Interdisciplinary research for bachelor students

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Domantas Sakalys

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Dag Kristian Dysthe

LagLivLab - Interdisciplinary research for bachelor students

Nigar Abbasova, Domantas Sakalys, Elizabeth Surgucheva & Dag Kristian Dysthe

Abstract

The “bio-makerspace” LagLivLab has evolved from an idea based on the Sensorama project in FYS3230 to a student driven interdisciplinary research lab supported by the Physics Department, CoE HTH and UiO:Lifescience. In this talk we will discuss the original intentions, how it has worked out during the first 2 years and possible directions for the future. LagLivLab has required serious investment of time, equipment and funds. We will present the motivations of both students (of biology and physics), faculties (of medicine and physics) and UiO:Lifescience for initiating, participating and funding LagLivLab. We will also present the student projects, what works and what doesn’t.

Dag’s point of view

Student research

Interdisciplinary

sensorama
the student science project 2015

This project is a part of the course: FYS3230 - Sensors and measurement technology

GEO-FYS4200 - Case study in physics of geological processes
GEO-FYS4300 - Methods in physics of geological processes

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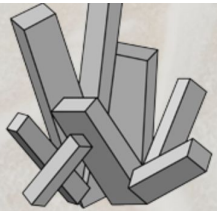


"This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 642976"

Motivation

Give BSc students

- Research experience
- Interdisciplinary experience
- Hands on training
- Innovation inspiration

More "bio"-activity at Physics Dept

- Dedicated labs
- Cool stuff for students
- Existing labs used more

UiO Lifescience:

- Had expressed special interest in a Bio-MakerSpace

UiO : Life Science
University of Oslo

UiO : Department of Physics
University of Oslo

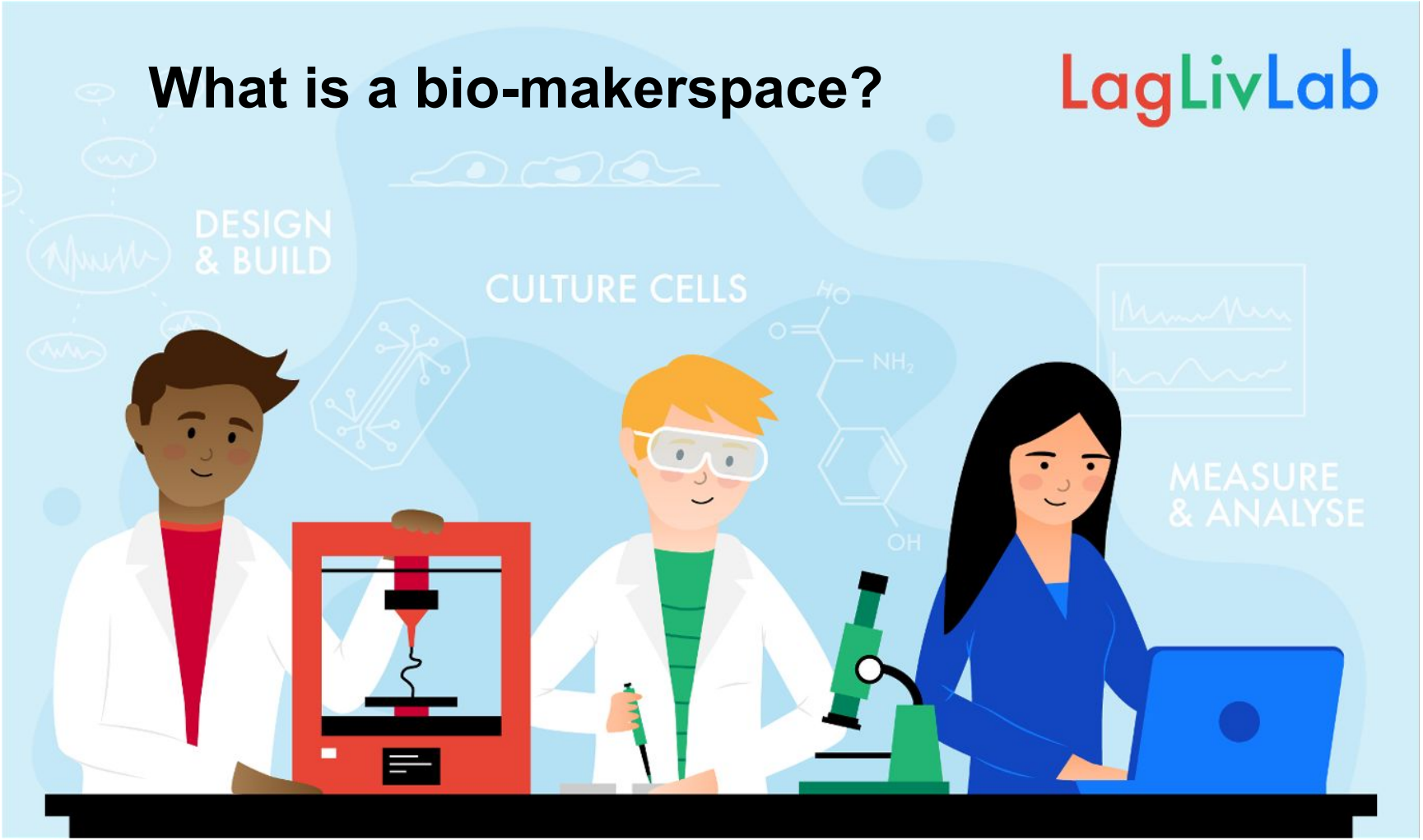
Convergence environments

CHIP ABINO ITOM

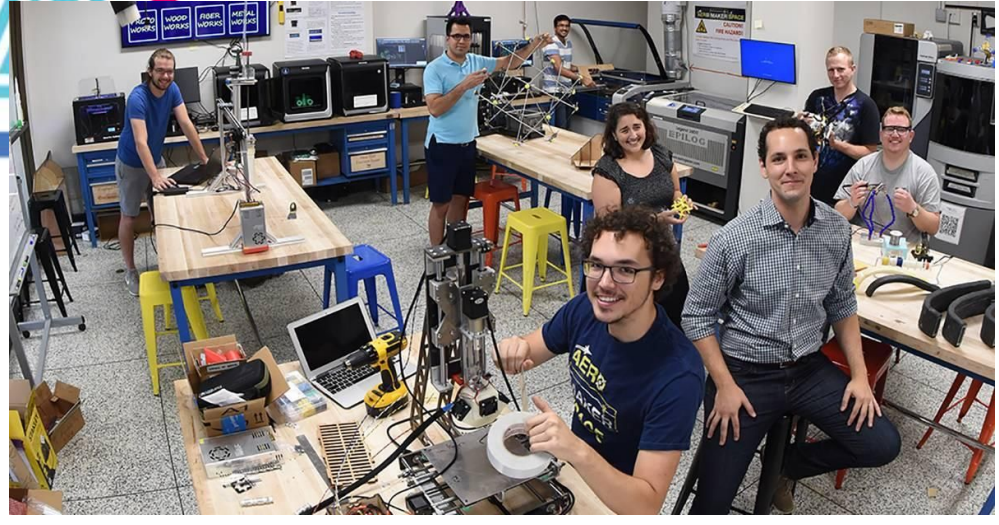
UiO : Hybrid Technology Hub
University of Oslo

What is a bio-makerspace?

LagLivLab



- Lab space
- Equipment for DIY/"making"
  - 3D printers
  - Carpenter & machining tools
  - Electronics tools
  - …
- Available for user defined projects, big and small



What is our bio-makerspace?

- Lab space (126, 128, 420, 431)
- Equipment for Bio-Phys-Tech DIY
  - 3D printer & tools
  - Sterile cell lab
  - Fab lab for lab-on-a-chip
  - Electronic equipment
  - Microscopes
  - Microfluidics
- Training, supervision and technical support
- Project based: no drop-in
- Students

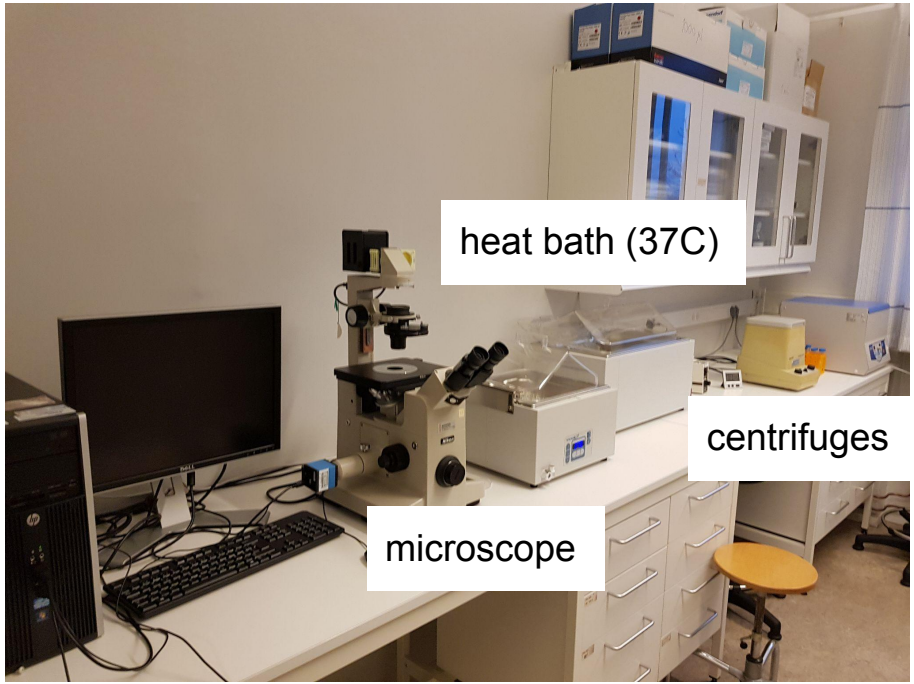
- Life science meets physics
- Real science: publish
- Cutting edge technology
- Learn by doing

