Biography: Nobuhiro Ohta was born in Japan in 1950. He graduated from Tohoku University in Sendai in 1972 and received his Ph. D. degree in 1977 from the same University. After working as a postdoc at Marquette University in Milwaukee, he was appointed as a research assistant at Research Institute of Applied Electricity at Hokkaido University in 1978, Associate Professor at the Faculty of Engineering in 1992, and full Professor at Research Institute for Electronic Science (RIES) in 1998, and Specially Appointed Professor at RIES in 2013. Since 2015, he is Professor Emeritus at Hokkaido University and Chair Professor at Department of Applied Chemistry and Institute of Molecular Science at National Chiao Tung University, Taiwan. He has received Moniro Foundation Award (1992), The Japan Photochemistry Association Award (1997), The Chemical Society of Japan Award for Creative Work (2001), The Japan Photochemistry Association Lectureship Award (2012), The Spectroscopical Society of Japan Award (2014), The Japan Society of Molecular Science Award (2014) and The Fellow of The Chemical Society of Japan (2016). His current research interest is in electric field effects on structure, dynamics and function of photoexcited molecules and molecular systems, including molecular conductors, ionic conductors and live cells, i.e., in the new field of "*Photoelectrics*" and "*Photobioelectrics*".

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“Photoelectrics” and “Photobioelectrics”

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Structure and dynamics of photoexcited molecules and molecular systems are influenced by application of electric field, which can be detected by measuring the electric field effects on absorption and emission spectra and emission decays. Along with the change in molecular photoexcitation dynamics, novel property and/or novel function may be generated by application of electric field and photoirradiation. The research field in which a combination of photoirradiation and electric field is applied to create new functions in materials and in biological systems may be called as “*Photoelectrics*” and “*Photobioelectrics*”. In fact, we have demonstrated the presence of field-induced switching of electrical conductivity enhanced by photoirradiation, based on time-resolved photocurrent experiments of organic charge-transfer salts using short laser pulse excitation.[1]

We have also demonstrated that the biological function can be significantly affected by application of short pulsed electric field. When the electric field having a pulse-width large enough is applied to biological systems, the voltage across the membrane becomes very large and results in the breakdown of the cell membrane and the production of holes on the cell surface. This behavior is well known as electroporation, which can be used for drug delivery or gene delivery. When the pulse-width of the applied electric field is small enough, in comparison to the charging time, the voltage across the membrane is negligible, resulting in the deep penetration of the applied electric field into intracellular organelles. In fact, we can show the nanosecond pulsed electric field effect on intracellular function, i.e., field-induced apoptosis, based on the fluorescence lifetime microscopy (FLIM), as shown in the figure.[2]

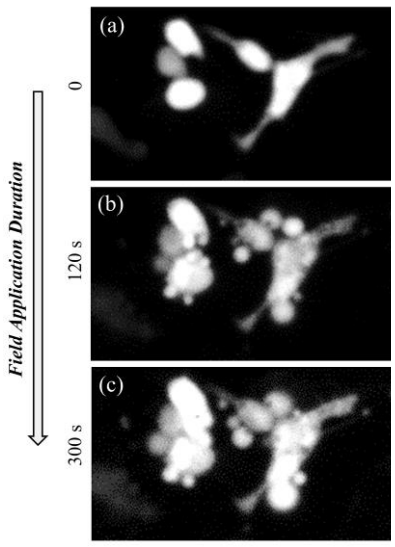

Fig.1 Fluorescence intensity images of HeLa cells, which show the apoptosis induced by nanosecond pulsed electric fields.

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