IPPS International Seminar on "Bioelectrics" No. 47

Date : **March 8, 2019 (Fri.) 13:30-16:00**

Venue: **Honjo Campus, Kumamoto University**
IMEG 1F Conference Room
http://www.imeg.kumamoto-u.ac.jp/access/

Scope **Bioelectrics refers to the use of pulsed power, powerful pulsed electromagnetic field for extremely short periods of time, non-thermal plasmas in gases or liquids, shock waves, to give new physical stresses to biological cells, tissues and/or organisms as well as bacteria. Bioelectrics is opening up new biotechnologies, e.g., manipulation of biological cells, tissues and organisms for medical treatment, tissue healing, sterilization applications, etc. This seminar provides an opportunity to share the new trends in cutting edge pulsed power technologies for biotechnology, medical treatment, drug and gene delivery, which are introduced by three distinguished Professors.**

Program

13:30 **Opening Address**: Prof. Sunao Katsuki (IPPS)

Chair: Prof. Hamid Hosano (IPPS)

13:35 **"The Use of Reversible Electroporation for Drug and Gene Therapy: Current Status and Perspectives"**
Prof. Maja Cemazar
(Institute of Oncology Ljubljana, Slovenia)


Prof. Cemazar

14:15 **"Electropermeabilization: Physics for Biology"**
Prof. Marie-Pierre Rols
(IPBS, University of Toulouse, CNRS, France)


Prof. Rols

14:55 **"Reversible Cell Membrane Manipulation: Current Trends and Future Prospective"**
Dr. Nushin Hosano
(IPPS, Kumamoto University)


Dr. N. Hosano

15:35 **Discussion**

Organized by Institute of Pulsed Power Science (IPPS), Kumamoto University
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ABSTRACTs

"The use of reversible electroporation for drug and gene therapy: Current status and perspectives"

Prof. Maja Cemazar
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Reversible electroporation is used for drug or gene delivery and is being utilized predominantly for treatment of cancer. However, its potential use is also in treatment of other diseases, especially for vaccination. When electroporation is used for enhanced drug delivery, it is called electrochemotherapy, which is well established local ablative technique, where the use of antitumor chemotherapeutic drug bleomycin dominates. On the other hand, electroporation with cisplatin is well established as well, and could have better potential that electrochemotherapy with bleomycin, due its better elicitation of immune response. Similar was shown also for calcium electroporation. The perspective is their combination with immunomodulatory cytokines that are produced locally at the tumor site. After in situ tumor vaccination with electrochemotherapy these cytokines delivered to tumors or skin by gene electrotransfer, is especially interesting, since it exploits the same delivery system i.e. electroporation, and the drug and the plasmid DNA could be delivered to tumors at the same time. Preliminary results in preclinical rodent tumor models and tumors in client-owned dogs show very promising response.

"Electropermeabilization: Physics for Biology"

Prof. Marie-Pierre Rols
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Cell membranes can be transiently permeabilized by application of electric pulses. This process, called electropermeabilization or electroporation, allows molecules such as anticancer drugs and nucleic acids to enter into cells and tissues. The knowledge of the mechanisms is mandatory for the method to be used. Their description takes benefit from studies performed on lipid vesicles, 2D and 3D cells culture. Single cell imaging experiments revealed that the uptake of molecules takes place in well-defined membrane regions. Small molecules can freely cross the electropermeabilised membrane. Heavier molecules, such as plasmid DNA, face physical barriers which engender a complex mechanism of transport.

"Reversible cell membrane manipulation: Current trends and future prospective"

Dr. Nushin Hosano
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Manipulating the cell membrane for therapeutic applications has been one of the greatest challenges in biotechnology. Despite decades of worldwide research, it has seen only limited success rate. Today, there is an urgent need to develop novel molecular delivery techniques with high transfection rates that have low-cost and avoid development of resistance mechanisms. Among different stimuli (biological, chemical, or physical), physical stresses, which are of crucial importance for the development and maintenance of our cells, have been well studied. Mechanical forces can directly open the cell membrane besides their ability to induce differentiation by targeting the activity and expression of enzymes involved in gene expression. Among different techniques, non-invasive approach of low intensity ultrasound (US) compare favorably with the other physical methods for gene/drug transformation. Ability to focus US in soft tissue gives an enormous advantage to US for clinical therapy. Low intensity US combined with micro/nano bubbles can temporally increase the cell membrane permeability without cell killing. Recent progress in micromanipulation of cell membrane by oscillating micro/nano bubbles provides exciting possibilities for localized/adjustable DNA/drug delivery for variety of biological targets.