



ICS-C National Centre for HPC, Big Data, and Supercomputing RE-TRAIN-ME Academy – call 2024/25

Rationale

Currently, the demand for experts in biomedical computing (medical informatics, bioinformatics, biomedical data science, and in silico medicine) exceeds the availability of newly graduated in these disciplines. The RE-TRAIN-ME Academy aims to provide post-degree training in biomedical computing to people with a master's degree in math, physics, chemistry, biology, engineering, etc., but no specific training in biomedical computing. Bridging this gap is in line with the objectives of the ICSC Foundation, which sponsors this call. The participating organisations will contribute to the programme financially or in kind (by committing their experts as lecturers) in exchange for the opportunity to retrain their existing staff or new staff they conditionally employed in connection to the programme. Thus, the programme is reserved for people already employed in one of the participating organisations or have won a scholarship provided by one of these organisations, conditional to being admitted to the second part of the programme. However, it will also be open to individuals outside the participating organizations who wish to compete for one of the three scholarships provided by the ICSC Foundation.

For 2024/25, the participating organisations are:

- CINECA Supercomputing Centre
- University of Catania
- University of Bologna
- Istituto Italiano di Tecnologia
- University of Bari
- University of Torino
- University of Pavia
- University of Milan Bicocca on behalf of BBMRI.it
- Istituto Nazionale di Fisica Nucleare

The programme

The applicants admitted to the first part of the programme will follow three mandatory online courses (*Elements of Informatics*, *Programming*, and *Elements of Biomedical Computing*). The courses will start on 30/09/2024 and will end on 27/11/2024. In Annex 2, we provide a detailed list of topics taught in each module, and in Annex 3, the tentative calendar of the lectures. Lectures and laboratories will occupy three days per week, morning and afternoon. *Elements of informatics* will provide core training in computer science, whereas *Programming* will cover Bash, Python, and R programming languages. In *Elements of Biomedical Computing*, various experts will introduce the four application areas: medical informatics, bioinformatics, biomedical data science, and in silico medicine.

Those selected will start the second part of the programme on 3/2/2025. The second part includes teaching and on-site activities/labs; at that point, the participants should get hands-on experience at the participating organisation that employs them. Participants must attend 90% of the lectures in the module relative to their application area; however, they are welcome to attend all other modules if interested; however, if one application area has no participants, that module might not be taught.

Lectures will conclude in April 2025, but the participants will continue to work at the participating organisations until the end of their contract.

The programme will conclude with a public event for the first 15 days of October 2025, hosted by Fondazione ICSC – Centro Nazionale in HPC, Big Data and Quantum Computing, where all participants and lecturers will meet in person, and the 2025-26 Academy will be presented.

Call for application

The call is open to candidates with a total of five years of university education, typically a three-year bachelor's and a two-year master's, in biology, biotechnology, pharmacy, physics, informatics, engineering, mathematics, human and veterinary medicine, chemistry, materials science, astronomy, natural sciences, and statistical science (for Italian candidates see “classi di laurea magistrale” in Annex 1).

The call is open only to people who, if admitted to the second phase of the programme, will work on-site at one of the partner organisations in the period February- September 2025 because:

1. They are already employed in any capacity (including PhD scholarships) by one of the participating organizations.
2. They have won a scholarship linked to this program, funded by one of the participating organizations, conditional on being admitted to the second phase of the program.
3. They applied for one of the scholarships linked to this program, funded by one of the participating organizations and/or provided through the ICSC-C National Centre, conditional on being admitted to the second phase of the program.

Applicants must submit their application online, including a curriculum vitae in Europass CV format and a motivation letter in which also indicate their preferences in one of the four application areas: medical informatics, bioinformatics, biomedical data science, and in silico medicine.

A panel of experts will rank the applicants based on their CVs and submitted documents.

All candidates will be first evaluated based on their CVs; some may be invited for an interview.

The application must also include a letter from the participating organisation that employs them or has offered them a conditional scholarship (if the candidate falls under scenarios 1 or 2 as set here above), supporting their application and committing to ensure enough free time for the applicant to attend and study the programme. If the candidate is applying for one of the ICSC-C scholarship (scenario 3), no specific letter is required, but additional conditions (related, among others, to minimum attendance and evaluation of the work done in the hosting institutions) will apply. A dedicated agreement will be signed to cover all these aspects.

