

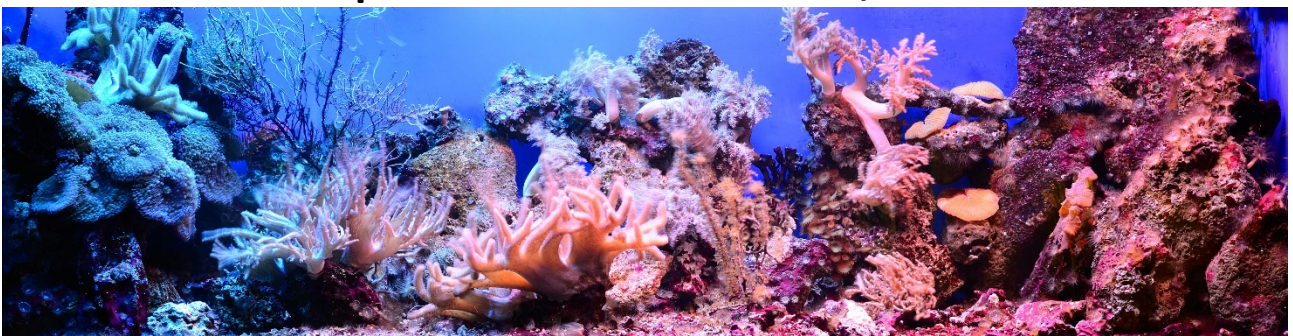


COST Action CA16203 Maristem

Virtual Training School

“Omics for studying stem cells in model and non-model aquatic invertebrate systems”

September 6th - October 8th , 2021



Schedule [Week 1](#) | [Week 2](#) | [Week 3](#) | [Week 4](#) | [Week 5](#)

Coordinators

Ildiko Somorjai (University of St Andrews, UK)
Loriano Ballarin (University of Padova, Italy)

Organising committee

Ute Rothbacher (University of Innsbruck, Austria)
Artur Burzynski (Polish Academy of Sciences, Poland)
Ana Varela Coelho (ITQB, Portugal)
Pedro Martinez (University of Barcelona, Spain)
Ildiko Somorjai (University of St Andrews, UK)
Loriano Ballarin (University of Padova, Italy)

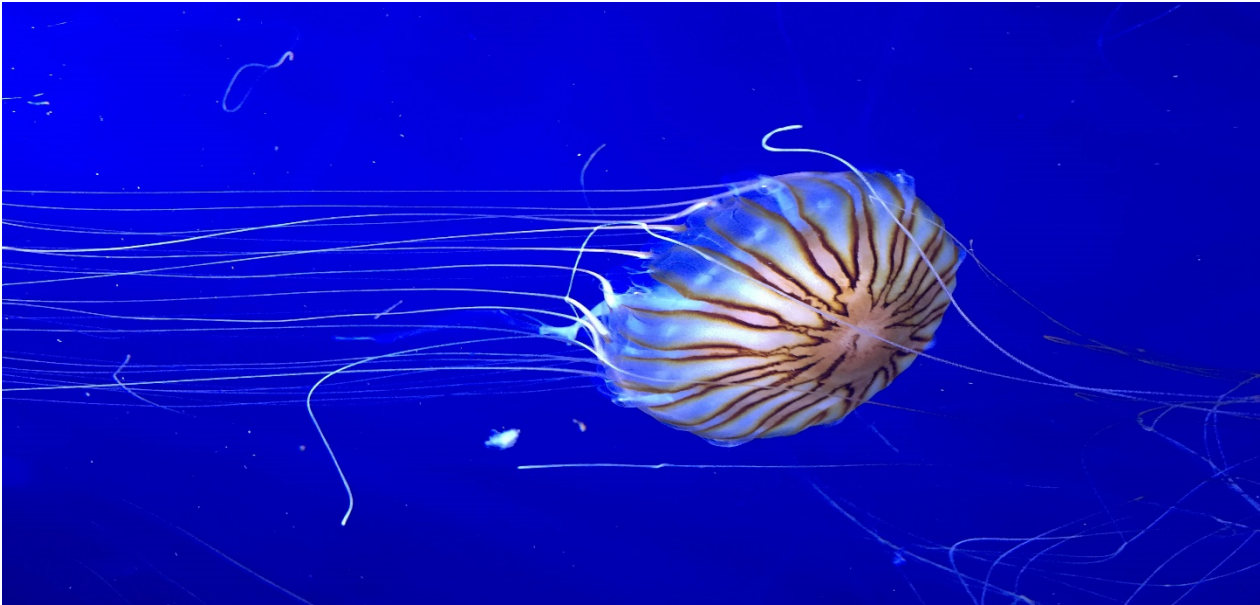
Our mission

Training young researchers is one of the main aims of the COST Action MARISTEM “Stem cells of marine/aquatic invertebrates: from basic research to innovative applications”. This goal is being accomplished through the organization of specific workshops, the support of short-term scientific missions and the provision of training schools.

