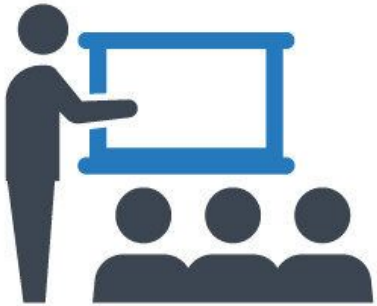
The Bicycle Principles

for Effective, Inclusive and Career-spanning Short-Format Training (SFT)



Lisanna Paladin
EMBL Bio-IT | bio-it.embl.de
Bioinformatics Community Project Manager

With feedback from **Celia van Gelder**

Why did this work start

Need: lifelong learning

> **STEM Careers and the Changing Skill Requirements of Work** - Deming & Noray, NBER 2019
>
> *[...] the labor market impact of rapid technological change depends critically on the extent to which schooling and "lifelong learning" can help build the skills of the next generation.*

Problem: short-format training is often ineffective

> **Null effects of boot camps and short-format training for PhD students in life sciences** - Feldon et.al., PNAS 2017
>
> *[...] participation in such short-format interventions is not associated with observable benefits related to skill development, scholarly productivity, or socialization into the academic community. [...] We conclude that boot camps and other short formats may not durably impact student outcomes.*

Why did this work start

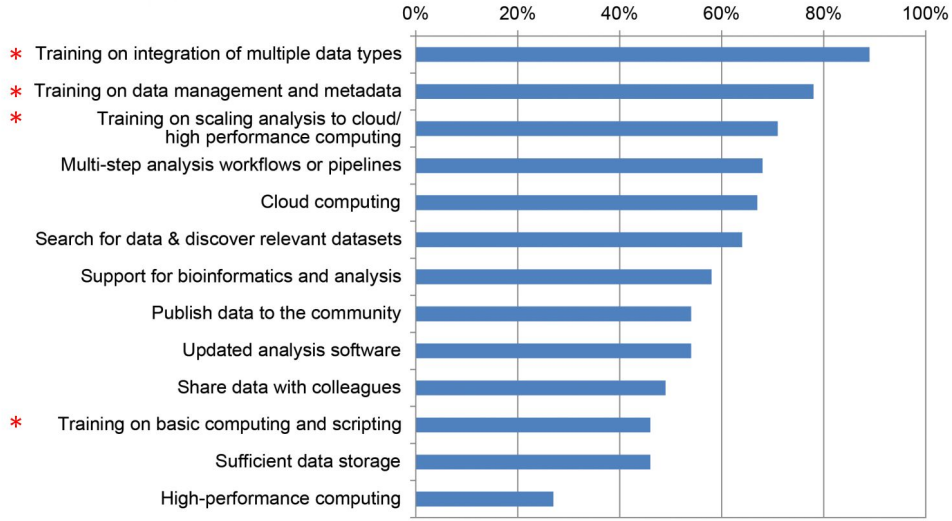
PLOS COMPUTATIONAL BIOLOGY

Unmet needs for analyzing biological big data: A survey of 704 NSF principal investigators

Lindsay Barone, Jason Williams, David Micklos

Published: October 19, 2017 • https://doi.org/10.1371/journal.pcbi.1005755

"Does your institution meet this need?"
('no' responses)



Where did this work start

December 2021 (virtual)
May 2022 (in person)

THE BANBURY CENTER
Cold Spring Harbor Laboratory

ANNOUNCEMENT

Making Career-spanning Learning in the Life Sciences Inclusive and Effective for All

Late 2021

Organized by: Jason Williams, Cold Spring Harbor Laboratory
Rochelle Tractenberg, Georgetown University
Bérénice Batut, University of Freiburg
Samuel Donovan, University of Pittsburgh
Kari L. Jordan, The Carpentries
Charla Lambert, Cold Spring Harbor Laboratory
Teresa Mourad, Ecological Society of America
Tracy Teal, Dryad
Celia van Gelder, Dutch Techcentre for Life Sciences

Who started this work

Bérénice Batut*	Charla Lambert*	Celia van Gelder*
Erin Becker	Ainsley Latour	Jason Williams**
Anne Brown	Jessica Lindvall	Lou Woodley
Melissa Burke	Marta Lloret Llinares	
Ben Busby	Gary McDowell	
April Clyburne-Sherin	Rana Morris	
Nisha Cooch	Teresa Mourad*	
Allissa Dillman	Amy Nisselle	
Sam Donovan*	Patricia Ordóñez	
Maria Doyle	Lisanna Paladin	
Jessica Guo	Patricia Palagi	
Christina Hall	Mahadeo Sukhai	
Kate Hertweck	Tracy Teal*	
Kari Jordan*	Rochelle Tractenberg**	
John R. Jungck		

