Centre ETH Zurich

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# University Center (Gloriastrasse)
# Location and Maps

**You may travel by public transport**
from Zurich main station, tram stop Bahnhofplatz, tram No 10 (direction Oerlikon) to Universitätsspital. Walk about 5 min. around the University Hospital to Gloriastrasse 30.
from Zurich main station, tram stop Bahnhofplatz No 6 (direction Fluntern) to Platte. Walk about 3 min. to Gloriastrasse 30.

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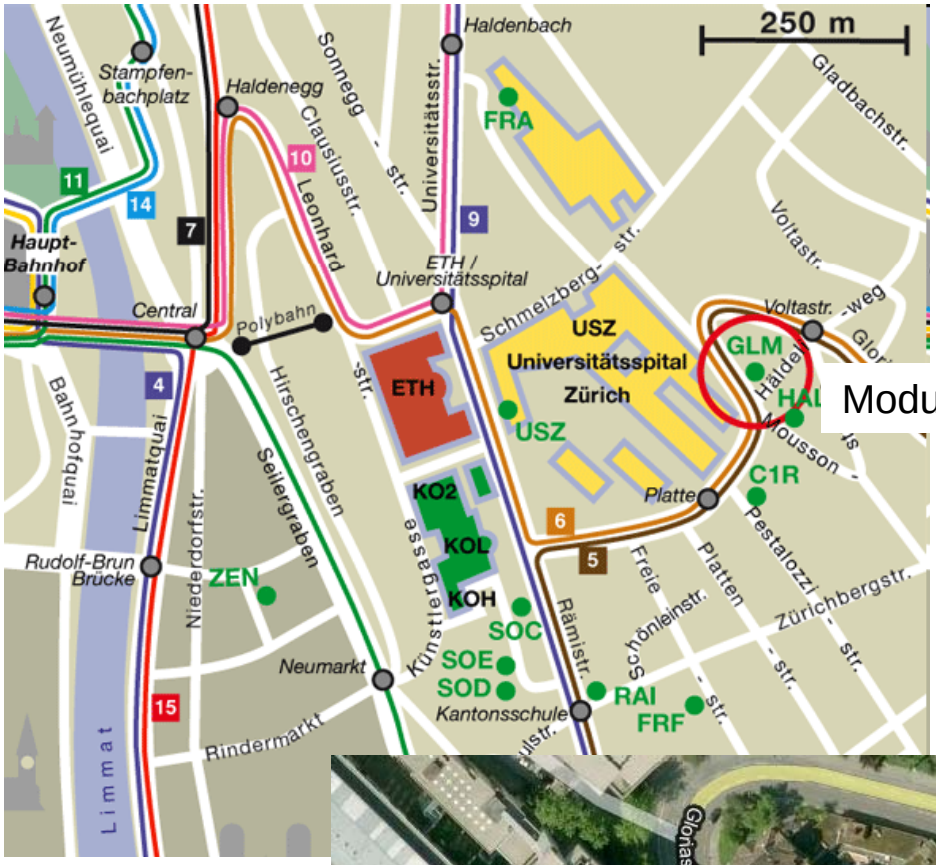
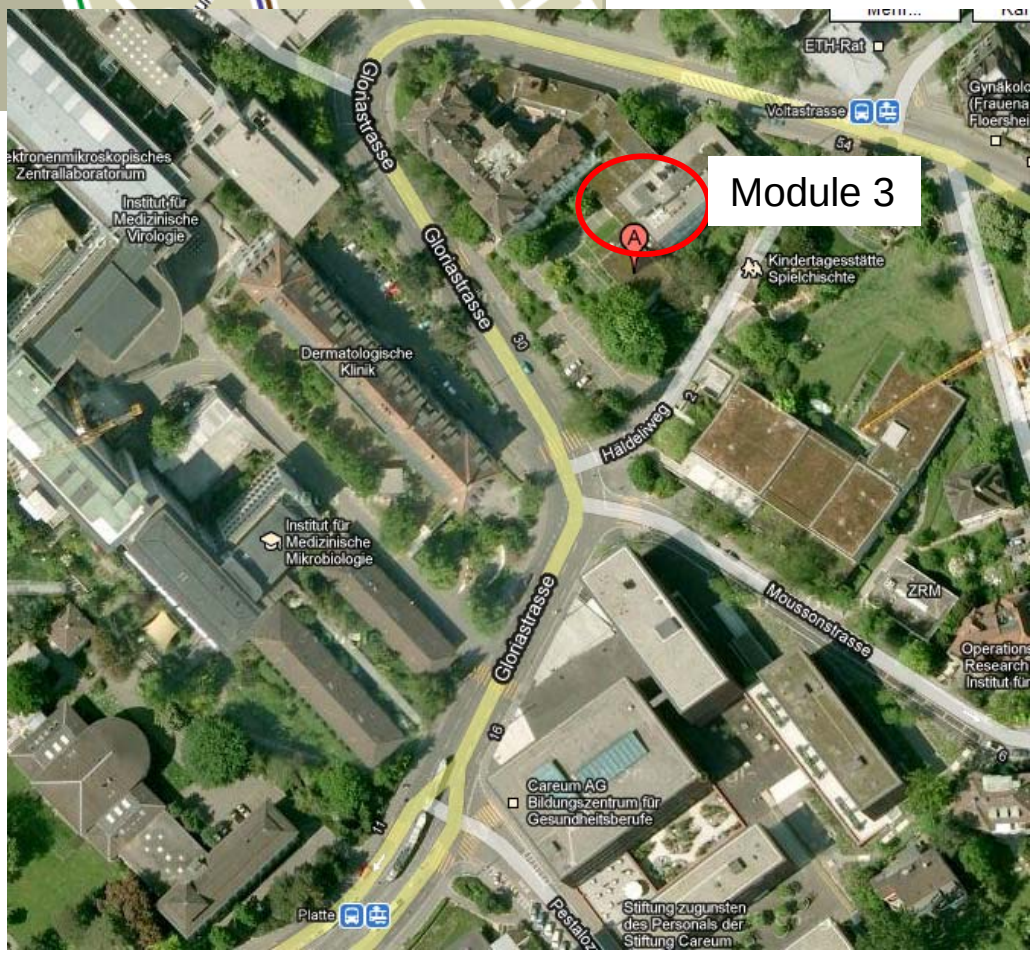
# University Center (Gloriastrasse 30)
# Location and Maps