Makerspace

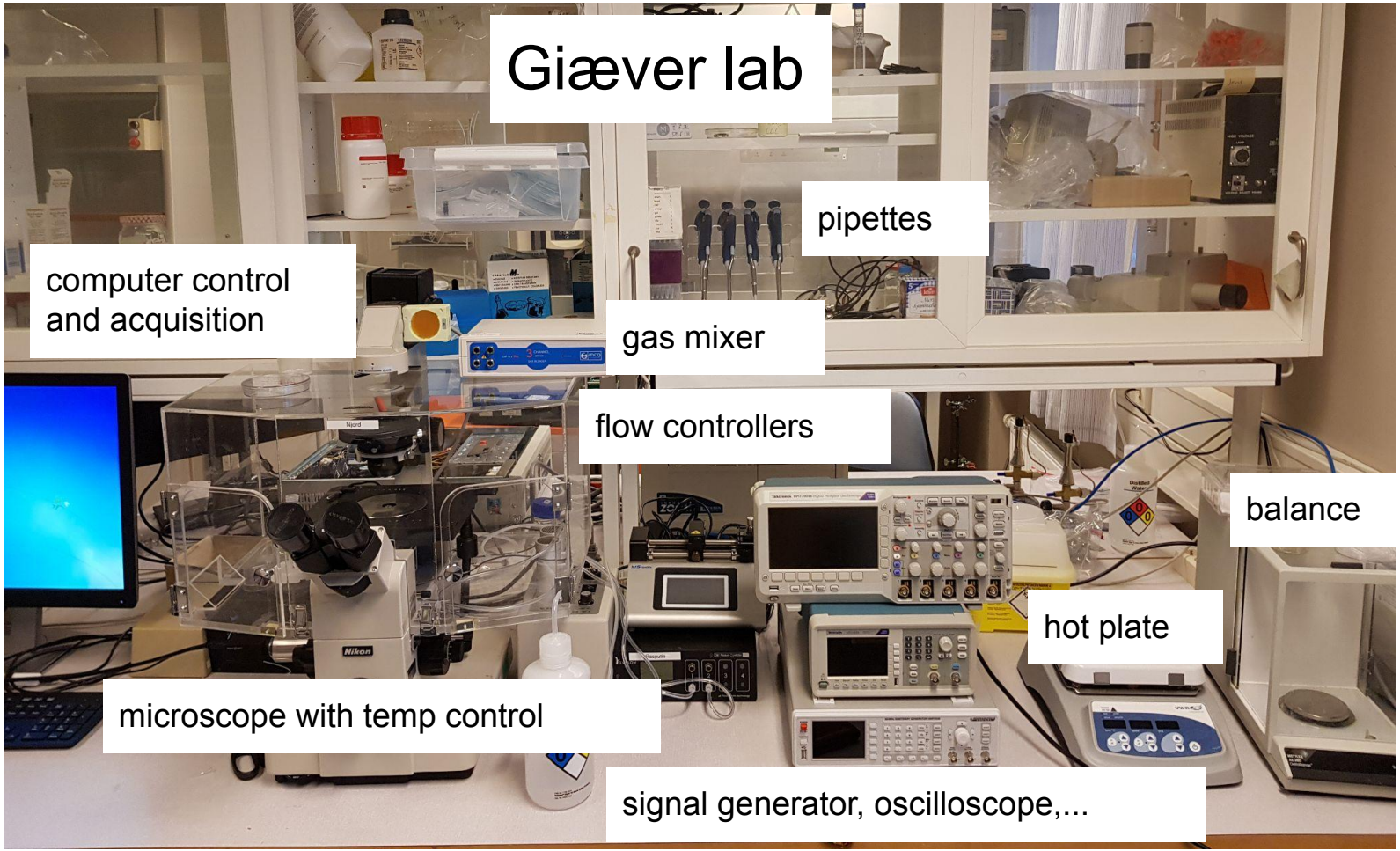
+ 3D printer
+ equipment in electronics section