*Organizing committee

** Project PIs

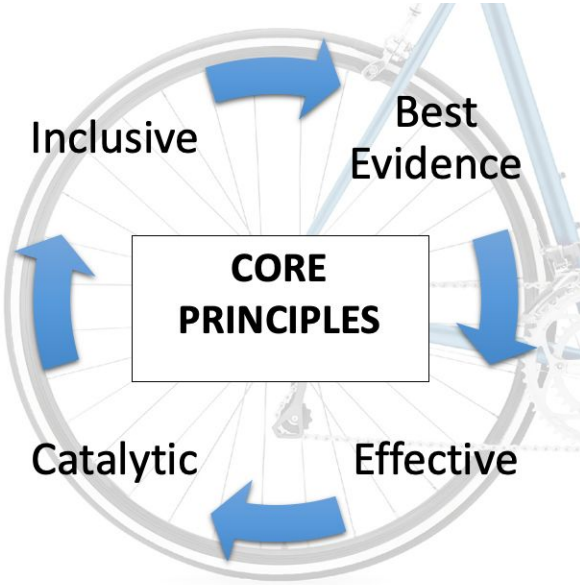
Short-format training (SFT) definition

Instruction in disciplinary skills and knowledge over a **relatively short duration** (i.e., hours, days, or a few weeks).

- Generally happens **outside of a formal degree-granting program**.
- **Content is determined by instructors** or instructional designers.
- Tends to be **stand-alone**, not requiring formal prerequisites or required subsequent SFT.
- Typically delivered to a group of learners who **enroll because of their interest** in the topic, rather than a mandate.
- Typically **developed and delivered by domain experts** outside of and separately from an institutional teaching role.

All Short Format Training should…

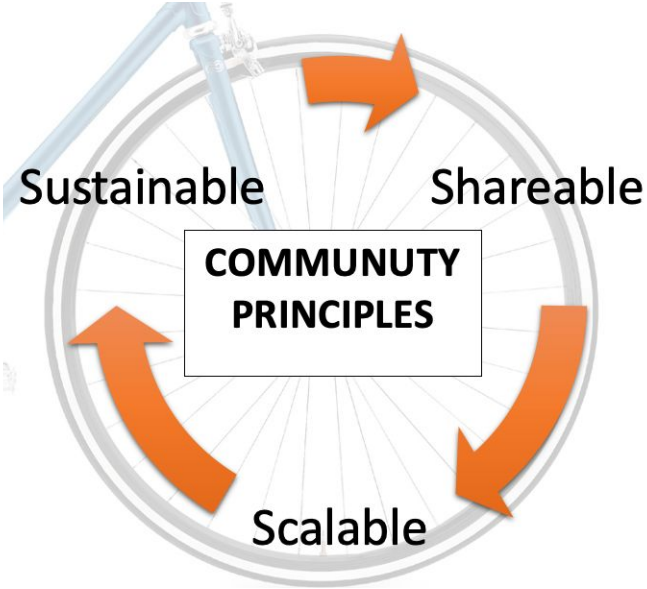
1. Use **Best Evidence**; grounded in findings from the education sciences and formally evaluated instruction.
2. Promote **Catalytic** learning; prepare learners to succeed when the application of knowledge, skills, and abilities requires further self-directed study.
3. Be **Effective**; provide evidence (i.e., from assessment, evaluation) to learners that they have made progress in achieving programmatic and learning goals.
4. Be **Inclusive**; maximize the ability of all learners to participate in and benefit from the learning experience.