# ETH Hönggerberg - Location and Maps

**From main station**
Journey time: about twentyfive minutes.
With S-Bahnlinien no. 2, 5, 6, 7, 8, 14, 16 to Bahnhof Oerlikon; change to the bus no. 80 (Oerlikon Nord) to «ETH Hönggerberg».
With tram no. 11 (direction Auzelg) from main station (Bahnhofstrasse or Bahnhofquai) to the stop Bucheggplatz; change to the connecting bus no. 69 to «ETH Hönggerberg».
With tram no. 14 (direction Seebach) from main station (Bahnhofplatz or Bahnhofquai) to the stop Milchbuck; change to the connecting bus no. 69 to «ETH Hönggerberg».

**From railway station Oerlikon**
Journey time: ten minutes.
With bus no. 80 (direction Triemli) from station Oerlikon Nord to the stop «ETH Hönggerberg».

**From University Irchel**
Journey time: twenty minutes.
Walk to tram/bus station Irchel. Bus Nr. 69 to ETH Hönggerberg

**By car**
From Bucheggplatz the way to the campus Hönggerberg is marked.

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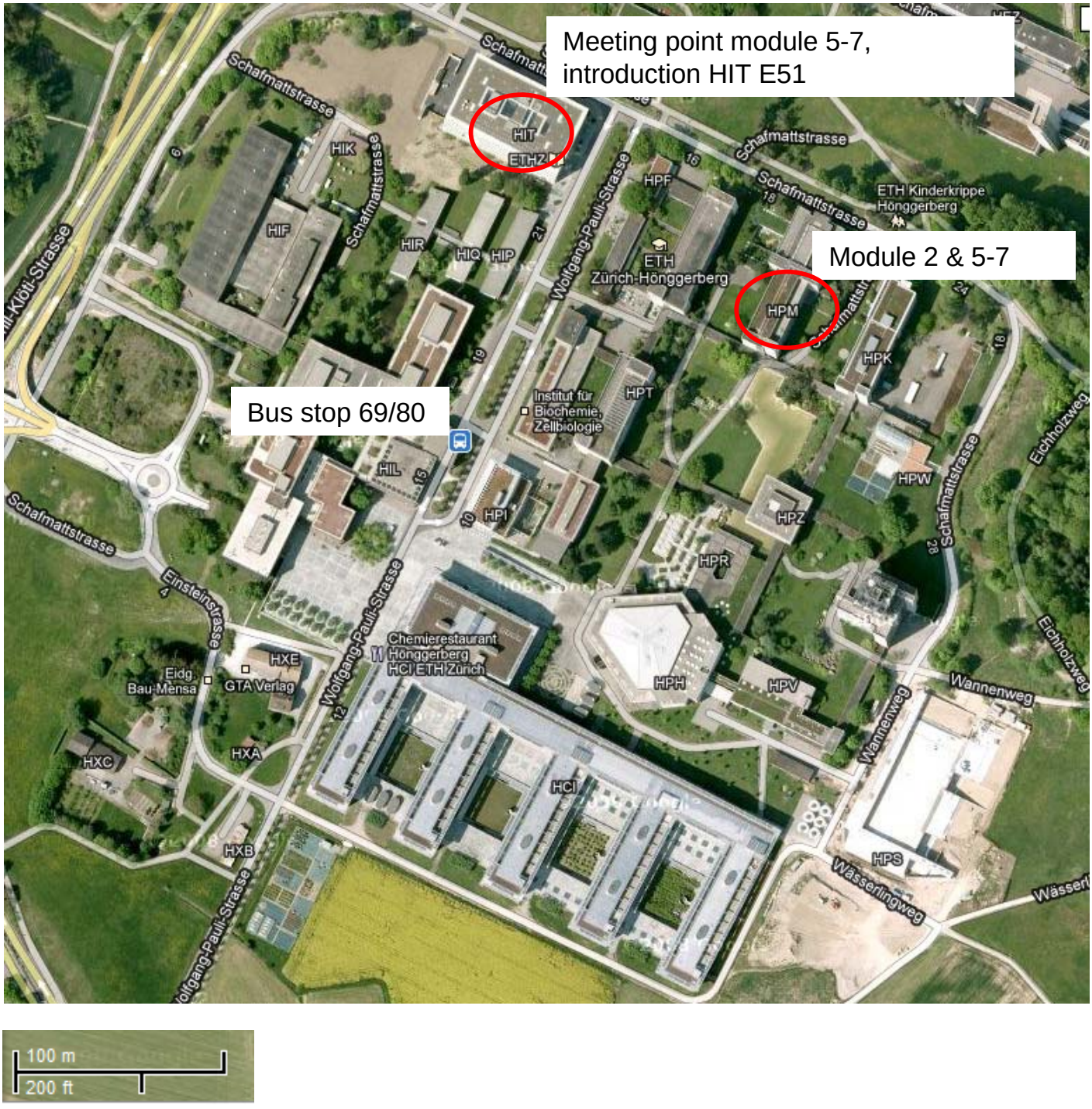
# ETH Hönggerberg - Location and Maps



# Winterschool 2011 3D LM&EM

*All lectures at University Zurich Irchel Room Y03G91*

| Time | Sunday 16.01.2011 | Monday 17.01.2011 | Tuesday 18.01.2011 | Wednesday 19.01.2011 | Thursday 20.01.2011 | Friday 21.01.2011 |
|---|---|---|---|---|---|---|
| 08:00 | | | | | | |
| 08:15 | | | | **Industry Day** | | |
| 08:30 | | | | | 8.30-9.00<br>Detector systems for light microscopy<br>Gábor Csúcs | |
| 08:45 | | 8.30-9.45<br>Image processing<br>Peter Horvath | 8.30-9.45<br>Correlative microscopy<br>Roger Wepf | 8.45-10.15<br>Talks & Presentations/ Networking<br>(see separate program) | | |
| 09:00 | | | | | 9.00-9.45<br>Tomography<br>Takashi Ishikawa | |
| 09:15 | **9-10**<br>**Arrival Coffee/Tea**<br>**Uni Irchel** | | | | | |
| 09:30 | | | | | | |
| 09:45 | | Coffee break individual | Coffee break individual | | Coffee break individual | |
| 10:00 | 10-10.45<br>Welcome and Introduction to course &<br>Imaging basics<br>Roger Wepf | | | | | Practical work in modules |
