



Research Trip Summary Report

Task 2. Foreign mobility of WUST doctoral students

I. Data of the doctoral student

1. Full name: ..Jakub Wojciechowski.....
2. Year of studies:3.....
3. Educational discipline:Biomedical Engineering.....

II. Foreign research trip (research visit)

1. Research institute in which the foreign research was implemented: ...Max Planck Institute for Interdisciplinary Sciences (Formerly Max Planck Institute for Biophysical Chemistry)
2. Name and surname of the host person (mentor): ...Dr. Johannes Soeding.....
3. Dates of the research trip:14.03.2022 - 14.04.2022.....
4. Title and date of a seminar delivered during the research trip: ...22.03.2022, "Gut ideas - The search for functional amyloids in human gut proteome"
5. Description of work carried out during the research trip:

The human gut microbiome composition can be directly related to the occurrence of severe diseases including amyloid related ones such as Parkinson's and Alzheimer's diseases or type II diabetes. Several possible mechanisms were proposed to explain this phenomenon including cross-interactions between microbial functional amyloids and human proteins. Unfortunately, despite two decades of study of functional amyloids from microorganisms only a small fraction of them were extensively studied.

The aim of this was to identify functional amyloids from the human microbiome assess possible interactions of newly identified functional amyloids with human proteins.

We have compiled the list of known functional amyloids from microorganisms, and analyzed their pairwise similarity as well as the presence of common sequential motifs. Then we have used it to search Unified Human Gut Proteome for homologs to identify potential functional amyloid candidates. First, we have searched for primary homologs using MMseqs2 software developed by Dr.



Soeding group, and used this data to build Hidden Markov Model profiles for each protein family and used them for more detailed searches. This procedure generated large dataset of protein sequences which likely consisted some false positive results. We performed clustering and made protein similarity networks to assess the presence of groups of similar proteins. We performed functional annotation of obtained proteins and predicted Gene Ontology terms for each sequence. Next we assess their most likely source organisms or taxa. Finally we have extracted potentially amyloidogenic regions from identified proteins.

6. Description of the main results obtained:

We have identified around 11 thousands homologs present in the human gut proteome. Unfortunately, most of them were poorly annotated and required additional functional annotation, which we have performed using EggNog mapper and Interproscan software. Among the others we have found terms directly related with amyloid fibers as well as with biofilm formation. We identified amyloid prone regions in homologs of 5 proteins; CsgA, CsgB, FapC, PSMbeta2 and Chaplin and putative amyloid regions in number of others which will be tested in the near future. Based on identified fragments from 5 homologs, common sequential motifs were found using meme software. Some of them were found in more than one family and one of them identified another protein family with amyloidogenic regions.

The visit allowed me to gather results for my doctoral dissertation and strengthen the collaboration with my second supervisor Dr Johannes Soeding. It was an opportunity to collaborate with a team which have great experience with development of high quality bioinformatic software.

7. Future collaborations (if applicable):

Identified amyloid regions will be then tested for potential cross-interactions with human amyloids associated with neurodegenerative diseases and type II diabetes using previously developed method PACT.

We are planning to expand the motif search combined with amyloidogenicity prediction to identify novel amyloid prone regions in the remaining homologs found in this study as well as build database of functional amyloid motifs.

8. Title and date of a seminar presenting the results of the trip delivered at Wrocław University of Science and Technology after returning from the research



trip: 24.05.2022 “Role of bacterial functional amyloids in type II diabetes and neurodegenerative diseases”

III. Doctoral student's signature

04.05.2022.....
(Date)
(doctoral student's signature)

IV. Confirmation and information from the host

1. Confirmation of compliance of the information contained in the report: I CONFIRM / DO NOT CONFIRM. *(In justified cases, the confirmation of the host may be sent by e-mail to the Dean's Office of the Doctoral School email: interdocschool@pwr.edu.pl)*

2. Additional information and comments

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(Date)
(signature(s) of Host)