The "unicycle" - fine for going alone

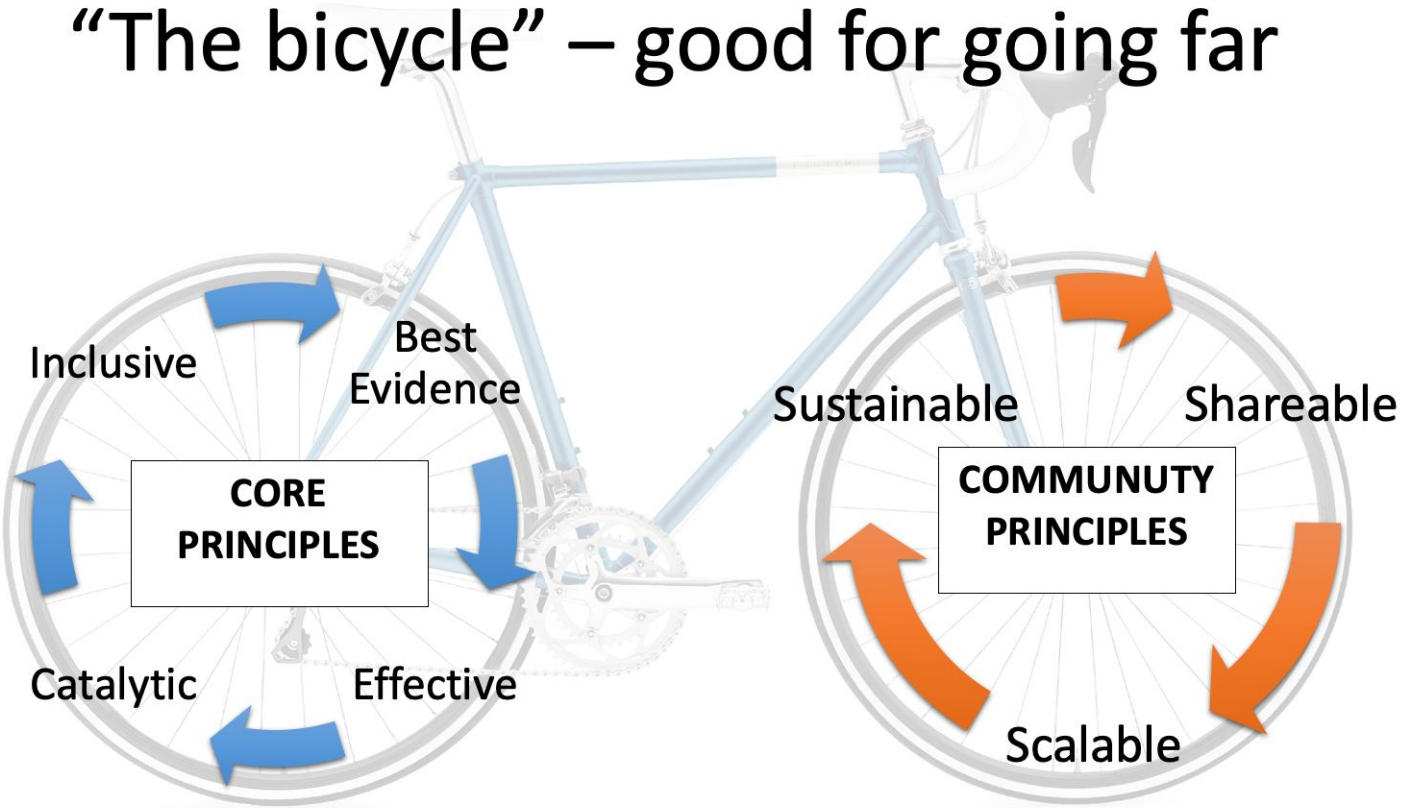
Community principles (when STF happens in)...

1. **Reach**: include new types and larger audiences of *learners*.
2. **Scale**: increase delivery of short-format training by new groups and larger numbers of *instructors and instructional developers*.
3. **Sustain**: work to maintain the availability, usability, relevance, and reliability of learning materials as well as supporting the supporting infrastructures, trainers, and communities which enable effective and inclusive training.



The "bicycle" - good for going far

“The bicycle” – good for going far



How to implement the principles in practice?

We collected a set of recommendations

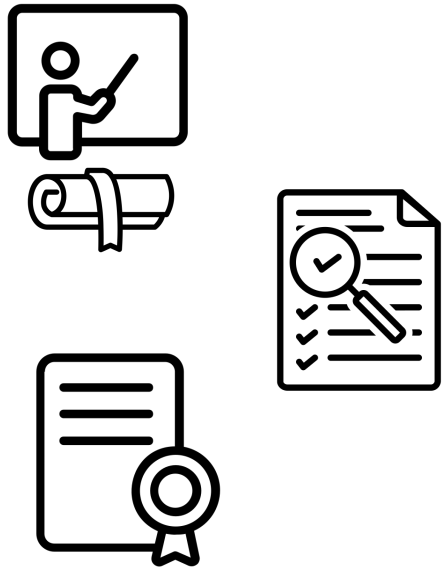
Descriptive Features

Every recommendation has six features:

- **Summary**: Expands upon what problem the recommendation tries to solve.
- **How might this work**: Brief implementation example and suggestions on evaluating success.
- **Related Principles**: Most closely related *Bicycle principles*.
- **Benefits to the learners**: How recommendation helps learners (directly or indirectly).
- **Incentives to Implementers**: Motivations for implementers to enact this recommendation.
- **Barriers to Implementation**: Obstacles that may hinder this recommendation.

