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SISSA
Scuola Internazionale Superiore di Studi Avanzati

Funded by the European Union

BioHYBRITE Doctoral Network
Decoding and designing biomolecular systems with hybrid DNA:RNA:protein nanotechnology
HORIZON-MSCA-2024-DN-01-01 - MSCA Doctoral Networks 2024

JOB INFORMATION

Host Organisation	Scuola Internazionale Superiore di Studi Avanzati
Department	Physics Area, PhD programme in Molecular and Statistical Biophysics
Country	Italy
Application Deadline	11th May 2026 – 13.00 hrs CET
Type of Contract	Temporary
Job duration	48 months
Job Status	Full-time
Offer Starting Date	October 1st 2026

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101227379.

Position DC12
Predictive modelling of translocation properties of nucleic acids and protein assemblies

Supervisory Team	Primary academic institution: Prof. Cristian Micheletti (SISSA) Associated advisory team: Prof. Ulrich Keyser, UCAM

Project Description
This PhD project has a planned duration of 48 months, including the 36 months funded under the BioHYBRITE (MSCA Doctoral Networks) action plus an additional 12 months of SISSA fellowship. The project will develop and apply advanced theoretical and computational models for two purposes. First, it will characterize how the structure of nucleic acids, proteins, and their biohybrid assemblies affects their motion through nanopores. The results will then be used to design molecules with desired pore translocation properties.

The theoretical/computational project will involve close international collaborations (planned secondments) with experimental and theoretical partner groups of the BioHybrite network, through which the doctoral researcher will iteratively refine models by comparing them with experiments and, finally, formulate predictions.

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This specific PhD research will be carried out within the Molecular and Statistical Biophysics programme, detailed at: https://msb.sissa.it/phd-program/

Objectives: Aim of this project is developing, validating and using a predictive theoretical and computational framework for the response of RNA, DNA and proteins and biohybrid assemblies to nanopore translocation. The project is building on the expertise of PIs at SISSA (Micheletti) on multiscale structural modelling and simulations. The analysis will be aimed at objectives central to WP4 and connected to WP3 and WP5, too, namely: (i) the development, validation against experiment, and refinement of coarse-grained models for RNA, DNA and protein biohybrids; use of the models and simulations to (ii) interpret experiments of other DCs on the pore translocation of the molecules, their transport properties in channels or their supramolecular assembly (iii) aid the design of new synthetic molecular constructs. Across each of these steps, the results will be shared with other DCs, including those involved in experimental measures of pore translocation responses of RNA, DNA and protein biohybrids and in designing nanosyringes and cages based on DNA origami.

Expected Results: The integration with the activity of Keyser group (UCAM) and Ouldrige's group (IMP) will allow for progressively improving the modelling by iterative comparison and refinement against experiments, and this will in turn make it possible to use the models predictively, thus making it possible to provide a structural interpretation to translocation measurements and to inform the prototyping of synthetic molecules with specific designed mechanical properties. Coarse-grained models for DNA origami will support the interpretation and design of experimental setup of Linko's group on nanosyringes (UTARTU) and of Heuer-Jungemann's group supramolecular cages (MPIB).

BioHYBRITE is a structured, highly interdisciplinary training program at the interface of molecular design, single-molecule analysis, AI-assisted protein development, and medical applications. Our goal is to train a new generation of highly qualified scientists at the interface of physics, chemistry, biology, and engineering – in the promising field of DNA-RNA-protein nanotechnology.
BioHYBRITE unites 12 partner institutions across six European countries, combining world-class expertise, research infrastructures, and complementary skills.

REQUIREMENTS

Education Level Master of Science degree or equivalent in Engineering, Physics, Chemistry, Mathematics or similar

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Skills/Qualifications Demonstrable prior experience in computer programming with either Fortran, Matlab, Python and/or C, as well as Unix shell scripting.
Demonstrable prior experience in modelling biomolecular system, and in molecular dynamics or Monte Carlo simulations. Strong background in Statistical Mechanics or Physical Chemistry.
Excellent level of spoken and written English;
Demonstrable prior experience in scientific writing.

