

Doctoral School of Information and Biomedical Technologies
Polish Academy of Sciences
(TIB PAN)

Subject: Regulated cell death modes in viral infections

Discipline: biomedical engineering

Supervisor: prof. dr hab. Tomasz Lipniacki

Description: Infected cells employ various strategies to limit viral spread. After detecting the virus, cells can secrete interferons to inform neighboring cells about infection, giving them time to prepare. They may attempt to digest viral material through autophagy or sacrifice themselves, triggering apoptosis or so-called inflammatory cell death such as pyroptosis or necroptosis – both associated with cell membrane rupture. Cell death can also be triggered by natural killer (NK) cells, which recognize and eliminate infected or cancer cells. Viruses often employ their nonstructural proteins to oppose autophagy and apoptosis and have acquired the capability to hijack and subvert these processes for their benefit. The complex interactions between the host cell and the virus may eventually lead to inflammatory cell death.

Inflammatory modes of cell death have become relatively well understood in isolation, however, their mutual interactions and interactions with apoptosis, which ultimately dictate cell fate, are not sufficiently understood. The distinction between death types is essential as inflammatory death pathways have an immunogenic potential and may trigger effective adaptive immune responses, but also harmful systemic inflammation.

In the project, we will use two respiratory viruses, RSV and Influenza A, and a panel of human respiratory epithelial cells to investigate the virus–host cell and NK cell–infected cell interactions that lead to divergent types of cell deaths: non-inflammatory and inflammatory. The aim is to elucidate crosstalk between apoptosis and inflammatory pathways both at the single-cell level. We will investigate what factors determine cell fate decisions and dictate the proportion of cells exhibiting a given death type. We will also verify whether the mentioned deaths are executed exclusively or whether a single cell may exhibit a combination of apoptosis and immunogenic death pathways.

The PhD candidate should have a biological background and some laboratory experience. Programming skills will be beneficial. The PhD project will be based on combination of laboratory work with data analysis.