The training school “Omics for studying stem cells in model and non-model aquatic invertebrate systems” aims to: i) provide trainees with tools in ‘omics technology useful for stem cell research; ii) raise the interest of young researchers in studying aquatic invertebrate stem cells, which exhibit

characteristics far beyond those seen in their vertebrate counterparts; and iii) establish new contacts among researchers in the field.

Due to COVID-19 restrictions, the training school will be completely virtual, and split into five modules blending theory and practice. Hands-on exercise sessions will be conducted throughout the training school to introduce students to the practical aspects of analysing 'omics data using programming pipelines.



Organisation of the Training School

This training school will be held from September 6th to October 8th, 2021, broken down into 5 week-long modules on different topics centred around 'omics technologies for the study of stem cells in aquatic invertebrate, mostly non-model systems. Lectures and online tutorials will be delivered using Zoom, recorded and provided online for the trainees to consult. All students should have internet access and are expected to participate in the entire training course. Although the course runs for 5 weeks, online attendance by students is only required Mondays, 2 hours on Friday mornings as well as in the afternoon of the last Friday of the Training School, on October 8th. This course is therefore designed to be compatible with the students' weekly lab work and duties. Certificates of participation will be provided at the end of the training school upon completion of all modules.

This course will cover broad aspects of methodologies, with a focus on adult stem cells (or progenitors) in invertebrates, and include relevant aspects of:

- organising the ideal experiment
- sample preparation
- workflow and (general) methodology



- troubleshooting
- analysis
- discussion about and examples of different invertebrate systems

Students will be provided with bibliography as well as information to access materials to prepare for each module. On Mondays, students will have lectures from experts, along with guided practicals. From Tuesday to Thursday, materials and exercises will be available for students to independently study and practice the content learned on Mondays. Time invested here will be at the student's discretion. On Fridays, the coordinator and tutor(s) will run a virtual 2- hour wrap-up with Q&A session covering all aspects of the module. On the afternoon of Friday October 8th, a wrap up session and informal "virtual drinks" session will take place. Recorded content will be kept available on the COST Action MARISTEM website after the end of the training school for dissemination across the Action. Certificates of participation will be provided at the end of the training school upon completion of all modules.

Application process

25 trainees (students registered for a PhD or postdoctoral researchers at recognised Universities or Institutes for Higher Education) will be invited upon successful application. Course participants must be from EU COST Action member states and affiliated countries in order to be formally recognised as having attended the training course.

The application must include:

- > A motivation letter from the student (500 words max)
- > A statement from the supervisor/line manager explaining the suitability of the applicant for the training school.

Please send applications to Dr Ildiko Somorjai at imls@st-andrews.ac.uk.

The deadline has been postponed to July 16th, 2021.

Preliminary schedule for the Training School

Week 1: Genomics Module

6th Sept 2021-10th Sept 2021

Module Organisers: Ute Rothbacher (University of Innsbruck, Austria), Simon Blanchoud (University of Fribourg, Switzerland)

Contact: ute.rothbaecher@uibk.ac.at



RATIONALE

‘Reading the genome’ i.e. predicting function from sequence remains one of the greatest challenges. In this module, we will outline some of the efforts to retrieve, assemble and annotate genomic sequences of model and non-model organisms and to learn how to utilize them for experimental design.