Recommendations

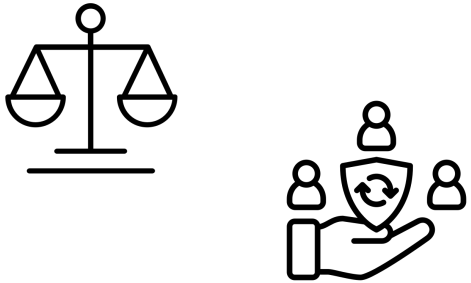
- A. **Professionalize** the training of short-format training **instructors and instructional designers**
- B. **Centralize infrastructure** for short-format **training assessment** and evaluation
- C. Support **microcredentialing** of short-format training instructors



Institutional role in certifying training

Recommendations

- D. Operationalize equitable and inclusive practice in short-format training as an **ethical obligation**
- E. Deploy short-format training to **counter inequity**
- F. Make the Bicycle Principles **actionable for funders**

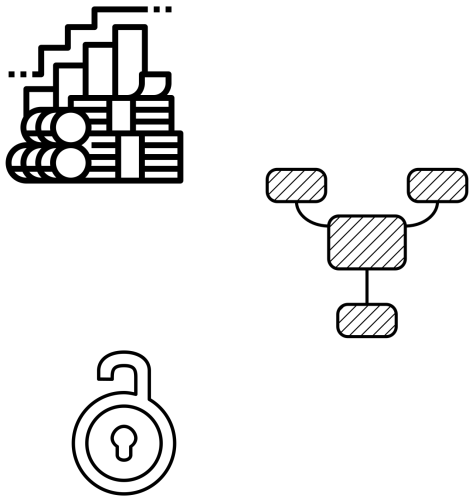


An ethical approach to training

Outreach to funders

Recommendations

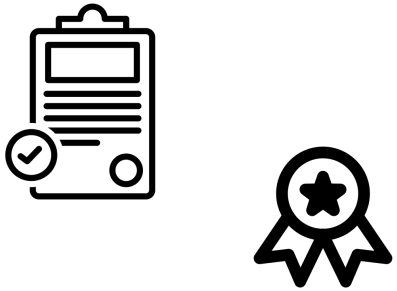
- G. Clarify the **economic models** that enable short-format training
- H. **Document models** for high-fidelity reaching, scaling, and or sustaining of short-format training
- I. Apply **FAIR principles** to training materials



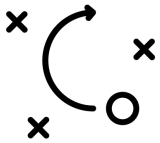
Planning (at all levels)

Recommendations

- J. Encourage interoperable short-format training **registries**
- K. **Communicate standards of instruction** through badging
- L. Develop an **implementation strategy** for Catalytic Learning



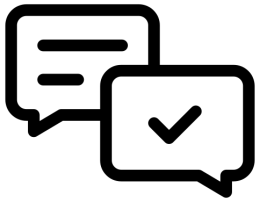
Institutional role (again!)



Make learning useful

Recommendations

- M. Support **integration of diagnostic assessment** into short-format training



Feedback

- N. Encourage **evidence-based guidance** to support career-spanning learning

Best evidence

One example of recommendation:

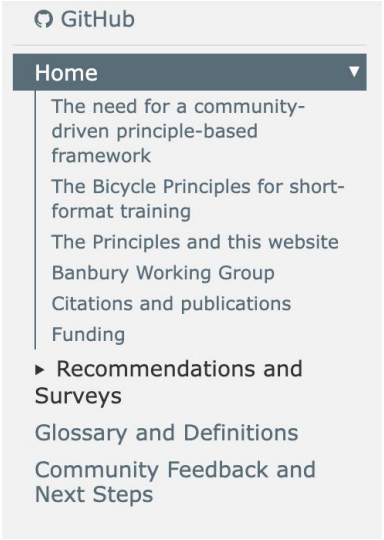
Apply FAIR principles to training materials

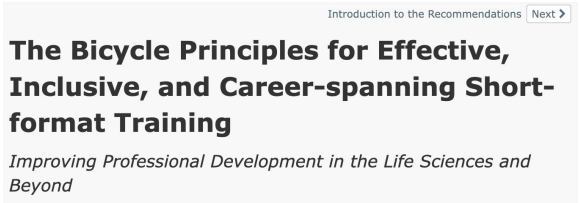
- **Summary**: The value of training materials increases [...]
- **How might this work**: [...] Specialized computational tools [...]
- **Related Principles**:
  a. Core: Inclusive
  b. Community: Reach, Scale, Sustain
- **Benefits to the learners**:
  a. easier to find
  b. more learners to be reached by training
  c. adapt and customize materials to their needs
- **Incentives to Implementers**:
  a. For Instructors and Instructional Designers
     i. easier to locate and reuse
     ii. credited by others
     iii. collaboration and co-development
  b. For Funders and Organizations
     i. reducing effort duplication
- **Barriers to Implementation**:
  a. mindset change needed, training and information resources may help
  b. extra effort when designing materials, templates and clear guidelines may help
  c. Institutional guidelines may prohibit application of FAIR

