



Welcome
to the lab!

Dr. Alexandra Bezler

September 2024



My scientific journey

Lecturer

- EPFL, Switzerland

Scientist

- UNIL, Switzerland
- EPFL, Switzerland

PhD

- EPFL, Switzerland

Research Internships

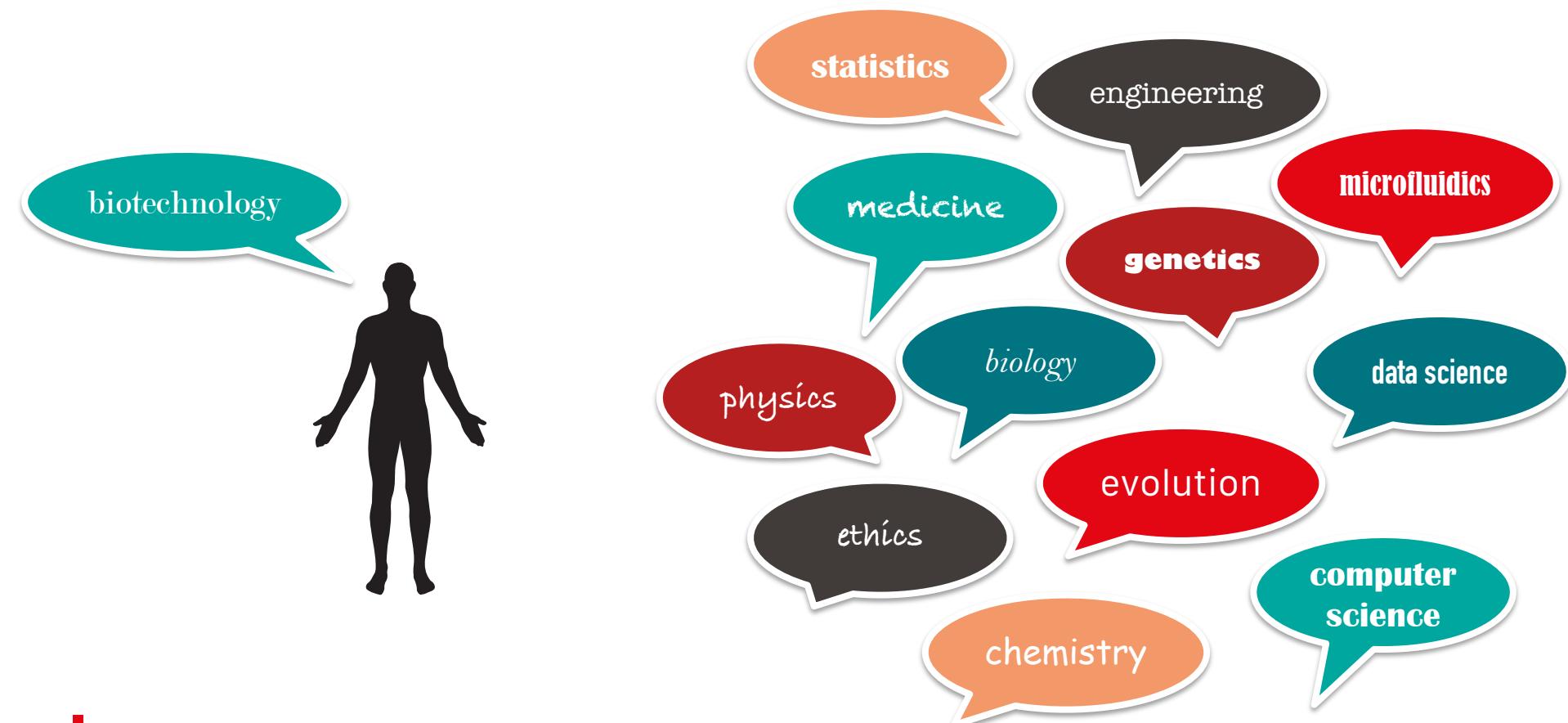
- Syndey, Australia
- FMI Basel, Switzerland
- EMBL, Heidelberg, Germany
- LionBiosciences, Heidelberg, Germany

MSc Biotechnology, Mannheim, Germany



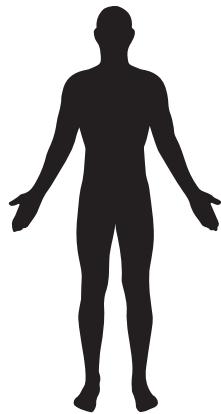


Greetings to all of you who made the journey enjoyable!