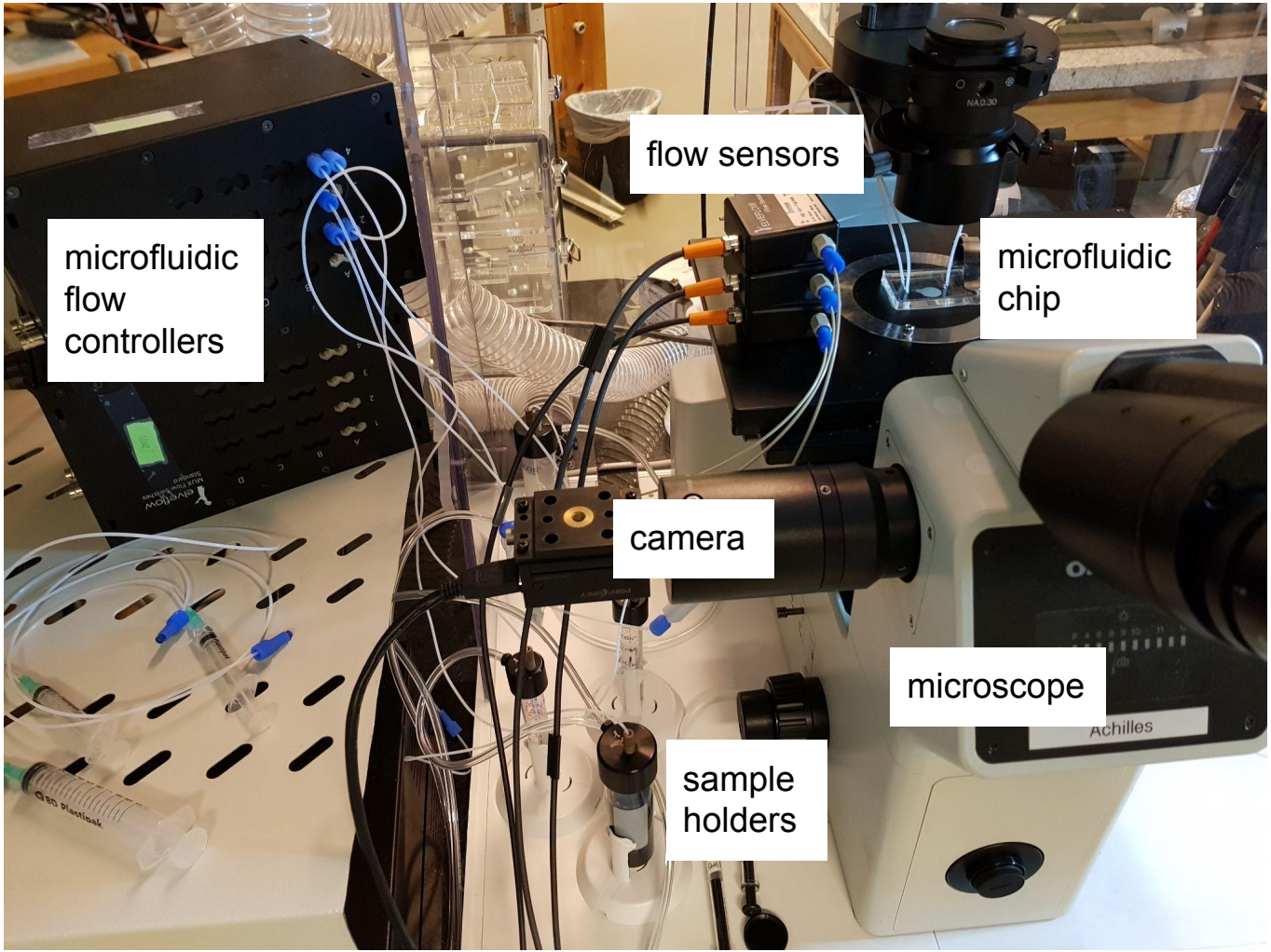
Cell lab


entrance

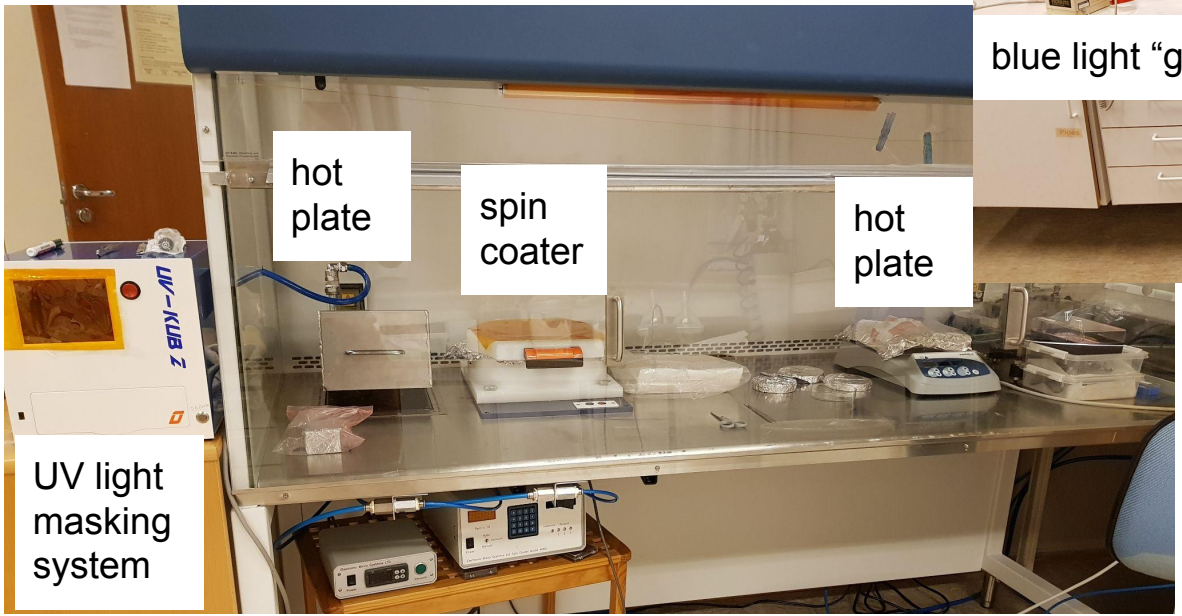

heat bath (37C)
centrifuges
microscope

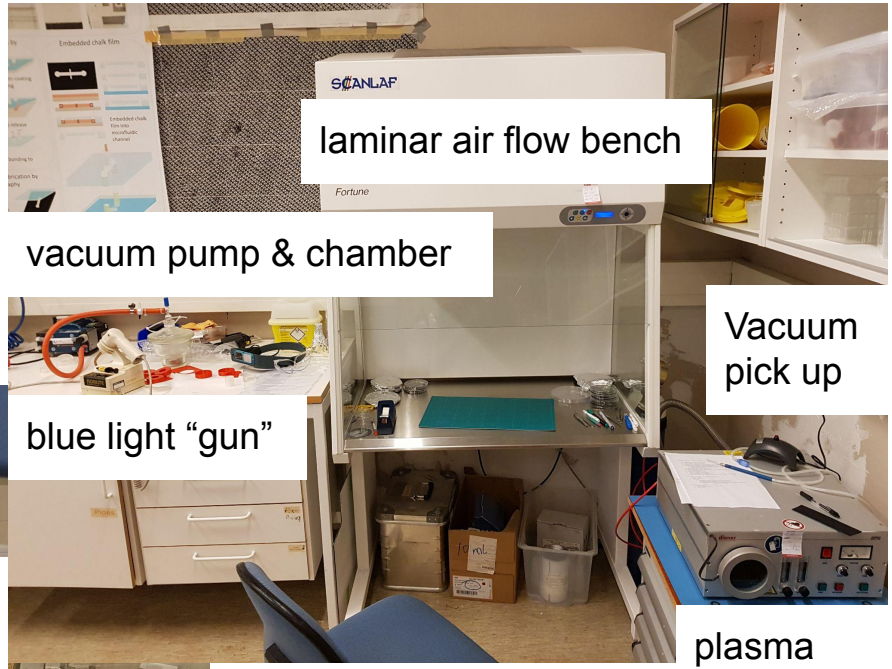

fridge &
freezer
plasticware
safety bench
incubator
bio-hazard
waste


Giæver lab
pipettes
computer control
and acquisition
gas mixer
flow controllers
balance
hot plate
microscope with temp control
signal generator, oscilloscope,...


flow sensors
microfluidic flow controllers
microfluidic chip
camera
microscope
sample holders
Achilles

Microfluidics & lab-on-a-chip fabrication





