2019 International Symposium on Interdisciplinary Pulsed Power

Date : **March 8, 2019 (Fri.) 9:00-12:05**

Venue: **Kurokami South Campus, Kumamoto University**
Kurokami South W3 Bldg. 2F, Lecture Room 203
http://ewww.kumamoto-u.ac.jp/en/about/access/campus/

Scope **In recent years, merits of extremely energetic states or extremely non-equilibrium states produced by pulsed power technology have been appreciated scientifically, as a result, their applications are expanding in various directions. This symposium provides an opportunity to share the new trends in cutting edge pulsed power technologies for biotechnology and biomedical treatment, from the basics to the applications, which are presented by four world's distinguished Professors.**

Program

9:00 **Opening Address: Prof. Hokamoto** (IPPS, Kumamoto Univ.)

Session I Chair: Prof. Hamid Hosano (IPPS)

9:05 **Prof. Marie-Pierre Rols** (Univ. of Toulouse, CNRS, France)
"Electropermeabilization: Physics for Biology"


Prof. Rols

9:50 **Prof. Gregor Sersa** (Inst. of Oncology Ljubljana, Slovenia)
"Biomedical Application of Electroporation: From Preclinical Research to Clinical Practice"


Prof. Sersa

- Break -

Session II Chair: Prof. Sunao Katsuki (IPPS)

10:50 **Prof. Ken-ichi Yano** (IPPS, Kumamoto University)
"Activation of Immune Cells by Nanosecond Pulsed Electric Fields"


Prof. Yano

11:20 **Prof. A.J.M. Pemen**
(Eindhoven University of Technology, The Netherlands)
"Pulsed Power for Bioelectrics and Environmental Applications"


Prof. Pemen

12:05 **Closing**

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

"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.

"Biomedical application of electroporation: From preclinical research to clinical practice"

Prof. Gregor Sersa
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Electroporation based biomedical applications are versatile. Irreversible electroporation exploits irreversible cell damage due to the electroporation of cells. However, reversible electroporation, does not cause cell death, they recover after electroporation, but it enables drug or gene delivery to cells due to the increased cell membrane permeability. Electrochemotherapy is the most advanced clinically approved therapeutic approach that utilizes electroporation for the intracellular cytotoxic drug delivery to cells. This local ablative technique is used in 140 cancer centers throughout the Europe for the treatment of various histiotypes of cutaneous tumors, and is currently translated also into the treatment of deep seated tumors. Another application of reversible electroporation is used for naked DNA delivery to cells. This form of gene therapy is called electrogene therapy. Its applications for treatment of cancer are in the early beginnings, in the phase of clinical trials. Especially intriguing is its application in combination with electrochemotherapy, where adjuvant electrogene therapy with immunomodulatory IL-12 cytokine to electrochemotherapy could transform local electrochemotherapy to locoregional or systemic therapy.

"Activation of Immune Cells by Nanosecond Pulsed Electric Fields"

Prof. Ken-ichi Yano
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Nanosecond pulsed electric fields (nsPEFs) have attracted considerable attention as a novel physical means for life sciences. In this study, we explored the potential of nsPEFs to stimulate specific cellular activities. Using neutrophil-differentiated HL-60 cells, we demonstrated that nsPEFs induce the formation of neutrophil extracellular traps, a neutrophil-specific immune response.

"Pulsed power for bioelectrics and environmental applications"

Prof. A.J.M. Pemen
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In this contribution we present methods flexible, fast rise-time (<200 ps), nanosecond high-voltage pulse generation. We focus on the general concepts involved in the design of this pulse source, with special attention to the basic underlying principles and the key characteristics that make it operate. Furthermore, we will discuss a method for the contactless delivery of pulsed electric fields in bioelectrics applications.