A maximum number of thirty-six (36) applicants will be admitted to the first part of the programme. Attendance will be monitored, and every participant is expected to attend 90% of the lectures to be considered for the second part of the programme. Only half of them will be selected for the second part of the programme and will receive the programme certificate. The others will receive an attendance certificate.

Link to the application form: https://agenda.supercomputing-icsc.it/e/RE_TRAIN_ME_2024/25

For additional information, please feel free to reach out via email to: educational@supercomputing-icsc.it

Annex 1: classi di laurea magistrale (for Italian degrees)

CLASSE LM06 Lauree Magistrali in Biologia
CLASSE LM08 Lauree Magistrali in Biotecnologie Industriali
CLASSE LM09 Lauree Magistrali in Biotecnologie Mediche, Veterinarie e Farmaceutiche
CLASSE LM13 Lauree Magistrali in Farmacia e Farmacia Industriale
CLASSE LM17 Lauree Magistrali in Fisica
CLASSE LM18 Lauree Magistrali in Informatica
CLASSE LM20 Lauree Magistrali in Ingegneria Aerospaziale e Astronautica
CLASSE LM21 Lauree Magistrali in Ingegneria Biomedica
CLASSE LM22 Lauree Magistrali in Ingegneria Chimica
CLASSE LM23 Lauree Magistrali in Ingegneria Civile
CLASSE LM24 Lauree Magistrali in Ingegneria dei Sistemi Edilizi
CLASSE LM25 Lauree Magistrali in Ingegneria dell'Automazione
CLASSE LM26 Lauree Magistrali in Ingegneria della Sicurezza
CLASSE LM27 Lauree Magistrali in Ingegneria delle Telecomunicazioni
CLASSE LM28 Lauree Magistrali in Ingegneria Elettrica
CLASSE LM29 Lauree Magistrali in Ingegneria Elettronica
CLASSE LM30 Lauree Magistrali in Ingegneria Energetica e Nucleare
CLASSE LM31 Lauree Magistrali in Ingegneria Gestionale
CLASSE LM32 Lauree Magistrali in Ingegneria Informatica
CLASSE LM33 Lauree Magistrali in Ingegneria Meccanica
CLASSE LM34 Lauree Magistrali in Ingegneria Navale
CLASSE LM35 Lauree Magistrali in Ingegneria per l'Ambiente e il Territorio
CLASSE LM40 Lauree Magistrali in Matematica
CLASSE LM41 Lauree Magistrali in Medicina e Chirurgia
CLASSE LM42 Lauree Magistrali in Medicina Veterinaria
CLASSE LM43 Lauree Magistrali in Metodologie Informatiche per le Discipline Umanistiche
CLASSE LM44 Lauree Magistrali in Modellistica Matematico-Fisica per l'Ingegneria
CLASSE LM53 Lauree Magistrali in Scienza e Ingegneria dei Materiali
CLASSE LM54 Lauree Magistrali in Scienze Chimiche
CLASSE LM58 Lauree Magistrali in Scienze dell'Universo
CLASSE LM60 Lauree Magistrali in Scienze della Natura
CLASSE LM66 Lauree Magistrali in Sicurezza Informatica
CLASSE LM71 Lauree Magistrali in Scienze e Tecnologie della Chimica Industriale
CLASSE LM82 Lauree Magistrali in Scienze Statistiche
CLASSE LM91 Lauree Magistrali in Tecniche e Metodi per la Società dell'Informazione

Annex 2: list of topics taught in each module

This list of topics is only for reference; it might be changed if the faculty sees it necessary.

Introduction to Computer Science

Theoretical bases: Von Neumann architecture, Turing machine; Hardware: CPU, RAM, storage, input, outputs; Hardware: GPU, bus, network adapters; Networks: From Ethernet to the Internet; Operating system and file systems; Compilers and programming environments; Database; Cloud computing; Time-sharing computer e HPC; Elements of information theory.

Programming

Introduction to the Unix Shell, Files and Directories; Pipes and filters e cycles; Scripting and finding things; Introduction to databases and SQL; Data manipulation; Introduction to the language and installation; Variable types, string formatting, containers, and operations; Cycles and conditions, functions, input/output; Introspection and modules, Classes - object-oriented programming; Error handling, Standard library, Scientific modules.