Candidates are required to pass an entrance selection based on academic qualifications and online exams, written and oral, as detailed further below.

ADDITIONAL INFORMATION
Working place, supervisor, and secondments

The project will be carried on under the supervision of Prof. Cristian Micheletti, within the Molecular and Statistical and Biophysics group at SISSA - Scuola Internazionale Superiore di Studi Avanzati, located in Trieste, Italy. SISSA is a scientific center of excellence within the national and international academic scene, with focus on three main areas: Physics, Mathematics and Neuroscience on a park campus overlooking Trieste, with in-house access to top facilities for research, such as High-Performance Computing, library and labs. The SISSA research community, about 90 principal investigators, 100 postdocs, and 280 PhD students, supports frequent cross-group scientific exchange, enables fast feedback on ideas, shared methods, and easy connections to external collaborators. In addition to fully-funded fellowships, PhD students have access to benefits that include financial contributions toward housing rent, purchasing personal laptops, and participation in external training programmes. SISSA has leading roles in large international collaborations and, constitutes a research network with the other scientific institutions in the area, including the International Centre for Theoretical Physics (ICTP). SISSA has also drawn up several collaboration agreements with the world's leading schools and research institutes. SISSA holds the top position among Italian scientific institutes in terms of research grants obtained in relation to the number of researchers and professors. The SISSA Valorisation Office will provide support for talent enhancement, career development, and offer training on best practices for dissemination and public outreach.

Prof. Cristian Micheletti: is a full professor at SISSA. After obtaining the PhD degree from Oxford University (1996) he joined the Statistical Mechanics group in SISSA, where he is part of the staff of the Molecular and Statistical and Biophysics unit. Prof. Micheletti leads a multidisciplinary group of young scientists that combines concepts from statistical mechanics, molecular dynamics, polymer physics, and numerical simulations to understand the physical properties of biomolecular systems.

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Planned secondments: Keyser lab, Ouldridge group, Linko lab, Heuer-Jungemann lab.

Eligibility criteria

Applicants can be of any nationality and must hold a Master of Science degree (or equivalent) in a scientific subject, relevant to the aforementioned topics. They need to fully respect the following eligibility criteria:
(a) Must be doctoral candidates, i.e., **not already in possession of a doctoral degree at the date of the recruitment**[1].
(b) **Must undertake transnational mobility.** The MSCA are based on the principle of physical mobility. Researchers must not have resided or carried out their main activity (work, studies, etc.) in Italy for more than 12 months within the 36 months immediately before their date of recruitment. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not taken into account[2]. Finally, the mobility rule is related to your residence or main activity and not to your nationality.

A good knowledge of spoken and written English is required and will be evaluated during the selection process.

How to apply

Candidates should apply through https://pica.cineca.it/sissa/ by 11th May 2026 – 13.00 hrs. CEST – and should provide:

- An application form duly completed.
- A Curriculum Vitae (CV) including previous technical and scientific experiences with a list of publications (if any) and/or participation to scientific meetings and research expertise.
- Motivation letter, including research interests and the reasons for applying for this programme;
- Degree certificates and transcripts (or equivalent official records) for both Bachelor/first-cycle and Master/second-cycle studies, including university grades and the detailed list of university courses with grades. Copies of any other scientific publication that the candidate believes significant are also welcome.
- Applicants who have not yet been awarded the Master's degree at the application deadline may apply, provided that the degree is obtained by the recruitment/enrolment date; they must upload an official certificate of expected graduation date (or equivalent) and the latest available transcript.
- Applicants must arrange for two reference letters to be provided by as many

[1] Researchers who have successfully defended their doctoral thesis but who have not yet formally been awarded the doctoral degree will not be considered eligible. See Article 6.2.A(b)(i) of the HE unit model grant agreement
2 Article 6.2.A(b)(vi) of the HE unit model grant agreement

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referrals, who will need to upload them by the set deadline through the PICA platform.
- Provide supporting documentation proving their place(s) of residence or work during the previous 3 years (transnational mobility requirement)

Evaluation and interview

In line with the Code of Conduct for the Recruitment of Researchers, the recruitment procedure is open, transparent, merit-based, impartial and equitable

The selection process will consist of three different selection phases and will be based on:
1. Academic qualifications (max score 10/10)
2. Written examination (max score 40/40)
3. Interview (max score 50/50).