Starter Reference: Wei, J., Zhang, J., Lu, Q., Ren, P., Guo, X., Wang, J., Li, X., Chang, Y., Duan, S., Wang, S., Yu, H., Zhang, X., Yang, X., Gao, H., & Dong, B. (2020). Genomic basis of environmental adaptation in the leathery sea squirt (*Styela clava*). *Molecular Ecology Resources*, 20, 1414–1431. <https://onlinelibrary.wiley.com/doi/10.1111/1755-0998.13209>

SCHEDULE

First day: Monday [6/9]

09:00 – 09:30 Introductory Keynote Lecture:

On the interest of studying stem cells in model and non-model aquatic invertebrate systems (Bert Hobmayer, University of Innsbruck, Austria)

09:45 – 10:30 General intro and presentation of participants (2 min each)

10:30 – 11:30 Retrieving genomic sequences (preservation, extraction, sequencing) of non-model organisms (Olga Vinnere Pettersson, Uppsala University, Sweden)

11:30 – 12:30 Long-read sequencing (Oxford Nanopore) for de novo genome assembly of non-model organisms (*Hydra oligactis*, Philip Bertemes and Peter Ladurner, University of Innsbruck)

12:30-13:30 Lunch break

13:30 – 14:30 Genome analysis (assembly, annotations, orthology) of tunicates (Phallusia, Christelle Dantec and Patrick Lemaire, CRBM, Montpellier, France)

14:30 – 15:15 Genome editing and design in cnidarians (James Gahan, University of Bergen, Norway)

15:15 – 15:30 Break

15:30 – 16:15 Genome activity (regulatory sequences, ATACseq, ChIP-seq, HiC) for cell type specification (Alessandro Pennati, University of Innsbruck, Austria)

16:15 – 17:30 Analyzing data examples (Simon Blanchoud & Alessandro Pennati)



Second day: Friday [10/9]

09:00-12:00 Individual report by each participant, with discussion. Each participant will have an approx. 9 min slot.

Week 2: Transcriptomics Module

13th Sept 2021-10th Sept 2021

Module Organiser: Artur Burzynski (Institute of Oceanology, Polish Academy of Sciences, Poland)

Contact: aburzynski@iopan.pl

RATIONALE

Characterising stem cells is a major challenge in non-model organisms. In this module you will learn how to use transcriptomic data to approach the problem and gain valuable insight from RNA-Seq experiments. The pipeline will include handling of raw Illumina data, their assembly and annotation, with a focus on candidate stem cell markers.

Starter reference: Ribeiro, R. P., Ponz-Segrelles, G., Bleidorn, C., & Aguado, M. T. (2019). Comparative transcriptomics in Syllidae (Annelida) indicates that posterior regeneration and regular growth are comparable, while anterior regeneration is a distinct process. BMC Genomics, 20, 1-13. [DOI: 10.1186/s12864-019-6223-y](https://doi.org/10.1186/s12864-019-6223-y)

SCHEDULE

First day: Monday [13/9]

09:00 -10:00 General intro and presentation of participants (3 min each)

10:00 – 11:00 Presentation of module. (Artur Burzynski, Polish Academy of Sciences, Poland)

11:00 -12:00 Primer on Next Generation Sequencing and transcriptomics (TBA)

12:00 – 13:00 Advantages offered by the transcriptomic approach in the understanding of the complex planarian stem cell system and tissue differentiation paths, with an introduction to sample preparation techniques (Gaetana Gambino, University of Pisa, Italy).

13:00 – 14:00 Lunch break

14:00 – 14:40 Assemblers and RNA-Seq assembly pipelines (TBA)

14:45 – 15:25 How to produce a reliable annotation of the assembled transcripts? (Polish Academy of Sciences, Poland)



15:30 – 16:10 Differential expression primer (TBA)

16:15 – 17:00 Identification of stem cell-related transcripts, with practical examples and exercises (Marek Lubośny & Beata Śmietanka, Polish Academy of Sciences, Poland)

Second Day: Friday [17/9]

09:00 – 12:00 Individual report by each participant, with discussion. Each participant will have an approx. 9 min slot.

Week 3: Proteomics Module

20th Sept 2021 – 24th Sept 2021

Module Organisers: Ana Varela Coelho and Luis G Gonçalves (ITQB, Portugal)

Contact: varela@itqb.unl.pt

RATIONALE

In this module, you will get an overview of the experimental tools, data treatment and functional interpretation of proteomics data to unravel physiological, biological and metabolic processes in aquatic invertebrates, and how these approaches may be applied to stem cell research.