Introduction to Biomedical Computing

Introduction to biomedical computing; Data, information, knowledge, wisdom; Introduction to Data Science; Fundamentals of statistics; Types of data in healthcare; Electronic medical record; Introduction to Molecular biology; Comparing sequences; Introduction to in silico medicine; Biophysical models.

Medical Informatics

Types of data in healthcare; Health Information Systems and Telemedicine; Bioimages e DICOM; Biosignals; Electronic health records; Clinical data standard formats: HL7 CDA, HL7 FHIR, OMOP; Clinical Data standard vocabularies: SNOMED CT, ICD, LOINC; Security to protect clinical data; Digital Twins.

Medical data science

Introduction to Data Science; Fundamentals of Statistics; Data Visualisation; Data Mining; Contingency Tables; Logistic Regression; Introduction to Probability and Information Theory; Introduction to Machine Learning.

Bioinformatics

Analysis of Exome sequencing data for clinical application; Introduction to long-read sequencing applications and analyses; Getting closer to the phenotype: proteomics and metabolomics; The impact of the "Genomic era" on daily life.

In Silico Medicine

Introduction to in silico medicine; Biophysical models: finite element methods; Biophysical models: condensed parameter methods; Finite state machines: agent-based models; Stochastic modelling; The credibility of predictive models; Clinical applications of patient-specific models.

Annex 3: Lectures calendar

Lectures calendar - First part			
weekday	Giorno	10:00-12:00	14:00-18:00
Lunedì	30/9/2024	Introduction to Computer Science	ICS lab
Martedì	1/10/2024	Programming	PRO Lab
Mercoledì	2/10/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	3/10/2024	Free study	
Venerdì	4/10/2024	Free study	
Sabato	5/10/2024		
Domenica	6/10/2024		
Lunedì	7/10/2024	Introduction to Computer Science	ICS lab
Martedì	8/10/2024	Programming	PRO Lab
Mercoledì	9/10/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	10/10/2024	Free study	
Venerdì	11/10/2024	Free study	
Sabato	12/10/2024		
Domenica	13/10/2024		
Lunedì	14/10/2024	Introduction to Computer Science	ICS lab
Martedì	15/10/2024	Programming	PRO Lab
Mercoledì	16/10/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	17/10/2024	Free study	
Venerdì	18/10/2024	Free study	
Sabato	19/10/2024		
Domenica	20/10/2024		
Lunedì	21/10/2024	Introduction to Computer Science	ICS lab
Martedì	22/10/2024	Programming	PRO Lab
Mercoledì	23/10/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	24/10/2024	Free study	
Venerdì	25/10/2024	Free study	
Sabato	26/10/2024		
Domenica	27/10/2024		
Lunedì	28/10/2024	Introduction to Computer Science	ICS lab
Martedì	29/10/2024	Programming	PRO Lab
Mercoledì	30/10/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	31/10/2024	Free study	
Venerdì	1/11/2024	Free study	



Sabato	2/11/2024		
Domenica	3/11/2024		
Lunedì	4/11/2024	Introduction to Computer Science	ICS lab
Martedì	5/11/2024	Programming	PRO Lab
Giovedì	6/11/2024	Introduction to Biomedical Computing	IBC Lab
Mercoledì	7/11/2024	Free study	
Venerdì	8/11/2024	Free study	
Sabato	9/11/2024		
Domenica	10/11/2024		
Lunedì	11/11/2024	Introduction to Computer Science	ICS lab
Martedì	12/11/2024	Programming	PRO Lab
Mercoledì	13/11/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	14/11/2024	Free study	
Venerdì	15/11/2024	Free study	
Sabato	16/11/2024		
Domenica	17/11/2024		
Lunedì	18/11/2024	Introduction to Computer Science	ICS lab
Martedì	19/11/2024	Programming	PRO Lab
Mercoledì	20/11/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	21/11/2024	Free study	
Venerdì	22/11/2024	Free study	
Sabato	23/11/2024		
Domenica	24/11/2024		
Lunedì	25/11/2024	Introduction to Computer Science	ICS lab
Martedì	26/11/2024	Programming	PRO Lab
Mercoledì	27/11/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	28/11/2024	Free study	
Venerdì	29/11/2024	Free study	
Sabato	30/11/2024		
Domenica	1/12/2024		
Lunedì	2/12/2024	Introduction to Computer Science	ICS lab
Martedì	3/12/2024	Programming	PRO Lab
Mercoledì	4/12/2024	Introduction to Biomedical Computing	IBC Lab
Giovedì	5/12/2024	Free study	
Venerdì	6/12/2024	Free study	
Sabato	7/12/2024		
Domenica	8/12/2024		



