DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING FRAME INFORMATION CALL 2022

PhD POSITION OFFER FORM

Position

1. Project Title/ Job Position title: **Mathematical Modeling with multidisciplinary applications**
2. Area of Knowledge: **Physical Sciences, Mathematics and Engineering**
3. Group of disciplines: **Theoretical and Applied Mathematics, Computer Sciences**
4. Research project/ Research Group description (max. 2.000 characters)

We offer two PhD thesis directions:

- Mathematical models for animal-to-human spillover events: assessing risks of new pandemics. Advisor: **Maíra Aguiar.**
Zoonotic spillover, which is the transmission of a pathogen from a vertebrate animal to a human, is a global public health concern. In this project, mathematical models to describe spillover dynamics of a disease will be developed. Evolutionary aspects of accidental pathogens such as virulence and transmissibility capacity will be investigated, and its implications for control of future emergent new pathogens. With an integrative research approach, this project will combine theoretical research with practice and policy. Understanding the dynamics of stochastic populations, and how they interact with the deterministic components of epidemiological models have maximum benefit on the practical predictability of the dynamical system by analyzing the available epidemiological data via mathematical models. The developed models will be analyzed using methods from dynamical systems theory and stochastic processes, covering applications in all fields related to public health epidemiology.

- A radical approach to Alzheimer's Disease via next-generation computational and experimental methods / PhD research project invitation towards a novel radical route in tackling Alzheimer's Disease. Advisor: **Serafim Rodrigues**.
A radical new path towards the study of Alzheimer's Disease (AD) is proposed, which builds upon compelling and independent lines of evidence that demonstrate that a family of microorganism are associated to AD; indeed, DNA of a family of microorganisms have been found in the brain of diseased AD patients. This has established the Infectious Hypothesis of AD. Moreover, $A\beta$ peptides released by neurons were previously thought to be the culprit of AD, however, we have established that it is in fact an anti-microbial peptide which attempts to fight microorganisms and when it fails it leads to AD! Thus, we aim to determine (for the first time) via advanced mathematical/computational methods the molecular mechanisms by which $A\beta$ inhibits infections and its weakness that leads to AD. This research direction provides tantalising hope for breakthrough preventive measures and development of drugs with high-therapeutic efficacy against AD.

1. Job position description (max. 2.000 characters)

- Mathematical models for animal-to-human spillover events: assessing risks of new pandemics We seek promising young researchers. Applicants must have their Bachelor's or Master degree preferable in Computer Science, Mathematics or Quantitative life Sciences field.

Skills and track-record:
- Good communication and interpersonal skills.
- Fluent in English (verbal and written).
- Programming in R.
- Programming in LaTeX.
- Programming in C, MatLab.
- Ability to clearly present and publish research outcomes in spoken (talks) and written (papers) form.
- Flexibility to work on different topics and participate in multiple activities carried out by the research team.

Scientific Profile:
- The preferred candidate will have:
- Strong background ordinary differential equations and probabilities/statistics.
- Information Technology Background.
- Knowledge of bio-statistics and experience in advanced programming are essential.
- Experience in the management of large databases is advantageous.

- A radical approach to Alzheimer's Disease via next-generation computational and experimental methods / PhD research project invitation towards a novel radical route in tackling Alzheimer's Disease The candidate will be supervised by Prof. Rodrigues (BCAM) and by Dr. Rodrigo A. Moreira da Silva (Institute of Fundamental Technological Research – Polish Academy of Science). The candidate will be based at BCAM, a world-class and a Severo Ochoa Excellence Centre in Applied Mathematics. The candidate is expected to have an MSc in either Mathematics, Physics, Computational Chemistry. It is desirable (but not expected) that the candidate is knowledgeable in Computational Physics. The envisaged project methodologies will involve, all-atom molecular dynamics simulations, multiscale modeling, topological and geometrical data analysis and possibly Machine-learning and big-data analysis. The candidate will be trained and will further develop specific methodologies. The candidate will interact with an international consortium including experimentalists, which will leverage the candidates learning curve and ensure career progression.

