

ALMA MATER STUDIORUM | AREA UNIVERSITÀ DI BOLOGNA FORMAZIONE E DOTTORATO

PHD PROGRAMME TABLE

Call for applications for the admission to the PhD programmes (41st cycle) - A.Y. 2025/2026 Second round

Section "Research Fields" modified on 04/06/2025				
PROGRAMME'S NAME	MATHEMATICS			
DURATION	3 years			
PROGRAMME START DATE	01/11/2025 (DD/MM/YYYY)			
LANGUAGES	Italian, English			
COORDINATOR	Prof. Giovanni Mongardi (<u>mat.dottorato@unibo.it</u>)			
PhD POSITIONS	1			
ADMISSION PROCEDURE	Qualifications evaluation Oral examination			

Available Positions and Scholarships

Pos. n.	Financial Support	Description	Positions linked to specific topics
1	PhD Scholarship	Funded by TGen - The Translational Genomics Research Institute, in memory of Renzo Tomasetti. The position requires research activities to be carried out at least in part at the funding body's headquarters in the USA.	Mathematical modeling applied to medicine

The yearly gross amount of the scholarships awarded for the PhD Programme in "Mathematics" is €16,243.

All winners of PhD positions must fulfil the study and research obligations decided by the Academic Board, as well as the obligations set out in the relevant regulations, in the call for applications, in the funding schemes and in any agreements relating to specific positions.

Admission Exams

	DATE AND TIME	RESULTS
Qualifications evaluation	Applicants' participation is not required	Available from 11/07/2025
Oral examination	Date: starting from 15/07/2025 – 9.00 a.m. CEST Place: In presence, Aula Seminario II, Department of Mathematics, Piazza di Porta San Donato 5, Bologna. Remotely, using Microsoft Teams	Available from 22/07/2025

The results of the qualifications evaluation, as well as the oral examination detailed schedule, shall be available on the webpage <u>Studenti Online</u> (select "requests in progress" > "see detail" and open the .pdf file at the bottom of the page). No personal written communication will be sent to applicants concerning the examinations results.

SETTORE DOTTORATO DI RICERCA

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Required and Supporting Documents to be attached to the application

Only documents **in Italian or English** will be considered valid and will be assessed by the Admission Board. Identity documents and diplomas/degree certificates issued in a language other than Italian or English must be accompanied by an official translation. The translation must be carried out by an authorized body or by the awarding university. Only qualifications obtained in the last 5 years will be taken into account, with the exception of university degrees. The Admission Board will assess the relevance of the supporting documents to the PhD programme.

REQUIRED DOCUMENTS				
Identity document	Valid identity document with photo (i.e. identity card, passport)			
Curriculum Vitae	The Curriculum Vitae must be prepared using the <u>Curriculum Vitae form</u> which can be downloaded in .docx format from the <u>University website</u> (select the PhD Programme \rightarrow " <i>More</i> <i>information</i> ", then check " <i>Notices</i> " at the bottom of the page) – 3 pages max . The Curriculum Vitae must contain all the experience that the candidate wishes to submit for evaluation. Any experience that can be assessed but is not included in the Curriculum Vitae will not be considered.			
Degrees	Documents attesting the awarding of the first and second cycle degrees, the exams taken and the marks obtained (see Art. 3 of the Call for Applications)			
SUPPORTING DOCUMENTS				
Thesis abstract	Extended abstract of the second cycle degree thesis (2 to 5 pages, in Italian or in English). Graduands applicants may submit an extended abstract of the draft of their thesis.			
Reference letter/s	No more than 2 reference letters signed by Italian and international academics and professionals in the research field, which do not form part of the Admission Board, attesting the suitability of the applicant and his/her interest in the scientific research. Letters shall be uploaded following the procedure on <u>Studenti Online</u> , detailed in the Call for Applications (Art. 3.2).			
Personal Statement	The statement should include the reasons why the applicant wishes to join the PhD programme and the relevant experience and research interests that make the applicant suitable for the specific PhD programme making explicit reference to Professors of the Department with whom the candidate intends to collaborate, and reference to corresponding scientific fields (max. 1 page).			
Other documents	 The following items will only be assessed if they are included in the Curriculum Vitae, which must be submitted in the format described above: Postgraduate vocational programmes and/or specialisation programmes relevant to the PhD Programme Research activity of any kind - whether basic, applied, translational, etc carried out in any capacity, including when covered by research grants, and as a staff member of research projects Periods of study abroad, completed by applicants outside their countries of origin (e.g. Erasmus programme or other similar mobility programmes) Other qualifications attesting the suitability of the applicants (scholarships, prizes, etc.) 			

Evaluation criteria*

Scores will be expressed in points out of 100, as follows.

1. Qualifications evaluation

Minimum score for admission to the oral examination: 30 points, Maximum score: 50 points

Final marks of both the first and second cycle (Bachelor's and Master's) degrees and Weighted Average Marks	10 points max
Curriculum Vitae, overall training and learning activities and other evaluable documents	10 points max
Extended thesis abstract	13 points max
Reference letter/s	10 points max
Personal statement	7 points max

2. Oral examination

Minimum score for eligibility: 30 points, Maximum score 50 points2 points maxEnglish language proficiency2 points maxGeneral knowledge of the PhD programme's main research topics and of the research topics linked
to the available PhD positions48 points max

Oral examination aims to assess the suitability of the applicant for scientific research as well as the general knowledge of the PhD programme's main research topics and of the research topics linked to the available PhD positions. **During the oral examination, the applicant's English proficiency shall be assessed, as at least part of the interview will be carried out in English**.

The oral examination is carried out in Italian or English.

* Possible further evaluation criteria will be available on the University website, selecting the relevant PhD Programme

> "More information".

Research Fields

PhD position with a scholarship funded by TGen - The Translational Genomics Research Institute, in memory of Renzo Tomasetti with research topic "Mathematical modeling applied to medicine"

The student will work with Prof. Cristian Tomasetti (City of Hope and TGen) as main advisor, in coordination with a coadvisor at University of Bologna, as well as with Associate Professor Sophie Pénisson and Assistant Professor Kamel Lahouel in Dr. Tomasetti's Lab on projects with a focus on mathematical modeling in cancer biology. Three proposed directions are described here and several more may arise during the program.

One line of investigation focuses on the refinement of models of carcinogenesis, the complex, multiscale process by which normal cells transform into cancerous ones. This includes modeling temporal dynamics of cell populations and signaling pathways, incorporating stochasticity in mutation events and cell fate decisions, and representing tumor progression as an evolutionary competition between subclones. Potential mathematical tools include stochastic processes, graph models, differential equations, machine learning, and statistical modeling.

A second line of investigation aims at modeling cancer risk, particularly the quantification of multicancer risk based on somatic mutational burden and its refinement through multiomic and clinical data integration. This involves both theoretical and algorithm development with data-driven analyses, from pilot studies to population-scale datasets. Methods may include stochastic processes, latent variable models, stochastic differential equations and statistical methods.

A third direction is to develop statistical and machine learning methods to learn Ordinary Differential Equations (ODEs), Stochastic Differential Equations (SDEs), or Partial Differential Equations (PDEs) from noisy and/or sparse data, using diffusion models, kernel methods and neural ODEs.