My personal summary

- Essential **role of the institution** to facilitate this process
- Assess what makes learning **effective and inclusive**

Where does this work continue





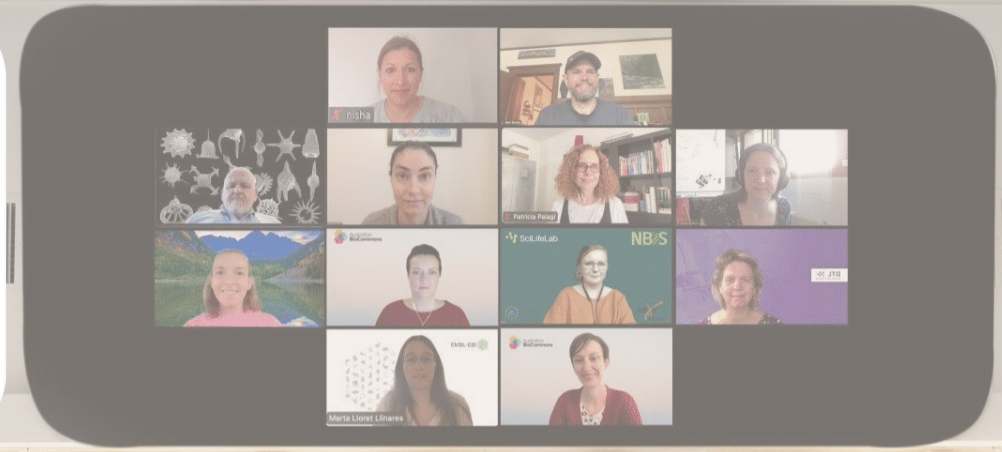
Announcement

November 2022

We're collecting feedback: Let us know what you think about the recommendations to improve short-format training. We will be conducting surveys and focus groups from now through February 2023. **Participants will be compensated for their time.**

- Let us know if you are interested by leaving your contact information on this form.
- Visit the feedback forum to ask questions and start conversations. Join this low-traffic mailing list for updates.

Thank you



bikeprinciples.org

The Bio-IT project: one example of bottom-up initiative that gained institutional recognition

* Disclaimer: I manage the project and believe in its value, hence I am biased

Bio-IT: what, who, where






European Molecular Biology Laboratory

Community initiative to build, support and promote **computational biology research** at EMBL

EMBL Bio-IT

The Project Managers:

Renato Alves

Lisanna Paladin

\+ *The community!*

The project structure: four pillars

- Training
- Community
- Infrastructure / Resources
- Information

Bio-IT website: information hub

bio-it.embl.de

Training

- Courses and events
- Course materials
- Catalogue *
- Consulting sessions

Community

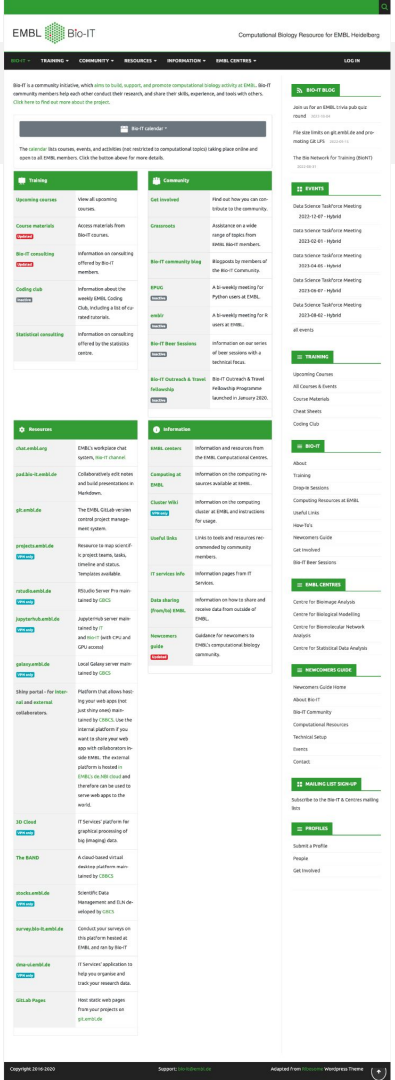
- Coding clubs *
- Grassroots *
- Community blog

Resources

- EMBL chat *
- GitLab
- Coding platforms
- Notes & survey tools
- Other resources