Lectures calendar - Second part		
weekday	Giorno	10:00-12:00
Lunedì	3/2/2025	In Silico Medicine
Martedì	4/2/2025	Medical Informatics
Mercoledì	5/2/2025	Health Data Science
Giovedì	6/2/2025	Bioinformatics
Venerdì	7/2/2025	Free study
Sabato	8/2/2025	
Domenica	9/2/2025	
Lunedì	10/2/2025	In Silico Medicine
Martedì	11/2/2025	Medical Informatics
Mercoledì	12/2/2025	Health Data Science
Giovedì	13/2/2025	Bioinformatics
Venerdì	14/2/2025	Free study
Sabato	15/2/2025	
Domenica	16/2/2025	
Lunedì	17/2/2025	In Silico Medicine
Martedì	18/2/2025	Medical Informatics
Mercoledì	19/2/2025	Health Data Science
Giovedì	20/2/2025	Bioinformatics
Venerdì	21/2/2025	Free study
Sabato	22/2/2025	
Domenica	23/2/2025	
Lunedì	24/2/2025	In Silico Medicine
Martedì	25/2/2025	Medical Informatics
Mercoledì	26/2/2025	Health Data Science
Giovedì	27/2/2025	Bioinformatics
Venerdì	28/2/2025	Free study
Sabato	1/3/2025	
Domenica	2/3/2025	
Lunedì	3/3/2025	In Silico Medicine
Martedì	4/3/2025	Medical Informatics
Mercoledì	5/3/2025	Health Data Science
Giovedì	6/3/2025	Bioinformatics
Venerdì	7/3/2025	Free study
Sabato	8/3/2025	



Domenica	9/3/2025	
Lunedì	10/3/2025	In Silico Medicine
Martedì	11/3/2025	Medical Informatics
Giovedì	12/3/2025	Health Data Science
Mercoledì	13/3/2025	Bioinformatics
Venerdì	14/3/2025	Free study
Sabato	15/3/2025	
Domenica	16/3/2025	
Lunedì	17/3/2025	In Silico Medicine
Martedì	18/3/2025	Medical Informatics
Mercoledì	19/3/2025	Health Data Science
Giovedì	20/3/2025	Bioinformatics
Venerdì	21/3/2025	Free study
Sabato	22/3/2025	
Domenica	23/3/2025	
Lunedì	24/3/2025	In Silico Medicine
Martedì	25/3/2025	Medical Informatics
Mercoledì	26/3/2025	Health Data Science
Giovedì	27/3/2025	Bioinformatics
Venerdì	28/3/2025	Free study
Sabato	29/3/2025	
Domenica	30/3/2025	
Lunedì	31/3/2025	In Silico Medicine
Martedì	1/4/2025	Medical Informatics
Mercoledì	2/4/2025	Health Data Science
Giovedì	3/4/2025	Bioinformatics
Venerdì	4/4/2025	Free study
Sabato	5/4/2025	
Domenica	6/4/2025	
Lunedì	7/4/2025	In Silico Medicine
Martedì	8/4/2025	Medical Informatics
Mercoledì	9/4/2025	Health Data Science
Giovedì	10/4/2025	Bioinformatics
Venerdì	11/4/2025	Free study
Sabato	12/4/2025	
Domenica	13/4/2025	
Lunedì	5/5/2025	Bioinformatics



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Martedì	6/5/2025	Bioinformatics
Mercoledì	7/5/2025	Bioinformatics
Giovedì	8/5/2025	Free study
Venerdì	9/5/2025	FINAL EVENT
Sabato	10/5/2025	
Domenica	11/5/2025	