Predictions on your future career:

1. Working with:



2. Speaking:





Working in a group

- 1) Embrace diversity
- 2) The team is better than you
- 3) Communication is key

This week

Tuesday

Course overview

Benchling software

Biosafety training

Friday

Figures and figure legends

Electronic lab notebook



Labo intégré en sciences de la vie

Put theory into practice!

Theoretical background:

- Biologie générale BIOENG-110
- Biologie moléculaire et cellulaire I+II
BIO-205 +BIO-207



Practical Work Prepares you for:



Bachelor project

Interdisciplinary projects (MAKE)

Master project

Internship

→ **Career in Life Sciences**

Learning Outcomes

- To learn **basic techniques** in molecular biology and biochemistry
- To acquire **good laboratory practice**
- To built skills in **recording and analyzing** data
- To write a **scientific report/ poster**
- To use specific **software**
- To work in **any team**

→ **Career in Life Sciences**

Fall semester

Clone pancreatic α -amylase cDNA into an expression plasmid

Spring semester

Express recombinant α -amylase in a mammalian cell line

Lab 1

Micropipetting

Lab 2

RNA Isolation

Lab 3

PCR

Lab 4

Ligation +
Transformation

Lab 5

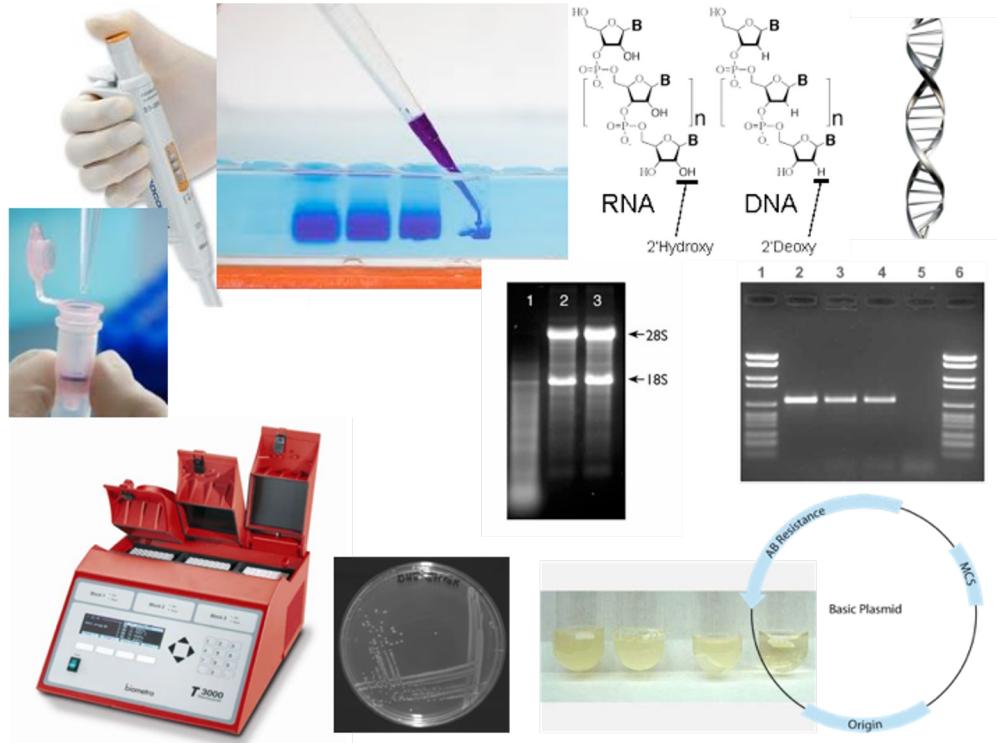
Plasmid Isolation +
Digestion

No Lab

Report and Revision

LISV I:

Work with RNA, DNA, Bacteria



Lab 6

Sequence analysis

Lab 7

Transfection into
mammalian cells

Lab 8

Affinity purification

Lab 9

Separation of proteins
by
SDS-PAGE

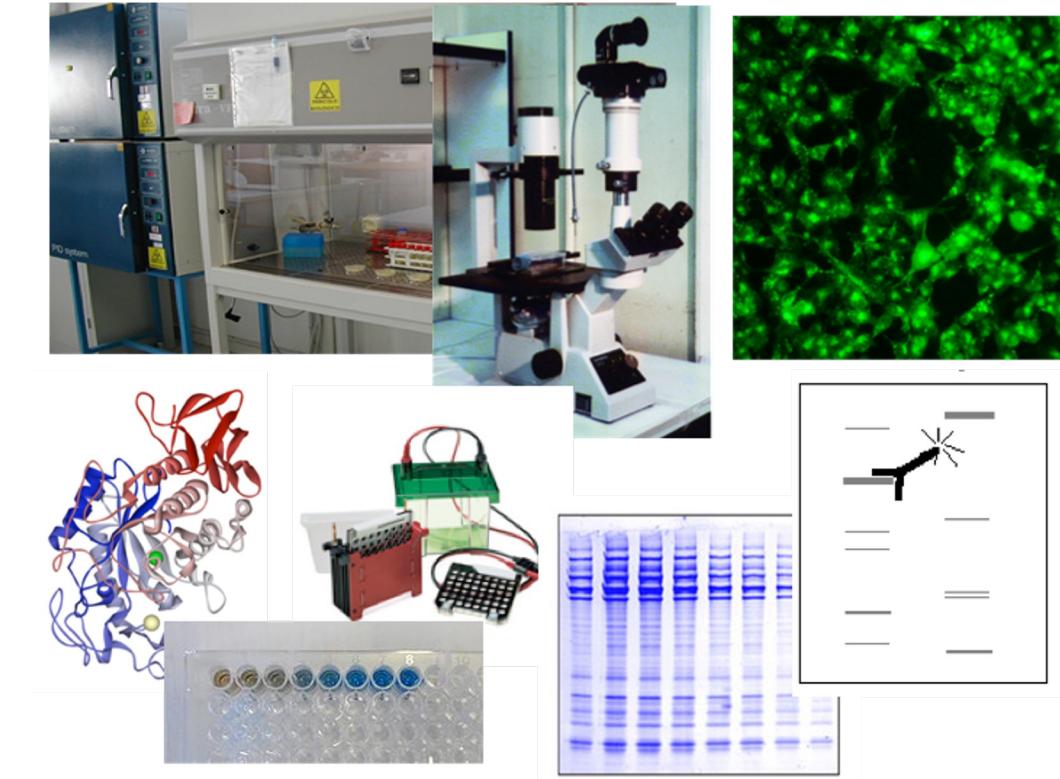
Lab 10

Western blot +
Activity assay

Lab 11

Enzyme kinetics

LISV II: Work with Proteins, Mammalian Cells



Practical lab sessions

Lab AI0111, last approximately 3-4 hours

Break during practical: according to experiments, in agreement with your assistant

Weekly workload during semester: 6 hour per week

- exercises, data analysis, writing lab notebook and report/ poster

Total workload: 90 hours corresponding to 3 ECTS (BIO-203)

Rooms available (CO121 or DIA004; see ISA)



How to distribute the work

Example group A/C: Distribute work during week



student 1

| Mo | Public holiday(Bank holiday) | Tu | We | Th | Fr | Sa |
|-----------|------------------------------|---|----|----|---|----|
| 8h - 9h | | | | | | |
| 9h - 10h | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | | | | |
| 10h - 11h | | Integrated labo in Life sciences I 0912, 0913 BSO-203 Practical work | | | | |
| 11h - 12h | | Integrated labo in Life sciences I 0911, 0913 BSO-203 Practical work | | | | |
| 12h - 13h | | | | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | |
| 13h - 14h | | | | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | |
| 14h - 15h | | | | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | |
| 15h - 16h | | | | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | |
| 16h - 17h | | | | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | |
| 17h - 18h | | | | | Integrated labo in Life sciences I 0911, 0912 BSO-203 Practical work | |
| 18h - 19h | | | | | | |