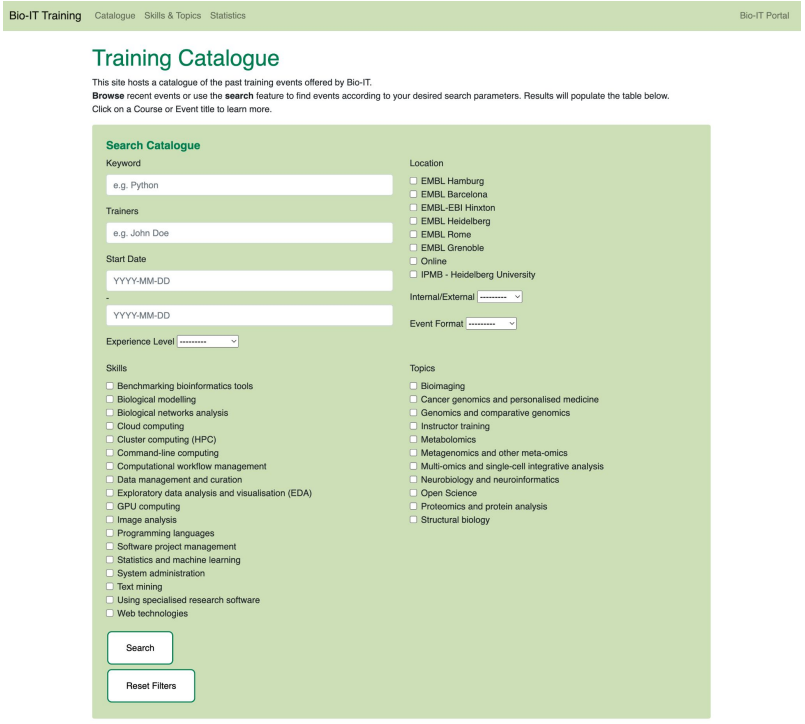
Information

- EMBL centers *
- IT services info
- WikiHows
- Newcomers guide *



Courses and events

catalogue.bio-it.embl.de



Coding clubs

EPUG Inactive	A bi-weekly meeting for Python users at EMBL.
emblr Inactive	A bi-weekly meeting for R users at EMBL.

python™

pip Installation

Grassroots

EMBL Bio-IT Portal + New Edit Page Duplicate Post

Name	Expertise	channels (In order of preference)
Martin Larralde Updated	Using specialised research software, Programming languages, Cluster computing, Command-line computing, Cloud computing, Data management and curation, Software project management, Text mining, Benchmarking bioinformatics tools, Web technologies, Metagenomics and other meta-omics	-
Matthias Monfort Updated	Programming languages, Cluster computing, Computational workflow management, Software project management, Web technologies, System administration Nextflow & Galaxy (for NGS Workflow management), Javascript (front-end development e.g. eith Vue), Apache (web server setup), R/Rstudio setup, Unix)	–
Nicolas Descostes Updated	Using specialised research software, Exploratory data analysis and visualisation, Programming languages, Cluster computing, Command-line computing, Computational workflow management, Software project management, Transcriptomics NGS Analysis, R, Galaxy	E-mail, Video Call on request

...

EMBL chat

chat.embl.org

Welcomebot BOT 3:06 PM

Awesome! I've added you to the following channels:

~Bio-IT 👉 Bio-IT channel for general bioinformatics, computational support
~Bio-IT-announce 👉 Bio-IT channel for course/workshop and Bio-IT activity announcements
~cluster 👉 EMBL Heidelberg HPC cluster support
~GBCS 👉 Genome Biology Computational Support channel
~Mathematical Modelling 👉 Genome Biology Computational Support channel
~STOCKS 👉 Support channel for STOCKS EMBL's ~GBCS electronic lab and data management system

You may also be interested in the following (click their name to join):
~Folding / AlphaFold 👉 A channel to discuss protein folding with AlphaFold and related technologies
~How could be done better 👉 A channel to discuss scientific figures and other kinds of scientific output in a constructive way

Awesome! I've added you to the following discussion channels for different programming related technologies:

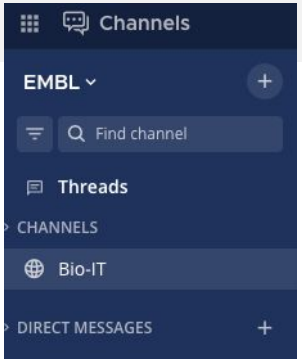
~Git 👉 Git and EMBL's GitLab
~Julia 👉 Julia
~MachineLearning 👉 For classic and deep learning discussions
~Python 👉 Python
~R_and_statistics 👉 R and statistics
~RStudio-Server 👉 RStudio EMBL server (by ~GBCS)