After the first selection phase, based on the CVs and qualifications, only candidates with a minimum mark of 7/10 will be contacted to attend the written examination, which will take place online on **25th May** (time and connection details announced at a later date). Candidates obtaining a minimum mark of 28/40 will then be admitted to the interview. Candidates will be interviewed by a committee that includes at least two BioHYBRITE members. The interview, aiming to assess the academic skills, the motivation and the fluency in English, will take place online on 26th May and possibly following days (minimum passing mark is 35/50). **To be considered eligible, candidates must pass all the phases meeting the minimum marks specified above.**

The final ranking list (graduatoria) will be drawn up on the basis of the total score obtained, calculated as the sum of the scores of the three phases (maximum 100 points).
In case of ex aequo, tie-break criteria will be applied in accordance with the applicable regulations.

The first candidate in the ranking list will be offered the position. If, for any reason, the selected candidate declines the offer or fails to comply with the requirements to take up the position, the next in the classification list will be offered the position.

The final decision is taken based on the candidates' scientific skills, the relevance of their research experience, the impact of the proposed training on their career, and ensuring a fair gender representation[3]

At SISSA, we value diversity and equality. SISSA recognizes that employees may wish to have working patterns that fit with their caring responsibilities or work-life balance. Due consideration will also be given to applicants who have had career

[3] Annex 5 of the HE unit model grant agreement – Specific rules for MSCA actions

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breaks for reasons including maternity, paternity or adoption leave, disability or illness.

Rights and responsibilities of researchers participating in Marie Sklodowska-Curie Actions

The European Charter for Researchers is a set of principles designed to create an attractive, open, and sustainable research environment across Europe. It defines the roles, responsibilities, and entitlements of researchers, as well as those of employers and funders, to ensure fair and supportive working conditions. The Charter consists of 20 principles grouped under four pillars: Ethics, Integrity, Gender and Open Science; Researchers' Assessment, Recruitment and Progression; Working Conditions and Practices; and Research Careers and Talent Development. Its aim is to strengthen the European Research Area by fostering conditions that enable researchers to generate, share, and disseminate knowledge effectively while advancing their careers. It applies to all researchers at every stage and across all sectors and disciplines, regardless of contract type or institutional setting.

It is mandatory for applicants to read and understand the detailed information regarding the rights and responsibilities of researchers engaged in a Marie Sklodowska-Curie Doctoral Network (DN). The European Charter for researchers can be accessed at

https://euraxess.ec.europa.eu/hrexcellenceaward/european-charter-researchers

Information note for Marie Skłodowska-Curie fellows in doctoral networks - Publications Office of the EU

Employment contract and remuneration

The selected candidate will receive a salary in accordance with the MSCA regulations for DCs for the MSCA-funded period (36 months). The gross includes a living allowance (approx. € 3,821.53 gross per month subject to MSCA Country Correction Coefficient) a mobility allowance (€ 710.00 gross per month) and a family allowance if applicable (€ 660 gross per month) where 'Family' means persons linked to the researcher by (i) marriage or (ii) a relationship with equivalent status to a marriage recognized by the legislation of the country where this relationship was formalized or (iii) dependent children who are actually being maintained by the researcher).

The MSCA-DN funding (provided by the European Commission) is for 36 months . Please note that the duration of PhD at SISSA is 48 months. SISSA will cover the remaining 12 months exceeding the BioHYBRITE funding**.** The applicable financial conditions and any allowances for this period will be specified in the offer/contract documentation.**"**

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Personal Data
Any personal data will be processed in accordance with the General Data Protection Regulation 679/2016 EU (GDPR) on the Protection of Individuals.

For more information on the BioHYBRITE network see:
https://biohybrite.cup.uni-muenchen.de/

Email: phd@sissa.it

The Director
(Prof. Andrea Romanino)

SISSA Firmato digitalmente da Andrea Romanino
Data: 22.12.2025 15:40:11 CET
Organizzazione: SISSATRIESTE/00551830326

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