Group Leader
1. Title: Prof.
2. Full name: Elena Akhmatskaya
3. Email: eakhmatskaya@bcamath.org
4. Research project/ Research Group website (Url): http://www.bcamath.org/en/research/lines/area/M3A
5. Website description: BCAM website with all the information on the group

Additional website (optional, max. 5 websites)

- Modelling and Simulation In Life And Material Sciences:
  http://www.bcamath.org/en/research/lines/MSLMS
- Mathematical and Theoretical Biology:
  http://www.bcamath.org/en/research/lines/MMB
- Mathematical, Computational And Experimental Neuroscience:
  http://www.bcamath.org/en/research/lines/MCEN

INPhINIT Offer, eligibility requirements, evaluation and selection process

Incoming:
https://fundacionlacaixa.org/es/becas-doctorado-inphinit-incoming

Retaining:
https://fundacionlacaixa.org/es/becas-doctorado-inphinit-retaining

How to Apply:

1. Click in https://hosts.lacaixafellowships.org/finder, click in RESEARCH CENTRE and choose
   "Basque Center for Applied Mathematics - BCAM"
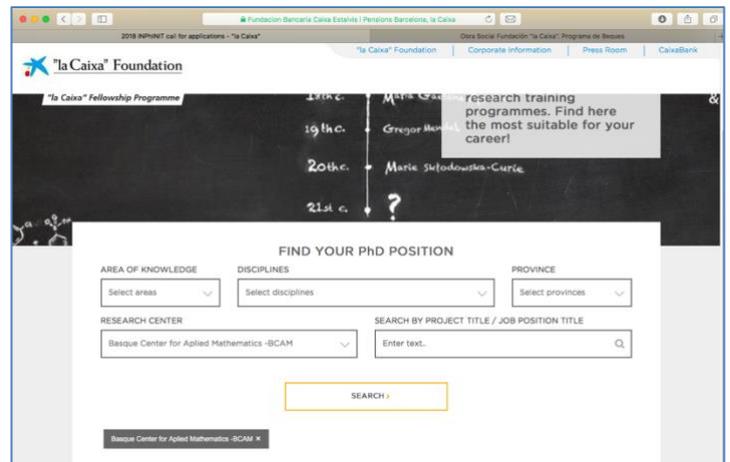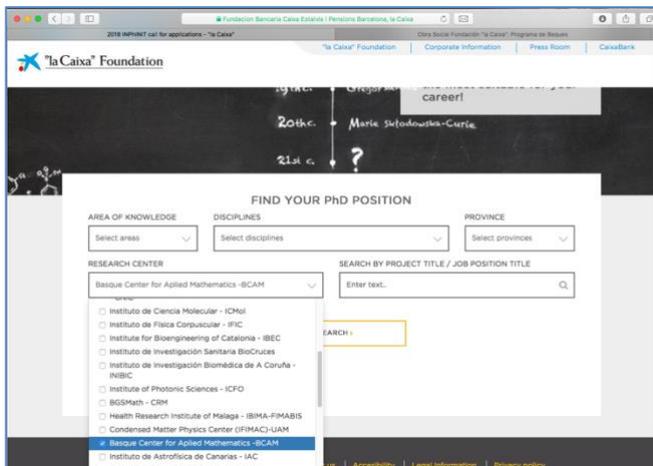
2. Click in "SEARCH" and the displayable will list the positions offered
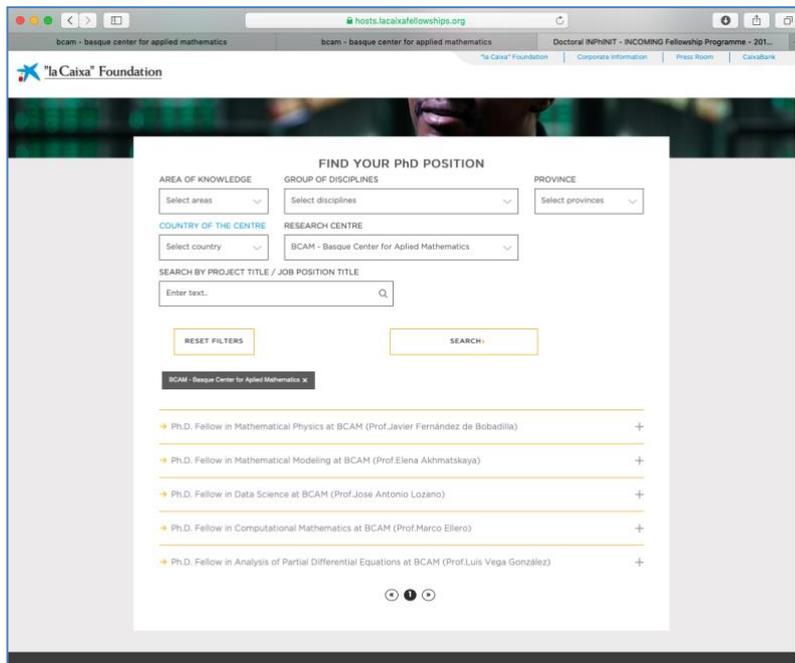
3. Click in the selected PhD Offer and click in "START THE APPLICATION"
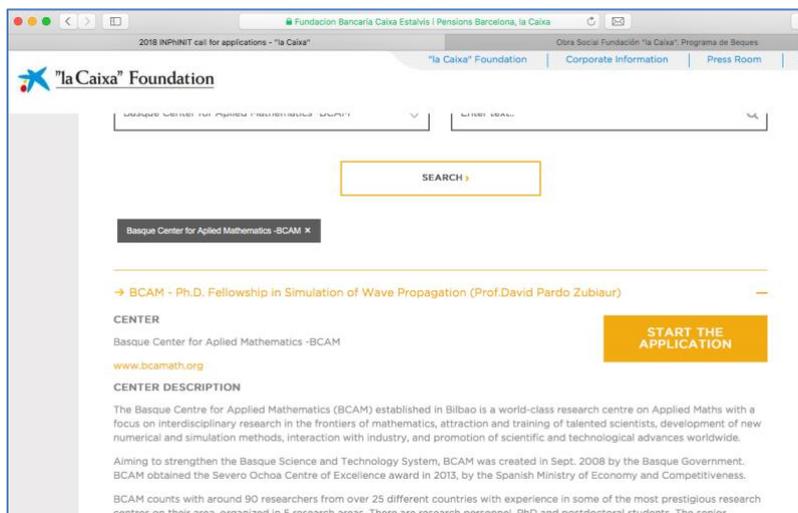
4. The system will open a new window with the application website https://www.lacaixafellowships.org/index.aspx. Click in "Please register" for new