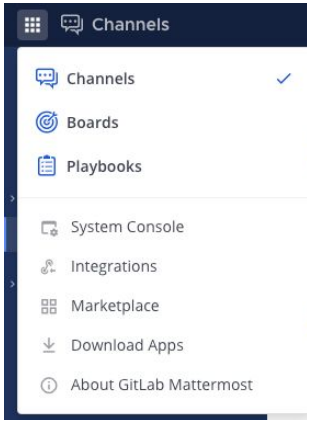
Awesome! I've added you to the following support channels:

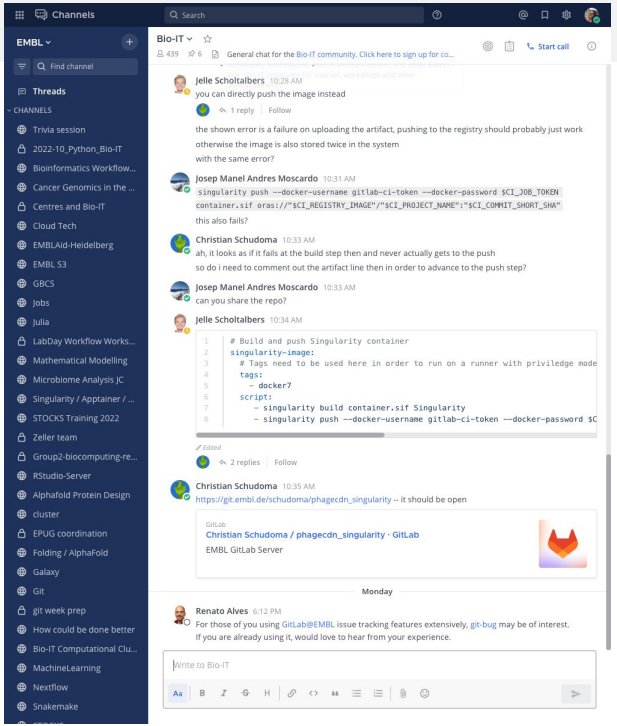
~Galaxy 👉 Galaxy@EMBL (by ~GBCS)
~Nextflow 👉 Nextflow workflow manager
~Snakemake 👉 Snakemake workflow manager
~Singularity / Apptainer / Docker 👉 Singularity containers

Awesome! I've added you to the following channels:

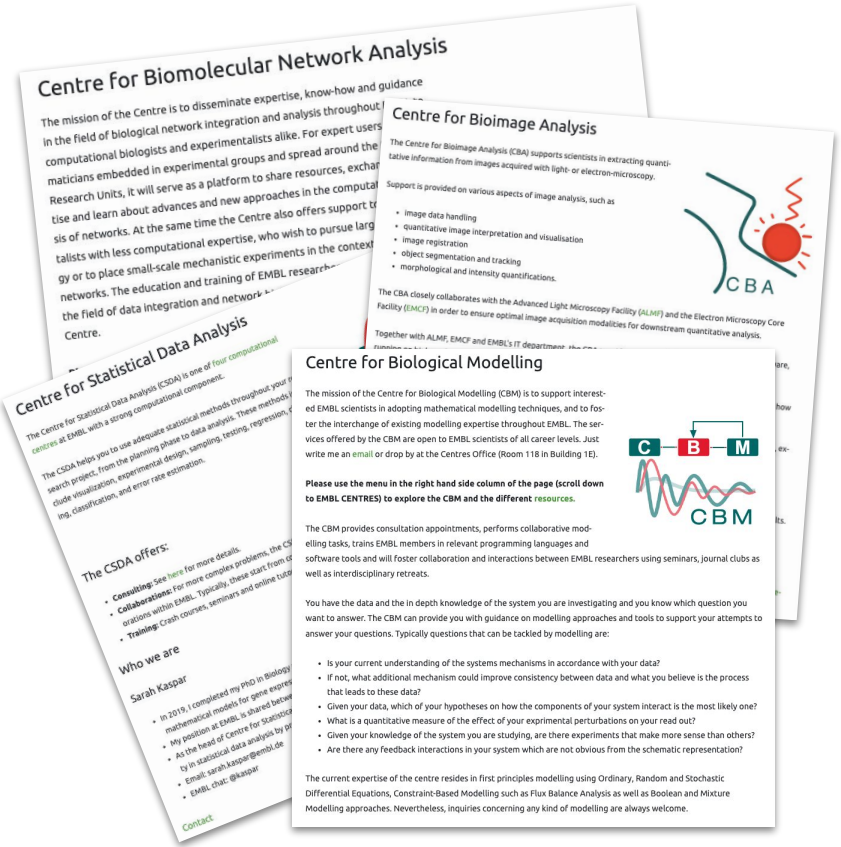
~Jobs 👉 Announce jobs and other opportunities in or outside of EMBL.
~marketplace 👉 General trading, buy&sell, giveaways, lost&found, ...
~EMBLAid-Heidelberg 👉 EMBLAid channel for Heidelberg (see also channels for other sites).