| 10:15 | | | | 10.15-10.45<br>Coffee break | | |
| 10:30 | | | | | 10.15-11.15<br>Super resolution techniques<br>Nathalie Garin | |
| 10:45 | 10.45-11.30<br>Introduction to light microscopy<br>Urs Ziegler | | | 10.45-12.15<br>Talks & Presentations/ Networking | | |
| 11:00 | | | | | | |
| 11:15 | | Practical work in modules | Practical work in modules | | Practical work in modules | |
| 11:30 | Short break | | | | | |
| 11:45 | 11.45-12.30<br>Introduction to electron microscopy<br>Andres Kaech | | | | | |
| 12:00 | | | | | | |
| 12:15 | | | | | | |
| 12:30 | *12.30-13.30 Lunch Break* | | | | | |
| 12:45 | | | | | | |
| 13:00 | | | | | | |
| 13:15 | | | | | | |
| 13:30 | 13.30-14.15<br>Preparation and labelling techniques for light microscopy<br>Urs Ziegler | | | 13.30-15.30<br>Talks & Presentation/ Networking | | |
| 13:45 | | | | | | |
| 14:00 | | | | | | 14.00-15.45<br>Short presentations of your practical works |
| 14:15 | 14.15-15.00<br>Preparation for electron microscopy<br>Andres Kaech | | | | | |
| 14:30 | | | | | | |
| 14:45 | | | | | | |
| 15:00 | 15.00-15.45<br>Immunocytochemistry for LM and EM<br>Heinz Schwarz | | | | | |
| 15:15 | | | | | | |
| 15:30 | | Practical work in modules | Practical work in modules | 15.30-16.00<br>Coffee break | Practical work in modules | |
| 15:45 | 15.45-16.15<br>Coffee break | | | | | 15.45-16.15<br>Final discussion |
| 16:00 | | | | | | |
| 16:15 | 16.15-17.00<br>3D electron microscopy techniques<br>Roger Wepf | | | 16.00-17.00<br>Talks & Presentation/ Networking | | |
| 16:30 | | | | | | |
| 16:45 | | | | | | |
| 17:00 | 17.00-17.45<br>3D light microscopy techniques<br>Gábor Csúcs | | | 17.00-17.45<br>Lecture Ohad Medalia | | |
| 17:15 | | | | | | |
| 17:30 | | | | | | |
| 17:45 | break and wrap up | | | | | |
| 18:00 | | | | | | |
| 18:15 | | | | | | |
| 18:30 | Apéro and small dinner | Open end | Open end | Exhibition and Dinner | Open end | |
| 18:45 | | | | | | |
| 19:00 | | | | | | |
| 19:15 | | | | | | |