Fume hood with autoclave and ultrasound cleaner

Fume hood for photolithography development

Support team

Postdocs

Thomas Combriat

Oliver Pabst

Kayoko Shoji

Denis Reis de Assis

Engineer Yi Hu

Initiative

Ørjan G Martinsen

Stefan Krauss

Dag Kristian Dysthe

Student Board: Nigar

UiO : Life Science
University of Oslo

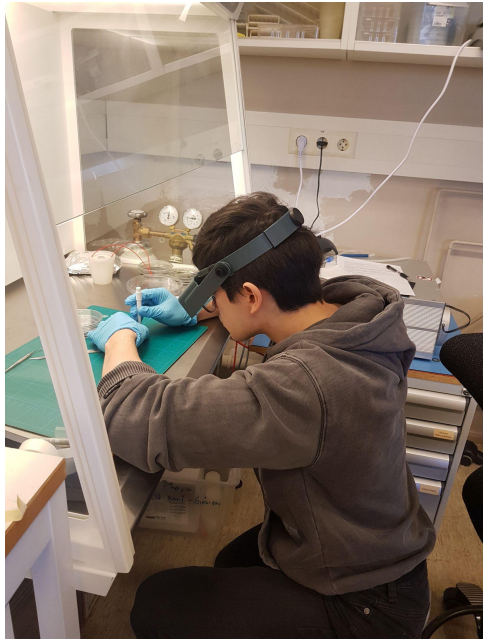
Open science

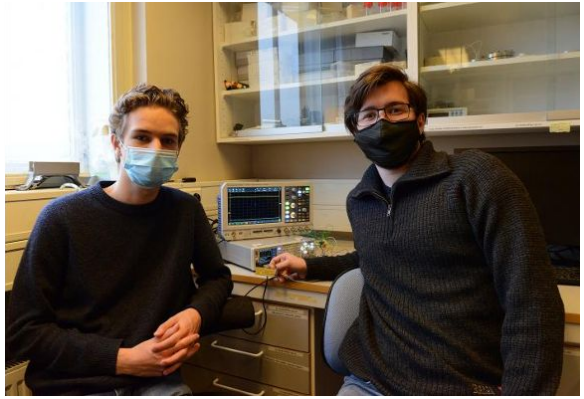
Everything shared on wiki

- Meetings
- Presentations
- Lab notes
- Protocols for
  - cell lab
  - microfabrication
  - experiments
- Results
- …