| Mo | Public holiday (Bank holiday) | Tu | We | Th | Fr | Sa |
|-----------|-------------------------------|---|----|----|---|----|
| 8h - 9h | | 111, 00111, BIO-203, Practical work | | | | |
| 9h - 10h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | | |
| 10h - 11h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 11h - 12h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 12h - 13h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 13h - 14h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 14h - 15h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 15h - 16h | | Integrated labo in Life sciences I 111, 00111, BIO-203, Practical work | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 16h - 17h | | | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 17h - 18h | | | | | Integrated labo in Life sciences I 00111, 00111, BIO-203, Practical work | |
| 18h - 19h | | | | | | |
| 19h - 20h | | | | | | |

student 2

| Mo | Public holiday(Bank holiday) | Tu | We | Th | Fr | Sa |
|-----------|------------------------------|--|----|----|----|----|
| 8h - 9h | | | | | | |
| 9h - 10h | | Integrated labo in Life sciences I 00111, 00112 BSO-203 Practical work  | | | | |
| 10h - 11h | | Integrated labo in Life sciences I 00111, 00112 BSO-203 Practical work  | | | | |
| 11h - 12h | | Integrated labo in Life sciences I 00111, 00112 BSO-203 Practical work  | | | | |
| 12h - 13h | | | | | | |
| 13h - 14h | | | | | | |
| 14h - 15h | | | | | | |
| 15h - 16h | | | | | | |
| 16h - 17h | | | | | | |
| 17h - 18h | | | | | | |
| 18h - 19h | | | | | | |

| Mo | Public holiday (Bank holiday) | Tu | We | Th | Fr | Sa |
|-----------|-------------------------------|--|----|----|---|----|
| 8h - 9h | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work [+] | | | | |
| 9h - 10h | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work [+] | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 10h - 11h | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work [+] | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 11h - 12h | | 60111, 00121 BIO-203 Practical work [+] | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 12h - 13h | | | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 13h - 14h | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work [+] | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 14h - 15h | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work [+] | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 15h - 16h | | | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 16h - 17h | | | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 17h - | | | | | Integrated labo in Life sciences I 60111, 00121 BIO-203 Practical work | |
| 18h - | | | | | | |
| 19h - | | | | | | |

Lab work

- Share tasks among group members, rotate responsibilities

Questions & Exercises

- Discuss with fellow students/ assistants

Lab report/ poster

- Group members are expected to equally contribute

Conflict within the group?

- Inform your assistant or course instructor



Lab Safety Rules

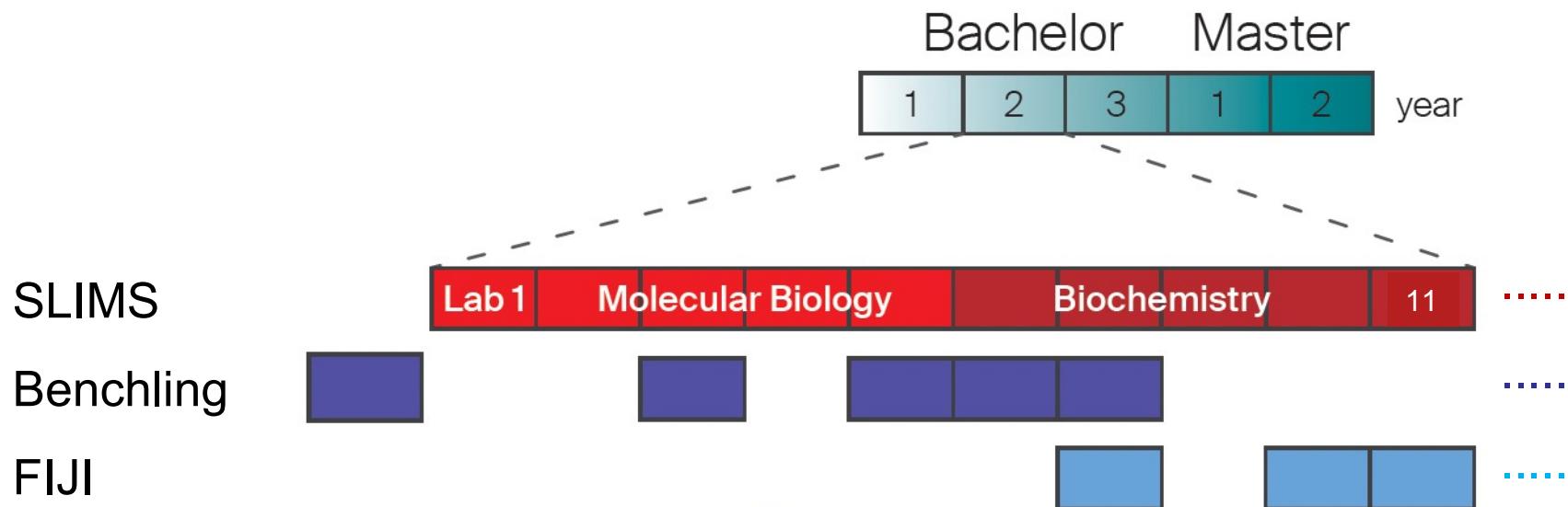
- Wear a lab coat (provided)
- Wear gloves during experiments
- Wear goggles when indicated
- Wear long trousers & closed shoes
- Tie up long hair
- No food and drinks in TP lab
- Clean up before you leave

