PhD position offer in the research project GRIEG

Interaction of natural killer cells with an infected cancer cell population: microfluidics-based experiments and single-cell-level mathematical modeling

(*Oddziaływanie komórek NK z populacją zainfekowanych komórek rakowych: eksperymenty w urządzeniach mikroprzepływowych i modelowanie matematyczne na poziomie pojedynczych komórek)*

funded from the Norway and EEA Grants 2014-2021 under the Basic Research Programme operated by the National Science Centre (Poland).

Information about the project and stipend

Principal Investigator: prof. Tomasz Lipniacki http://pmbm.ippt.pan.pl
Project duration: 36 months
Institution: Institute of Fundamental Technological Research, Polish Academy of Sciences
The project will be conducted in cooperation with the Norwegian Institute SINTEF in Trondheim.

We offer 5000 PLN/month stipend for 36 months. Some additional support can be obtained from the doctoral school such as TIB PAN http://ibib.waw.pl/en/doctoral-schools/tib-pan.

Approximate starting date Sep – Oct, 2020.

PROJECT OBJECTIVES

The aim of the project is to analyze interactions of natural killer (NK) cells with a virus infected cell population at the single-cell resolution. Specifically, we will investigate the interactions of NK cells, two respiratory epithelial cell lines: cancerous A549 and non-cancerous BEAS-2B, and two respiratory viruses: respiratory syncytial virus (RSV) and influenza A virus (IAV). The main objectives are as follows:

- Elucidation of the impact of NK cell-induced cell death on the dynamics of propagation and eradication of RSV and IAV infections. Characterization of distinct levels of NK cells' activity towards the infected and the noninfected subpopulation of the cell culture.
- Determination of the capacity of NK cells to induce immunogenic cell death in infected cells.
- Development of a droplet-based microfluidic system to perform experiments on co-cultures of adherent and suspended cells, that will enable data acquisition at the single-cell resolution.
- Development of an agent-based, spatial stochastic model capturing interactions of NK cells with an infected cell population.

TECHNIQUES

We will integrate the following techniques:

- Live confocal imaging using viruses encoding fluorescent proteins, cells expressing fluorescently tagged transcription factors and fluorescent markers of apoptosis.

- Immunostaining scanning. In this technique we simultaneously observe different triplets or quadruplets of proteins of a considered regulatory pathway in single cells. We will also use RNA FISH and the emerging technique of sequential immunostaining.
- Gene expression, protein analysis and cytokine production in infected cell populations through the use of RT-PCR, digital PCR, Western Blot. ELISA and other relevant techniques

- Droplet-based microfluidic systems to culture adherent and suspended cells allowing for their confocal imaging and immunostaining.

- Mathematical modeling employing Markov processes to describe virus replication, intra- and intercellular signaling, NK cells activation, eradication of infected (and non-infected) cells in heterogeneous cell populations. We will account for spatial aspects of the cytokine diffusion and viral spread.

Requirements for candidate

The recruitment will follows the rules of the National Science Center (Poland) given in

https://www.ncn.gov.pl/sites/default/files/pliki/uchwaly-rady/uchwala68_2019_grieg_ang.pdf

and https://ncn.gov.pl/dioscuri/dioscuri3/ncn_scholarships_regulations_25_2019.pdf

According to National Science Centre regulations candidate must became a 'participant in a doctoral program' or a 'doctoral candidate at a doctoral school', such as TIB PAN
http://ibib.waw.pl/en/doctoral-schools/tib-pan

Candidate should meet criteria given in
https://www.ncn.gov.pl/sites/default/files/pliki/regulaminy/grieg_guide_for_applicants.pdf

We seek candidates having basic experience in one or two of the following areas:

1. Immunology, virology or cancer cell biology, with basic knowledge in experimental techniques: cell culture, RT or digital PCR, Western blot, live and fixed-cell confocal imaging, cell sorting. Experience in other methods planned for the project and described above is desirable.

2. Mathematical and numerical system biology, ordinary and partial differential equations, stochastic processes, programming.

3. Microfluidic fabrication and droplet microfluidic techniques.

Background in two of above areas will be considered an additional benefit.

Required documents
1. Copy of MSc diploma. Bachelor diplomas may be also included for evaluation.
2. CV containing information about:

Publications,
Conference presentations,

Prizes and stipends,

As well as other information that can help to evaluate, experience, achievements, and scientific standing of the candidate.

Please include in your CV the following clause: "I agree to the processing of personal data contained in my job offer for the needs necessary to carry out the recruitment process conducted by IPPT PAN with headquarters in Warsaw, ul. A. Pawińskiego 5B, according to art. 13 para. 1 and 2 of Regulation (EU) 2016/679 of the Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and the free movement of such data and the repeal of Directive 95/46 / EC (RODO).

The documents should be sent till **August 15, 2020** to the Project PI, prof. Tomasz Lipniacki tlipnia@ippt.pan.pl with a copy to Department Secretary Ms. Agnieszka Ponarska aponar@ippt.pan.pl. If needed the candidates will be contacted and invited for the interview. The final decisions will be taken before Oct 1, 2020