Activity

- Started Feb 2021 with 15 students and 3 projects
- Corona: One of few available activities
- 18 alumni that participated 1-3 semesters
- 11 students currently active on 2 projects
- Students from Physics & Biology

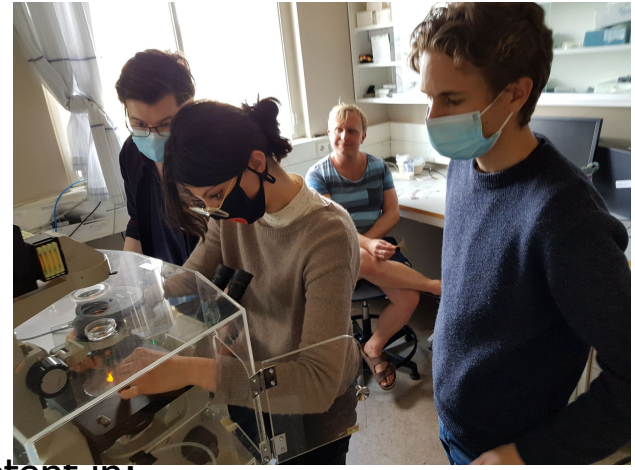


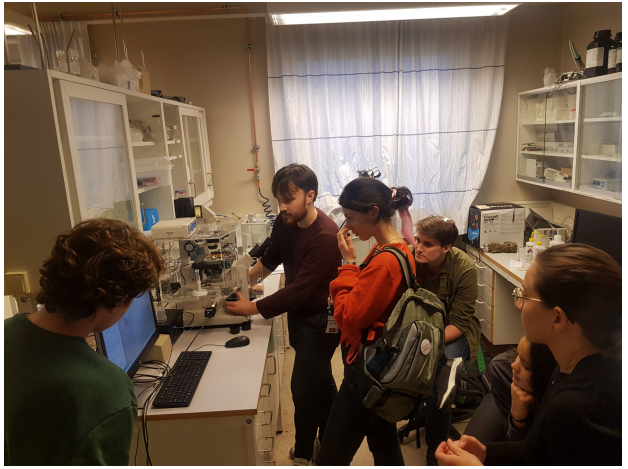


- Initial training by postdocs
  - Aseptic techniques
  - Cell culture
  - Design and fabrication
  - Electronics
- Now they train each other
- Lab maintenance by students

Outcome

- The students
  - Were self-motivated
  - Independent
  - Engaged
  - Creative
  - Learned very quickly
- Students became competent in:
  - Cell culture
  - Scientific thinking
  - Electronics
  - Microfluidic design & fabrication
- Research projects have results!!

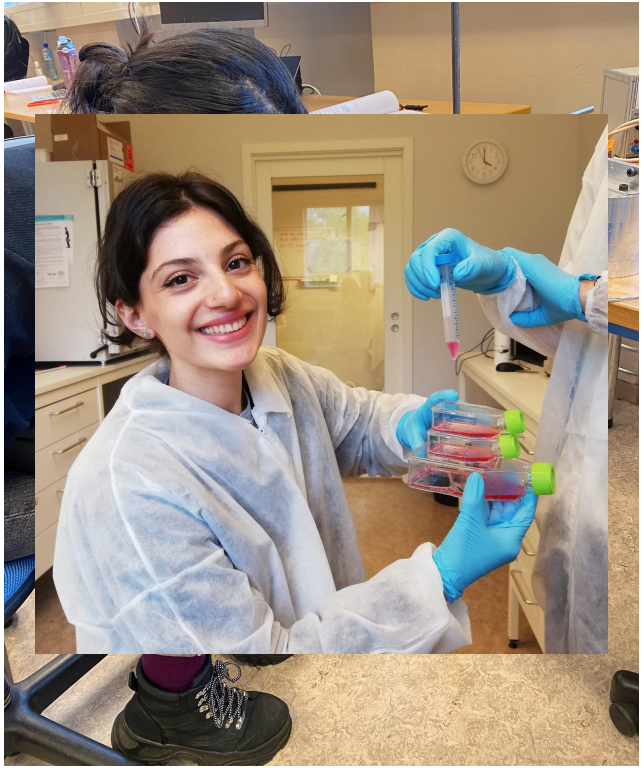




Student’s point of view

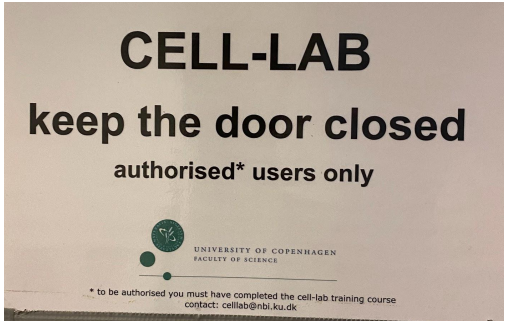
Why LagLivLab?

- Experimental physics
- Covid19 lockdown
- Cool concept → new skills!
- New people, new knowledge…
- Team building!



Benefits?