Starter reference:

Shen, M., Di, G., Li, M. et al. (2018) Proteomics studies on the three larval stages of development and metamorphosis of *Babylonia areolata*. *Sci Rep*, 8, 6269. doi.org/10.1038/s41598-018-24645-z

SCHEDULE

First Day: Monday [20/09]

09:00 – 10:00 Introduction to proteomics and metabolomics workflow. Experimental design and mass spectrometry

10:00 – 11:00 Sample preparation and data collection (virtual Lab)

11:00 – 13:00 Protein identification and databases (tutorial and exercises)

13:00 – 14:00 Lunch break

14:00 – 15:00 Asteroidea coelomic epithelium – a hematopoietic organ? (Ana V Coelho)

15:00 – 17:00 Functional analysis and bioinformatics tools (tutorial, exercises)



Second Day: Friday [24/9]

09:00 – 12:00 Individual report by each participant, with discussion. Each participant will have an approx. 9 min slot.

Week 4: Metabolomics Module

27th September 2021 – 1st October 2021

Module Organisers: Ana Varela Coelho and Luis G Gonçalves (ITQB, Portugal)

Contact: varela@itqb.unl.pt

RATIONALE

In this module, you will get an overview of the experimental tools, data treatment and functional interpretation of metabolomics data to unravel physiological, biological and metabolic processes in aquatic invertebrates, and how these approaches may be applied to stem cell research.

Starter reference:

Reverter M, Tribalat MA, Pérez T, Thomas OP. (2018) Metabolome variability for two Mediterranean sponge species of the genus *Haliclona*: specificity, time, and space. *Metabolomics*, 14, 114. [DOI: 10.1007/s11306-018-1401-5](https://doi.org/10.1007/s11306-018-1401-5).

SCHEDULE

First Day: Monday [27/09]

09:00-10:30 Sample preparation and nuclear magnetic resonance data collection for metabolomics (Virtual Lab)

10:30 – 12:00 Identification of metabolites by NMR and MS (tutorial and exercises)

12:00 – 13:00 Differential 'omics: quantification and statistical analysis

13:00 – 14:00 Lunch break

14:00 – 15:00 Metabolomics and marine invertebrate stem cells (TBD)

15:00 – 14:00 Integrated functional analysis (tutorial, exercises)

16:00 – 17:00 Integrated 'omics (TBD)



Second Day: Friday [01/10]

09:00 – 12:00 Individual report by each participant, with discussion. Each participant will have an approx. 9 min slot.

Week 5: Single Cell Sequencing Module

4th October 2021 – 8th October 2021

Module Organiser: Pedro Martinez (University of Barcelona, Spain)

Contact: pedro.martinez@ub.edu

RATIONALE

The advent of new single cell sequencing technologies is allowing us to understand development and disease in extraordinary detail. In this module, the students will get a good idea of the basic principles that underlie the use of this technology, both practical and theoretical, with a focus on marine animals.

Starter Reference: Siebert S, Farrell JA, Cazet JF, Abeykoon Y, Primack AS, Schnitzler CE, Juliano CE. (2019) Stem cell differentiation trajectories in Hydra resolved at single-cell resolution. *Science*. 365, 341. [DOI: 10.1126/science.aav9314](https://doi.org/10.1126/science.aav9314)

SCHEDULE

First day: Monday [4/10]

09:00 – 10:00 General intro and presentation of participants (3 min each)

10:00 – 11:00 Presentation of module (Pedro Martinez, University of Barcelona, Spain)

11:00 – 12:00 Primer on single cell transcriptomics. Introduction and potential of single cell analysis. (Maria Ina Arnone, Stazione Zoologica, Naples, Italy)

12:00 – 13:00 Single cell analysis in marine animals. Introduction to methodologies (Jules Duruz, University of Fribourg; Switzerland)

13:00 – 14:00 Lunch break

14:00 – 14:40 Analyzing data examples (TBD)



14:45 – 15:25 Gathering and analyzing embryonic development with single cell sequencing data (Periklis Paganos, Stazione Zoologica, Naples, Italy)

15:30 – 16:10 Alternative methodologies for high throughput preparation of aquatic/marine samples. (Jordi Solana, Oxford Brookes University, UK)

16:15 – 17:00 Further analysis (TBD).

Second day: Friday [8/10]

09:00 – 12:00 Individual report by each participant, with discussion. Each participant will have an approx. 9 min slot.

12:00 – 14:00 Lunch Break

14:00 – 17:00 Training School Wrap-Up Discussion and Virtual Networking Event (BYOB)

***Please note, the order or specific topics covered within modules may be subject to change.
Please contact module organisers for specific queries.***

