Translation of the Director’s Decree Nr. 1119 Dated 28.12.2023

Selection for the conferment of two PhD fellowships in Theoretical and Scientific Data Science financed by Human Technopole Foundation- Academic year 2024/25

In the framework of the agreement signed with Human Technopole Foundation, the International School for Advanced Studies (SISSA) announces a selection based on academic qualifications and written and oral exams for the conferment of three PhD fellowships in Theoretical and Scientific Data Science starting from the academic year 2024/25.

Amount of the fellowship: € 29,234.74 gross per year (approx. € 1,700 monthly net)
Financing Body: Human Technopole Foundation
Duration of the programme: 4 years
Research Fields:
- Data Science methods for molecular biomedicine and biological imaging
- Computer vision applied to biological data
- Statistical physics, machine learning and systems biology for the prediction of antibiotic resistance
- Cancer evolution and reconstruction of dynamical systems
- Spatial modelling of gene expression in tissues

● Requirements:

SISSA welcomes applications from young candidates who have completed, or are going to complete, their undergraduate studies, with a strong interest in research.

To apply, candidates, without limitations of age and nationality, must be in possession of one of the following degrees by 31st October, 2024:

- Italian laurea magistrale
- A University degree obtained abroad and considered equivalent to the aforementioned Italian degree by the evaluation Committee.

● Online application:

An online application must be filled and sent using the procedure available at the page https://pica.cineca.it/sissa/ by 13.00 hrs. of 23rd February 2024 (Italian time).

Candidates should upload the following documents in pdf format:
- curriculum vitae;
- a certificate of University examinations taken (with marks);
- a final degree certificate;
- If, at the time of application, candidates should not be yet in possession of a degree certificate, they can submit it at the time of the examination.
European Union candidates can submit a personal declaration instead of the aforementioned certificates.
- a copy of the diploma thesis (if any), or its abstract.
- A motivation letter (2 pages max.)
- Identity document.

At the end of the procedure, candidates will have to indicate the names and email addresses of two professors that will receive an email requesting to send a recommendation letter through the same online procedure by 13.00 hrs. of 25th February 2023 (Italian time).

The candidate will then have to print out the admission request form, sign it and send it through the same online procedure.

Candidates with disabilities certified according to the law n. 104/1992 and subsequent modifications, and those diagnosed with Specific Learning Disorder certified according to the law n. 170/2010 and to the D.M. n. 5669 dated 12/07/2011, can report their needs together with the submission of the admission application, within the deadline set by this announcement.

- Selection Procedure:

After the deadline of the announcement, the Selection Committee, which will be composed of two Faculty Members of SISSA, two Human Technopole Members, and one external, will evaluate the documentation produced by the candidates (curriculum vitae, letters of recommendation, etc.). Candidates who have obtained a minimum score of 7/10 will be invited to take the written test via zoom on 11th March 2024. Those who will obtain a minimum mark of 28/40 in the written test, will be admitted to the interview which will be held between 15th and 19th March 2024 via zoom, with scheduled times that will be communicated later on.

For the interview, the candidate should be reachable at the address indicated in the application, at the time communicated by SISSA through email.

Candidates should show an ID document for identification at the beginning of the interview. The absence of a contact email in the application or of a valid ID during the interview, imply the exclusion from the competition.

- Admission:

The admitted candidates will be notified by email and will be asked to be present at SISSA on 1st October 2024 for the registration.

Failure to do so without a valid reason will result in the loss of the fellowship awarded.

In order to be enrolled and to be awarded the fellowship, admitted candidates must pay a “Regional Tax” of the amount of € 120.00 - € 160.00 per year. Information can be retrieved at http://www.ardiss.fvg.it/.

For information about rights and duties of the doctoral students please consult the SISSA PhD Courses Regulations.
As per Legislative Decree 30.06.2003 n.196, and of the European Regulation 2016/679 (General Data Protection Regulation), we inform that all data given to this Administration will be processed only for purposes related to and instrumental to the existing contract, in compliance with the provisions in force.