- Interdisciplinary research
  - Applying theoretical knowledge in the lab
  - Critical thinking
- Basic understanding of biology as a physicist
  - Taught by biologists!
  - Supervised by physicists working with biological systems
- Supervised by researchers, but not assessed
  - Labs and supervisors at the Physics Building
  - International collaborations! PhDs, professors…
  - HTH @ Domus Medica
- Valuable wet lab experience
  - Research internship @ NBI



Challenges?

- Experiments are never easy!
  - Cells die if something is off
  - Apparatus doesn't always behave well
  - Human error
  - Long tedious hours at the lab

- Working with others can be challenging!
  - Busy students with tight schedules
  - Students at different academic levels (bachelor 1,2 or 3 year, master…)

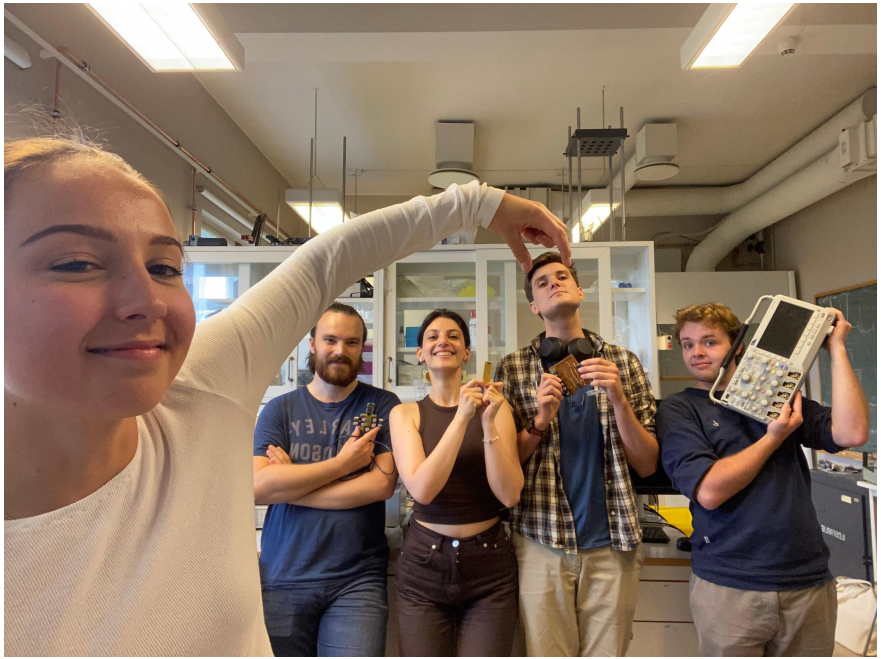
- Reality vs expectations?

Source: ErrantScience

Why continue?

- Real life research is fun!
- Biophysics: relatively new field
  - Chance to find answers to exciting questions
- Learning from each other!
- Learning by doing!!!
- Social!
- Your knowledge is valued

🌟**Electrorotation Team**🌟

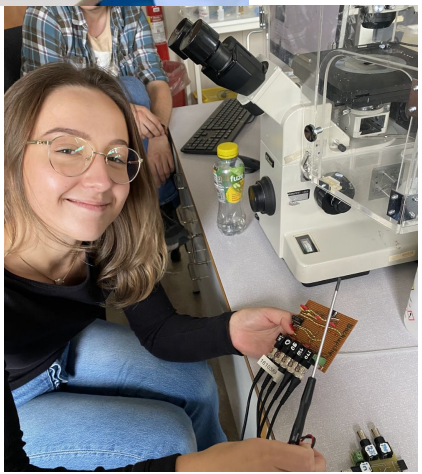


But most importantly…

- Results!!!

Why I joined LagLivLab

- Lab-work is fun, and before enrollment at UiO I aspired to get a part-time "job" in a laboratory.
- Was very intrigued when I first heard about workshop
  - Exciting to have the opportunity to do science in your spare time.
- An opportunity to get better skills as a biologist
- Work and cooperate with students from different fields
  - Exchange knowledge and experience



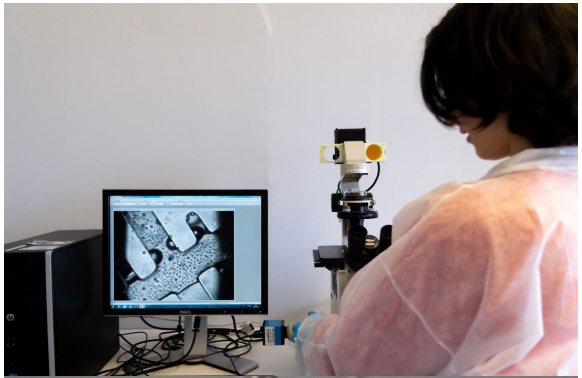
Lab experience

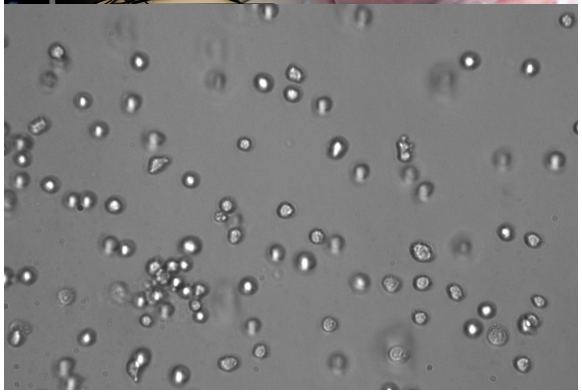
- Currently running our experiments on HeLa cells before moving over to advances mice cell lines with induced ALD
  - Electrorotation as a diagnostic tool?