International Team of Assistants



career

| |  |  |
|----------------------------------|--|---|
| Course documents & presentations | + | |
| Assistants speak | + | some |
| Ask questions | + | + |
| Exam questions | + | + |
| Lab notebook & reports | encouraged | allowed |



Getting started with Benchling software

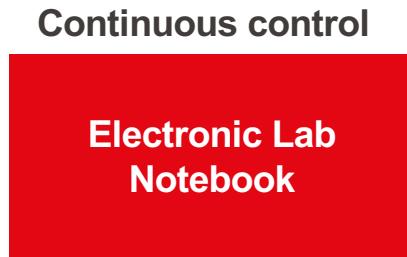
Creating effective scientific figures and legends

How to analyse scientific data

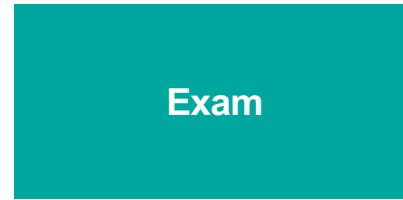
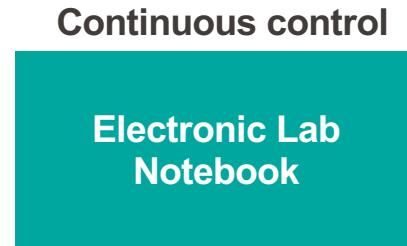
How to write a scientific report

See Moodle

Evaluation



LISV I



LISV II

40%

30%

30%

Final grade

Laboratory Notebook

A lab notebook is a **legal document** (publication, patents)

A **record of everything you do** in the lab and **why**

All **data** must be entered and labeled with an adequate description

Electronic Laboratory Notebook (ELN)



Each student writes an individual lab notebook

Preformatted content for each lab session

Must be completed one week after the lab session

Assistants will give feedback the week after (Moodle/ SLIMS)

Use the feedback to improve

Final Laboratory Report/ Poster

Guidelines will be posted on Moodle

Describe the aims, experiments, results and discussion of the data (figures + figure legends)

Submitted at the end of the semester

Multiple choice questions

December 17

Délégués de classe

Please contact me

Questions ?



Intro Benchling Software

Dr. Alexandra Bezler

image source
Benchling.com

Benchling: What? Why?

