Kratek opis usposabljanja mladega raziskovalca (*Short description of the Young Researcher's training)*

1. Raziskovalna organizacija (*Research organisation)*:

Univerza v Ljubljani, Fakulteta za elektrotehniko *(University of Ljubljana, Faculty of Electrical Engineering)*

2. Ime, priimek in elektronski naslov mentorja (*Mentor's name, surname and email*):

Peter Kramar, peter.kramar@fe.uni-lj.si

3. Šifra in naziv raziskovalnega področja (*Research field*):

2.06 –	Tehniške vede / Sistemi in kibernetika *(Engineering sciences and technologies / Systems and cybernetics)*

4. Kratek opis usposabljanja mladega raziskovalca (*Short description of the Young Researcher's training)*:

Navedite tudi morebitne druge zahteve, vezane na usposabljanje mladega raziskovalca (npr. znanje angleškega jezika, izkušnje z laboratorijskim delom, potrebne licence za usposabljanje…).

slo:
Usposabljanje bo potekalo v Laboratoriju za biokibernetiko Fakultete za elektrotehniko Univerze v Ljubljani, v okviru raziskovalnega programa »Elektroporacija v biologiji, biotehnologiji in medicini«.
Delo mladega raziskovalca bo usmerjeno v laboratorijsko okolje, kjer se bo izvajalo merjenje lastnosti ravninskih lipidnih dvoslojev ter identifikacijo in modeliranje kemičnih reakcij ob elektroporacij. Ravninski lipidni dvosloj je pomemben gradnik biološke celice. Zato je študij, vpliva električnega polja membrane različnih lipidnih molekul, izrednega pomena. Umetno zgrajen ravninski lipidni dvosloj obravnavamo kot koščck celične membrane, ki je električno dostopen z obeh strani. S tokovnim ali napetostnim vzbujanjem merimo odziv ravninskega lipidnega dvosloja v električnem polju kot je njegova kapacitivnost, prevodnost ter porušitvena napetost. Vzporedno lahko s simulacijami molekularne dinamike opazujemo dogodke, ki jih v laboratorijskem eksperimentu ne moremo.
Med elektroporacijo pride tudi do nekaterih kemičnih reakcij, npr. (per)oksidacija lipidnih molekul, in pa zaradi samega dovajanja pulzov na stiku elektroda-elektrolit ter posledično sprememb, do katerih lahko pride v elektrolitu/biološkem tkivu (npr. spremembe pH, prevodnosti), kar pa lahko vpliva tako na molekule, ki jih vnašamo v celico (npr. protonacija pDNA), kot tudi na permeabilizacijo in zaceljenje celične membrane in preživetje celic.

Od kandidata se pričakuje osnovno znanje elektrotehnike z razumevanjem električnih meritev in napredno znanje kemije. Raziskave bodo potekale v sodelovanju s tujimi partnerji, zato je potrebno znanje angleškega jezika.

eng:
The training will take place in the Laboratory of biocybernetics, Faculty of Electrical Engineering, University of Ljubljana under the Research programme "Electroporation-based technologies and treatments".
The workplace of the young researcher will be situated in vet lab where her/his task will be measuring properties of planar lipid bilayers as well as identification and modelling of chemical reactions due to electroporation. Planar lipid bilayers are important constituents of living cell. This fact provokes a serious interest towards the study of membranes and the influence of different lipid bilayer compositions on these properties. Artificially built planar lipid bilayer is considered as a small fraction of total cell membrane, it represents the simplest model for experimental studies of membrane properties; especially because it is accessible from both sides. Planar lipid bilayer is especially suitable for experiments that apply electric voltage or current to the membrane and measure its electrical and mechanical response. Behaviour of planar lipid bilayers in electric field can be studied using Molecular Dynamic Simulation to explain the events that experimentally cannot be observed.
During electroporation, chemical reactions might appear such as (per)oxidation of lipid molecules and electrode-electrolyte interface due to the pulse application. Following changes of electrolyte properties hence biological tissue (*e.g.* pH and conductance changes) can affect on molecules introduced to the cell (*e.g.* protonation of pDNA) as well as permeabilization and resealing of the cell membrane and its survival.

Thus request from the young researcher to have the basic knowledges of Electrical Engineering, with understanding of measurement principles, and advanced knowledge of chemistry. Research work will request collaboration with partners' abroad therefore English proficiency is necessary.