EMBL centers



Bio-IT

The Bio-IT community initiative provides support to computational biology research through training, courses, consulting, networking opportunities, and computational resources and tools.

Contacts: Renato Alves and Lisanna Paladin (bio-it@embl.de)
Stop by our Drop-In Sessions Tuesdays 10am-12pm

Centre for Bioimage Analysis (CBA)

The CBA supports you in extracting quantitative information from images acquired with light- or electron-microscopy.

Contacts: Christian Tischer, Sebastian Gonzalez, and Arif Khan (image-analysis-support@embl.de)
Send a mail to schedule a consultancy session.

Centre for Biological Modelling (CBM)

The CBM aims to support you to adopt mathematical modeling techniques into your everyday research.

Contact: Eva Geissen (eva.geissen@embl.de)
Write me an email to request an appointment or come over to Room 118.

Centre for Statistical Data Analysis (CSDA)

The CSDA helps you to use adequate statistical methods throughout your research project, from the planning phase to data analysis.

Contact: Sarah Kaspar (sarah.kaspar@embl.de)

Centre for Biomolecular Network Analysis (CBNA)

The CBNA disseminates expertise, know-how and guidance in network integration and analysis throughout EMBL.

Contact: Santhust (santhust@embl.de), Room 118

Newcomers guide

Table of contents

Bio-IT Newcomers Guide

Note that several linked pages in this document can be accessed only from inside the EMBL network

Table of contents

- About Bio-IT Project
- Members of the Bio-IT Community
- Computational Resources
- Technical Setup
- Events
- Contacts

About this document

This document is developed to help newcomers to learn all about computational systems at EMBL-HD, Bio-IT, and (almost) everything that will help them intergrate with the bio-computational community of EMBL Heidelberg.

The information in this guide overlaps with the material contained in the other documents useful for newcomers to EMBL. We also recommend that you check out the following resources:

- Bio-IT EMBL website for general information about Bio-IT activities.
- EMBL website for general information about EMBL.
- EMBL newcomer's booklet including information about first day best practices, housing, banking, medical service, chidlcare and family care, transportation, free time activities, additional informaton about Germany.
- EMBL Staff Association website, including SA events calendar, forums and working groups and initiatives for the EMBL-ites' well being.
- Heidelberg city guide, featuring city tour and events announcements.
- Szilard library guide, including the catalogue and access information.

If you can't find the information that you were looking for, please go ahead and directly interact with the EMBL-ites via the EMBL chat.

Acknowledgments

This guide borrows heavily (with permission) from the newcomers guides previously developed in the Zaugg and Huber Labs at EMBL. We thank the authors of those documents for their efforts and help.

Several sections also link out to the excellent Netherlands eScience Center Guide.

In summary: #collaboration

* The next slide was presented at the CW22

THE CONTEXT

European Molecular Biology Laboratory

- Intergovernmental organisation
- 6 sites in EU, international staff
- Dynamic research context
- Open Science policy

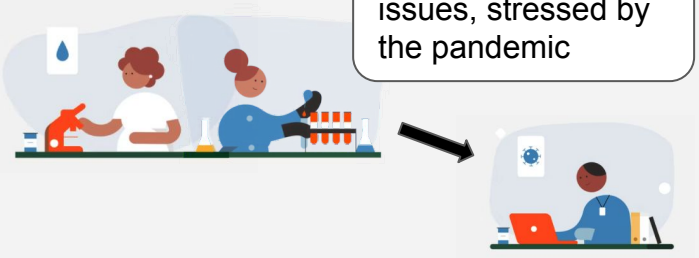
TRAINING INFORMATION TOOLS COMMUNITY

EMBL Bio-IT

Community initiative to build, support and promote computational biology research at EMBL

THE PROBLEM

Context-related issues, stressed by the pandemic



- Remote work highlighted some challenges and opportunities
- Distributed nature of the institute
- Synergising experts' knowledge
- Standardisation of the training process
  - Identification of needs and design of training
  - Advertisement and delivery

THE SOLUTION

Platform to support computational training, remote collaboration, community building

CHAT SHARE CODE SHARE INFO

and others…

- Allow people to communicate & train
- Allow people to work together
- Structured and accessible information

VISION

Structure a platform to support collaboration, building on what exists

bio-it.embl.de

bio-it@embl.de

@EMBL_BioIT