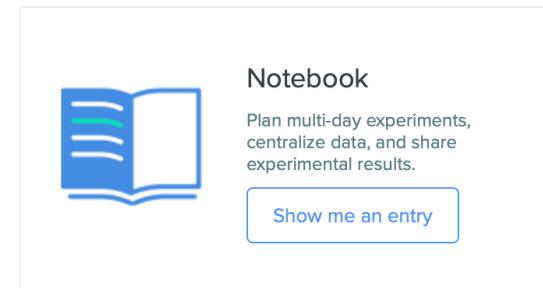
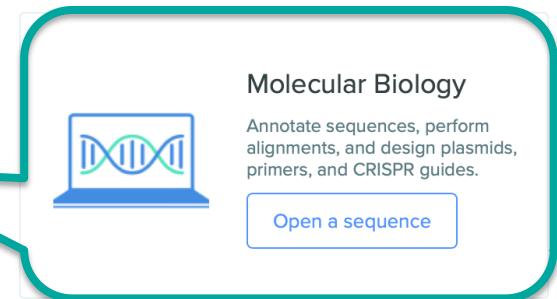
DNA sequence visualization + analysis

Professional tool (used in industry + EPFL)

Cloud based software

Basics quick to learn

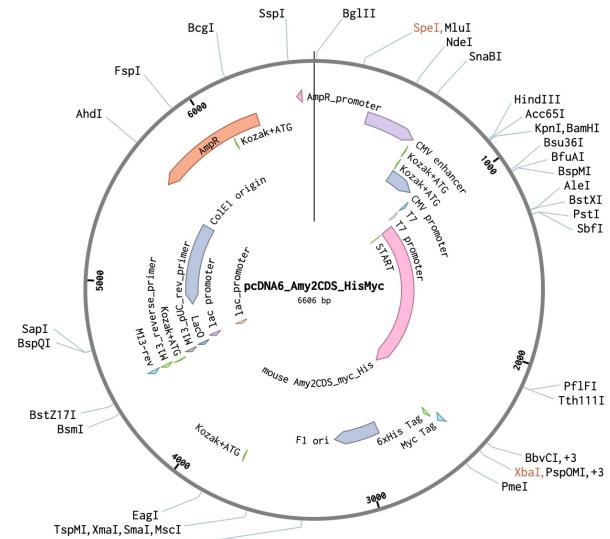
'How to' tutorials



Using Molecular Biology Tools

BIO-203/ BIO-204:

- annotate sequences
- restriction digest
- primer design
- translation
- sequence alignment
- virtual cloning



GTGCTAACACTCGGCCATTGACGCAAATGGCCGTAGGGCTGTACGGTGGGGCTATAAGCAGAGCTCTGGCTAACTAGAGAAC
CAGCATTTGAGGGGGTACTGGTTAACCCGCATCCGCACATGCCACCTCCAGATAATTCTGGAGAGACCGATTGATCTCTTG
CMV promoter
750 760 770 780 790 800 810 820 830

Acc65I
HindIII KpnI BamHI
CCACTGCTTACTGGCTTATCGAAATTAACTGACACTACTAAGGGAGACCCAGCTGGCTAGTTAACCTGGTACCGAGCTGGATCCACCAT
GGTGACGAATGACCGAATAGCTTAAATTGCTGAGTATCCCTCTGGTCGACGATCAATTGACCATGGCTCGAGCTTAGGTGTA
T7 promoter
840 850 860 870 880 890 900 910 920 930

GAAGTTGCTCTGCTGTTCTCTATTGGGTTCTGCTGGGCTAAATGACCCACATACTTCAAGATGGGAGACTGCTATTGTCACCTGTT
CTTCAAGCAAGACGCCAAAGGGAGTAACCCAAAGCACCCGGATATACTGGGTATGAGCTACCCCTCTGGCATACACAGTGGACAA
K F V L L S L I G F C W A Q Y D P H T S D G R T A I V H L F
mouse Amy2CDS_myC_His
940 950 960 970 980 990 1,000 1,010 1,020

The screenshot shows the BioEdit software interface with a sequence map and a plasmid map for the vector pcDNA6TM/myc-His A.