*14.01.11*

| 5th INDUSTRY DAY WEDNESDAY, JANUARY 19, 2011 IRCHEL UNIVERSITY ROOM Y03G91 | | | |
|---|---|---|---|
| TIME | AFFILIATION | NAME | TITLE/CONTENT |
| 08.00 - 08.45 | WELCOME COFFEE | | |
| 08.45 - 09.15 | Nikon | Dr. Tiana Steinhoff | Of Diamonds and Microscopes |
| 09.15 - 09.45 | Olympus | Dr. Florian Eich | Expert optics for expert jobs |
| 09.45 - 10.15 | ZEISS | Dr. Christine Strasser | Highest Sensitivity and Flexibility in Optical Sectioning Microscopy |
| 10.15-10.45 | COFFEE BREAK | | |
| 10.45 - 11.15 | Gloor Instruments | Dr. Harry Brandenberger | ATLAS - Large Area Imaging in Life Science |
| 11.15 - 11.45 | JEOL | Dr. Oliver Senftleben<br>Dr.Marco Schwieder | New Developments in Cryo Electron Microscopy |
| 11.45 -12.15 | Leica Microsystems | Dr. Kim Rensing | Cryo-preparation systems for electron microscopy |
| 12.15 - 13.30 | LUNCH BREAK | | |
| 13.30 - 14.00 | Leica Microsystems | Dr. Nathalie Garin | Ultrafast, ultrasensitive: how to push the limits in optical microscopy |
| 14.00 - 14.30 | VISAGE IMAGING | Dr. Brandt | folgt |
| 14.30 - 15.00 | V S G • Visualization Sciences Group | Dr. Peter Westenberger | Image Processing, Quantification and Model Reconstructions in SEM/FIB using Avizo Fire |
| 15.00 - 15.30 | Perkin Elmer | Dr. Björn Wendik | Complete solutions in microscopy - live cell imaging, image analysis and data management |
| 15.30 - 16.00 | COFFEE BREAK | | |
| 16.00 - 16.30 | Andor Technology | Dr. Axel Wiegand<br>Dr. Andrew Hubbard | Andor Neo – harnessing the full potential of sCMOS Technology for Microscopy<br>Differential Spinning Disc (DSD) – White Light Confocal Microscopy System |
| 16.30 - 17.00 | FEI | Jens Greiser | Revealing Surface And Intracellular Membrane Morphologies Of Host Pathogen Interactions Combining Chromatic Aberration Corrected SEM And STEM Imaging |
| 17.00 - 17.45 | Institute of Biochemistry, University of Zürich | Professor Ohad Medalia | Keynote Lecture: Exploring the inner space of cells by cryo-electron tomography |
| 17.45 - 18.00 | BREAK | | |
| 18.00 - 19.00 | Picture Exhibition | Dr. Nathalie Garin, microscopist<br>Madlaina Boillat, photographer<br>Coline Le Brun, painter | Squares of science |
| 19.30 | DINNER | Il Postino | |

| Last name | First name | Email | Institute | Organization | Street | Nr. | Zip | Town | Country | Cell phone | Phone |
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LMC Light Microscopy Centre ETH Zurich

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