- Hands-on laboratory experience
  - Develop problem-solving and critical-thinking skills.

- Gain experience with reactions, substances and equipment in a lab setting and not only through the textbook.
  - Few wet-labs in my courses
  - Thanks to LagLivLab I get the opportunity to become more confident with use of equipment and performing of lab protocols.

- Lab etiquette





Creates opportunities when searching for relevant jobs

- Student assistant at Novartis
- Shows that you are interested and invested in the field
- Experience with lab protocols

Source: Vecteezy

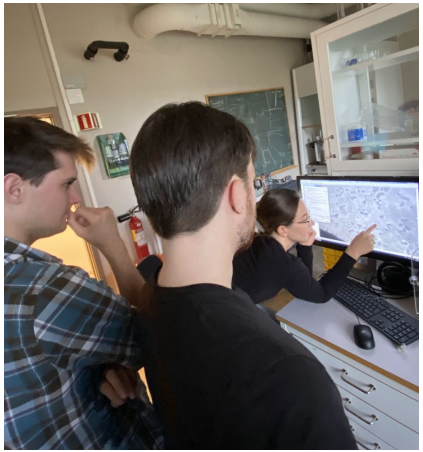
Summer internship and part-time job

- By working with LLL you expose yourself to a potential employer
- LLL helps you develop needed skills
- LLL prepares you for challenges You will meet

Working as a group

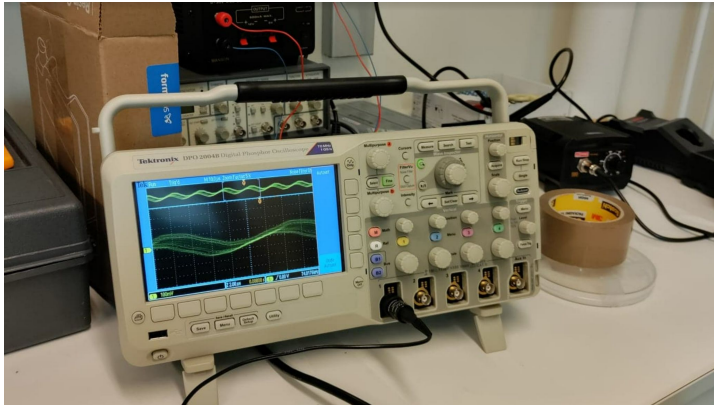
- Teaches better communication
- Planning
- Network
- More fun to share!

🌟**Bioactuator Team**🌟



Working in a scientific environment

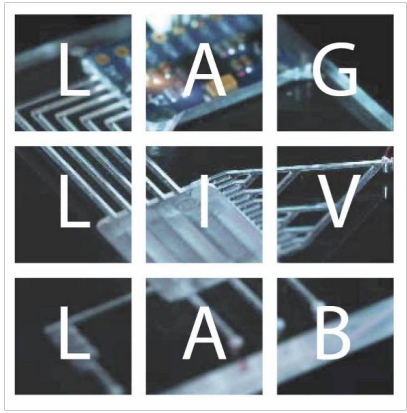
- Hybrid Technology Hub (HTH)
- Professional tools
- Freedom to fail by not being assessed



What works and not

- Projects work when teams have fun and have good vibes
- Projects need a wow-factor
- Students inner motivation is alfa & omega
- Students must choose project and keep recruiting to that project
- LagLivLab falls between chairs in financing
  - Innovation = product oriented
  - Education is institutionalized
  - Thon fund removed support for student active projects
  - No other funds seem appropriate
  - => only UiO:LS or some fund we have not found yet

Where do we go?



Student association?

Financing?

Project courses? (FYS2810, FYS2820, FYS2830, BIOS3060)

Competitions? (iGEM)

Nigar Abbasova

Master student in condensed matter physics interested in biological physics. Active member of LagLivLab since the start of the project. Head of the student board of LagLivLab.

Domantas Sakalys

Master student in condensed matter physics. Main academical interest is quantum technology, but have been working with bioimpedance and bio-actuators in free time. Been active member of LagLivLab for the past three semesters.

Elizabeth Surgucheva

Bachelor student in Biosciences, and my main interest is biotechnology within sustainability and gene therapy. Member of LagLivLab since April 2022.

Dag Kristian Dysthe

Professor of condensed matter physics at UiO since 2006. My main interests are in the physics of complex systems in geology and biology. Currently my projects focus mostly on biology.