SEQUENCE MAP

The sequence map displays the DNA sequence with various restriction enzyme cleavage sites indicated by orange and blue arrows. The sequence is organized into several regions:

- BglII:** 19, 29, 39, 49, 59, 69, 79, 89, 99
- MfeI:** 100, 118, 128, 138, 148, 158, 168, 178, 188
- Bpu10I:** 190, 200, 210, 220, 230, 240, 250, 260, 270
- MluI:** 280, 290, 300, 310, 320, 330, 340, 350, 360, 370
- SpeI:** 380, 390, 400, 410, 420, 430, 440, 450, 460
- NdeI:** 470, 480, 490, 500, 510, 520, 530, 540, 550
- SnaBI:** 560

LINEAR MAP

The linear map shows the physical structure of the plasmid vector pcDNA6TM/myc-His A. The vector is a circular molecule with various restriction enzyme sites and functional elements:

- AmR_promoter:** AmpR promoter
- CMV enhancer:** CMV enhancer
- CMV promoter:** CMV promoter
- SV40 T7 promoter:** SV40 T7 promoter
- SV40 T7 polyA signal:** SV40 T7 polyA signal
- CMV enhancer:** CMV enhancer
- Kozak+ATG:** Kozak+ATG
- SpeI:** SpeI
- XbaI:** XbaI
- AgeI:** AgeI
- PmeI:** PmeI
- HindIII:** HindIII
- BglII:** BglII
- MfeI:** MfeI
- Bpu10I:** Bpu10I
- SspI:** SspI
- BcgI:** BcgI
- Scal:** Scal
- NdeI:** NdeI
- SnaBI:** SnaBI
- FspI:** FspI
- AhdI:** AhdI
- PciI:** PciI
- SapI:** SapI
- BspQI:** BspQI
- BstZ1I:** BstZ1I
- BsmI:** BsmI
- BpuMI:** BpuMI
- BglI:** BglI
- BsaBI:** BsaBI
- StuI:** StuI
- AvrII:** AvrII
- TspMI:** TspMI
- XmaI:** XmaI
- SmaI:** SmaI
- SexAI:** SexAI

ASSEMBLY WIZARD **SPLIT WORKSPACE**

Your turn to play: See Moodle Benchling

Worked example 1

PCR and primer design



Worked Example 2

Sequence annotation

first copy file to your account



Today

- ✓ create Benchling account
- ✓ exercise 1
- ✓ exercise 2

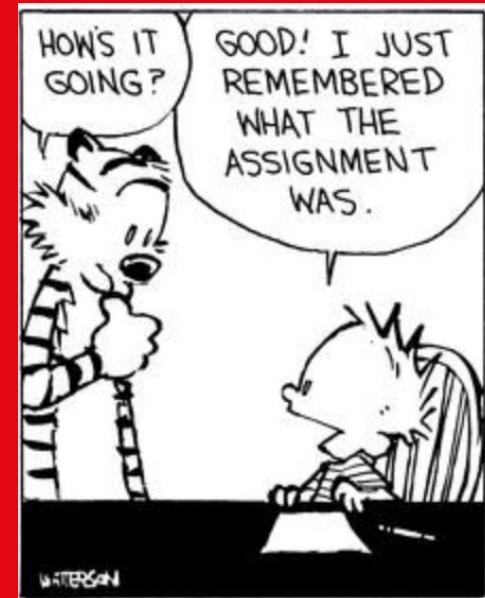
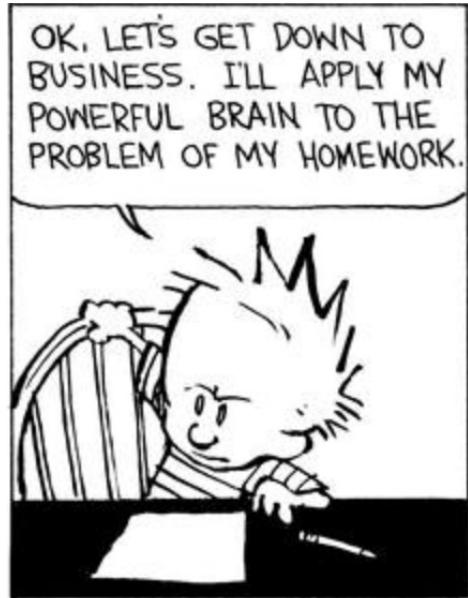
Homework

biosafety (Moodle)

- presentation
- quiz

finish Benchling exercises

See you soon!



Calvin & Hobbes
by Bill Watterson