The Director
Prof. Andrea Romanino
(digitally signed)
Selection for the conferment of three PhD fellowships in Theoretical and Scientific Data Science financed by Human Technopole Foundation- Academic year 2023/24

Project: The project will deal with the development and application of data science and artificial intelligence methods to the issues of molecular biomedicine. Each project will be followed by an HT supervisor and a SISSA supervisor. From the second year, the student is expected to spend most of their time at HT in Milan.

Research Fields: The last two decades have witnessed an unprecedented development of biotechnology. This has led to the availability of increasingly extensive databases documenting at the molecular, genetic and phenotypic level a large number of biological and pathological processes. However, extracting biological knowledge, and consequently clinical strategies, from this large mass of high-dimensional data represents a formidable open problem at the intersection of biology, computer science and physical sciences. These three projects, part of the strategic collaboration between the data theory and science group at SISSA and the Institute for Computational Biology at HT, will develop new methodologies in the field of biomedical data science. Specifically, the research areas will be:

- **Predicting the evolution of cancer**
  Tumours change over time, transforming from benign to malignant and becoming resistant to treatment. Cancer drug resistance is arguably the biggest problem in oncology today. In this project we will combine evolutionary theory with cutting-edge machine learning methods to analyse and interpret high throughput data from patients and patient-derived model systems, including single-cell and longitudinal data, with the aim of anticipating the evolution of cancer and designing better treatment strategies that prevent or delay the emergence of resistance.

- **Predicting antibiotic resistance evolution in microbial communities**
  Ecological and evolutionary processes of microbial pathogens are key to understanding antibiotic resistance and human health. These organisms often grow in complex communities, which behaviour is difficult to model and predict. We will combine systems-biology approaches, evolutionary models, statistical methods, and experimental data to predict microbial behavior in interacting microbial systems. Establishing new theoretical methods to predict antibiotic response of interacting microbes could change the way we fight against the emerging global health problem that is antibiotic resistance.

- **New machine learning methods for single cell multi-omic data**
  It has become recently possible to profile the molecular content of human cells at unprecedented resolution. Those multidimensional datasets from single cells are highly complex and hard to interpret in a biologically meaningful way. We need to develop novel machine learning algorithms for data integration and interpretation that will allow extracting new biological and medical information from those datasets.
Modeling mutliomic states of brain cells in evolution, development, and disease

The human brain, formed by millions of diverse cells, is the most complex organ known. How these cells collectively mediate brain function and behavior and why they lead to dysfunction in disease is not understood. We will combine single-cell multi omic data analysis, comparative genomics, and mechanistic modeling to study brain cell behavior in evolution, development, and disease. Computational predictions will guide collaborative experiments to dissect the mechanistic basis and behavioral consequences of brain (dys)function, opening up opportunities for therapeutic intervention and control.

Qualification required: Italian laurea magistrale, or equivalent degree obtained abroad
Amount of the fellowship: € 29,234.74 gross per year (approx. € 1,700 monthly net)
Financing Body: Human Technopole Foundation
Duration of the programme: 4 years (starting from 1 October 2023)

**Deadline for online submission of applications: 17th February 2023 (13.00 hrs – Italian Time)**

**Admission:** Academic and scientific qualifications + written test + oral exam

**Written Test (remotely):** 6th March 2022
**Oral Exam (remotely):** 13th – 17th March 2023

**Evaluation of academic and scientific qualifications:** 10 points
**Access to Written test:** minimum mark of 7/10 in the academic and scientific qualifications

**Evaluation of written test:** 40 points
**Access to Oral Exam:** minimum mark of 28/40 in the written test

**Evaluation of Oral Exam:** 50 points
**Minimum Evaluation of oral exam:** 35/50

**Total Evaluation:** 100 points
**Eligibility:** 70 points

Admission to the written test, oral exam and results of all evaluations will be notified by email.