

Personal information:

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Education and training:

Education:

- 2014-2016: Master in Genetics, Molecular Biology and Virology, specialization: Virology
Study programme: Biology
Institution: Faculty of Science, Charles University (Albertov 6, Praha 2, 128 43)
Passed with honors
Master thesis topic: Utilization of mouse polyomavirus derived virus-like particles for cargo delivery into cells (Supervisor: RNDr. Hana Spanielova, Ph.D.)
- 2011 – 2014: Bachelor in Molecular Biology and Biochemistry of Organisms
Study programme: Special Chemical and Biological programmes
Institution: Faculty of Science, Charles University (Albertov 6, Praha 2, 128 43)
Passed with honors
Bachelor thesis: Vesicular trafficking from acidic compartments to the endoplasmic reticulum (Supervisor: doc. RNDr. Jitka Forstova, CSc.)
- 2012-2014: Bachelor PLUS (Bakalar Plus) – interest life-long course for motivated and talented students
Institution: Faculty of Science, Charles University (Albertov 6, Praha 2, 128 43)
- 2002 – 2011: Secondary education with state school leaving exam
Institution: Gymnazium Cheb (Nerudova 7, Cheb, 350 02), 8 year study, general secondary school

Courses, summer schools and training:

- 2015: Semester-long exchange study programme based on university bilateral agreement
Faculty of Science, McGill University (James Administration Building, 845 Sherbrooke Street West, Montréal, Québec, Canada)
- 2013: Research Summer School Angers 2013 – “Intensive training for earlier exposure to research”

Faculty of Medicine, University of Angers (Rue Haute de Reculée, 49045 Angers
Cedex 01, France)

2013, 2014: Courses on www.edx.org:
7.00x Introduction to Biology – The Secret of Life (by Massachusetts Institute of
Technology)
CHEM181x Food for Thought (by McGill University)
BIOC372.1x Fundamentals of Immunology, Part 1 (by Rice University)

2011, 2010,
2009, 2008: Summer school LOS Běstvina (14 days intensive courses for best participants of
Biology Olympiad and Chemistry Olympiad in the Czech Republic)

2011: Preparatory Selection Intensive Course before 22nd International Biology Olympiad,
Faculty of Science, Charles University and Faculty of Science, University of South
Bohemia in České Budějovice

2011: Proteomic practical class, Faculty of Science, Charles University

Honors and awards:

2011: Central round of the Czech Republic of Biology Olympiad in category A: 6th place,
successful participant, first substitute for International Biology Olympiad 2011

2010: Central round of the Czech Republic of Biology Olympiad in category A: 13th place,
successful participant

Work experience:

2012 – 2016: scientific work in Laboratory of Virology (group leader: doc. RNDr. Jitka Forstová, CSc.),
Department of Genetics and Microbiology, Faculty of Science, Charles University

2011: practical work experience in Central Laboratory CHEVAK Cheb, a. s. Tršnická
4/11, 350 02 Cheb, Czech Republic (microbiological and chemical analysis of
fresh and wastewater)

Language skills:

Mother tongue: Czech language

English: Advanced skills
Internet based test iBT TOEFL score: 115, reading: 30, listening: 29,
speaking: 29, writing: 27
FCE (First Certificate in English)

French: Basic skills

Others skills:

- Job-related skills: Work in a laboratory: basic techniques (measuring weight, volume, pH, protein and DNA concentration using spectrophotometric methods), light and fluorescence microscopy, negative staining for electron microscopy, horizontal agarose electrophoresis, SDS PAGE, western blot, immunodetection of proteins, ELISA, work with eukaryotic cell lines and bacteria, isolation of virus and virus-like particles, DNA manipulation and isolation techniques, PCR
Use of bioinformatics tools for DNA and protein sequences.
- Communication skills: Team work (gained: practical laboratory courses, work in Laboratory of Virology).
Good communication skills in English (gained: exchange study programme McGill University 2015 and Research Summer School Angers 2013,)
- Organization skills: Time organization of work, thoroughness, responsibility (gained: practical laboratory courses, work in Laboratory of Virology)
- Computer skills: State exam from techniques of administration (computer writing “all ten fingers” and formal written communication)
Intermediate – advanced user of Microsoft Office programs and Internet
Basic skills in Adobe Photoshop and Adobe Illustrator
- Driving license: B

Additional information:

Bachelor theses: Vesicular trafficking from acidic compartments to the endoplasmic reticulum

- Year: 2014
- Key words: retrograde transport, endosome, GTPase, COPI, Shiga toxin, ricin, papillomavirus, polyomavirus
- Abstract: The cell uses retrograde transport from endosomes to Golgi apparatus and further to the endoplasmic reticulum to recycle its receptors and other proteins. There are several pathways starting on different types of endosomes aimed to the trans-Golgi network and from it further to the endoplasmic reticulum. From the early and maturing endosomes the proteins are transported using the retromer complex. Rab9 GTPase is essential for transport from the late endosomes. Rab6 and Rab11 play major role in the transport from the recycling endosomes. There are two pathways going through the Golgi apparatus. The first one is mediated by COPI vesicles which are regulated by Arf1 GTPase and the pathway is sensitive to brefeldin A. The second pathway is regulated by Rab6 GTPase.
Except for endogenous proteins the retrograde transport is used by protein toxins and small unenveloped DNA viruses as well. Rab6 pathway from the recycling endosomes and through the Golgi apparatus is characteristic for Shiga toxin. The retrograde transport of ricin starts on the early endosomes and is less clear. Scientists only started uncovering the transport of small unenveloped DNA viruses.

Master thesis: Utilization of mouse polyomavirus derived virus-like particles for cargo delivery into cells

Year: 2016

Key words: mouse polyomavirus, VLPs, endosome escape, cargo, delivery, histidine

Abstract: Mouse polyomavirus-derived virus-like particles composed from major capsid protein VP1 (MPyV VP1-VLPs) are interesting structures for use as a delivery system of various cargos into cells. VP1 protein self-assembles into icosahedral particles of 45 nm in diameter that are hollow highly regular nanoparticles.

In this work, model small molecule cargo, Cyclodextrin-Based Bimodal Fluorescence/MRI Contrast Agent, was encapsidated into MPyV VP1-VLPs. The cargo was stably associated with VLPs and was delivered into mammalian cells using these VLPs.

To prevent VLPs entrapment in endolysosomal compartments and increase the potential of VLPs applications, MPyV VP1 protein was modified by insertion of histidine-tag (6 histidine long sequence surrounded by glycine and serine) sequences into VP1 surface loop DE, because histidine modification of synthetic systems had enhancing effect on endosome escape and cargo delivery. With the use of in Bac-to-Bac® baculovirus expression system His-VP1 protein was expressed in insect cells and a variety of VP1-assemblies was obtained: long tubules and small 20nm VLPs formed from VP1 with 4 histidine-tags in DE loop, and novel VP1 nanostructure, which we named nano-jumpers, formed from VP1 with 2 histidine-tags. Nonetheless the endosome escape properties of His-VLPs and nanostructures were analysed and it was proved that histidine modification enhanced endosome escape of these structures.

Moreover, the effects of histidine-rich peptide (KH₂₇K) and known endosome disrupting agent polyethylenimine (PEI) were tested. KH₂₇K had similar effect on endosome disruption as PEI, which was detected using endocytosed fluorescent antibody. The effect of KH₂₇K and PEI on MPyV infectivity was also investigated. It was shown for the first time that endosome membrane disruption enhances MPyV infectivity.