applicants.
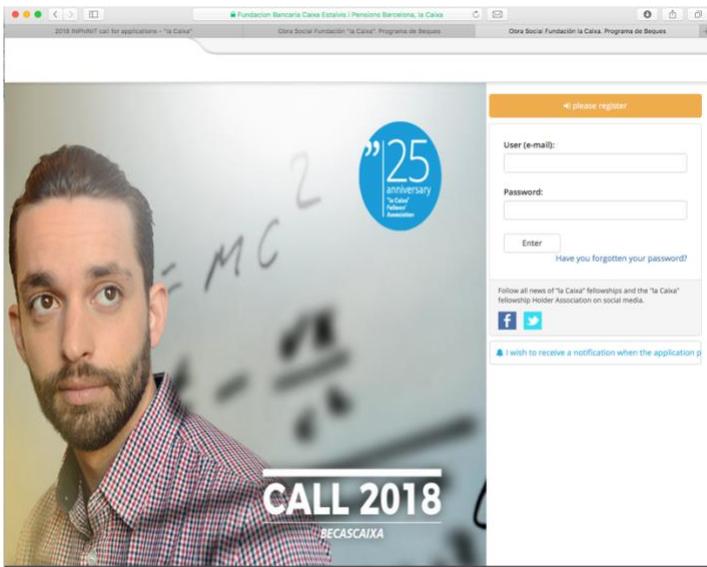
5. After the registration, the system will send to you the confirmation email and the link to access into the system. Now you are in the position to access into the application system. Please choose INPhINIT: Doctorate in Spanish Research Centre of Excellence.
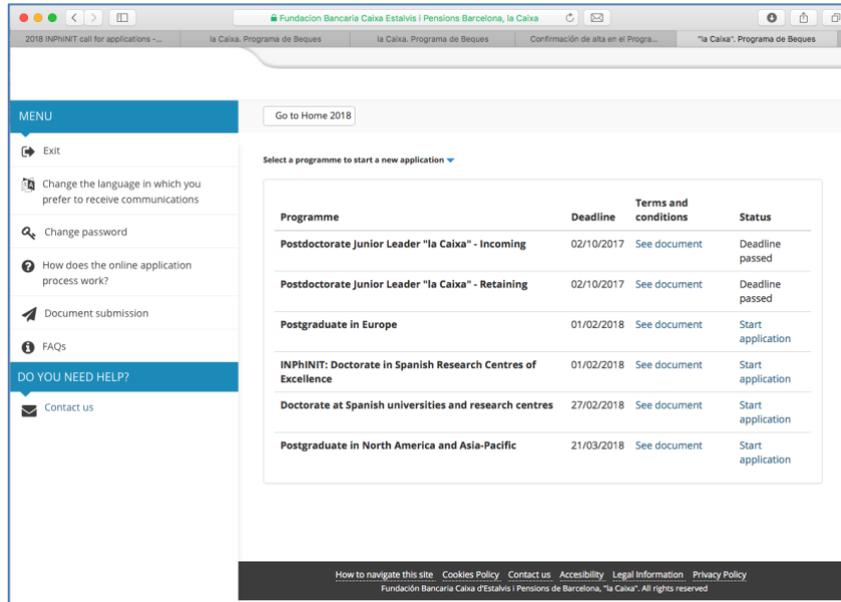
6. Now you are in the position to fill the application form, upload the required documents and choose the project thesis. To choose the project thesis, click in "Studies to be Pursued", choose the centre and the position.