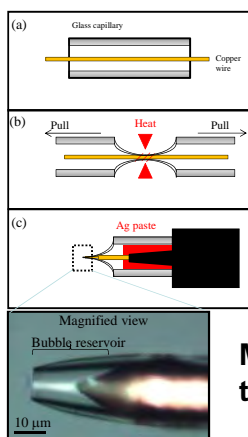


## 1. Abstract

Ablation and injection was successfully operated by using electrically-induced micro-bubble knife for biomedical applications. The novelties of the technique are:

- (1) Mono-dispersed directional micro-bubbles attack on a cytomembrane and penetrate into it which enables ablation,
- (2) The reagent is successfully introduced to the interface of the bubble surface. The technique has advantages over the conventional technologies in terms of localization of ablation and injection sites and also ability of material transportation.

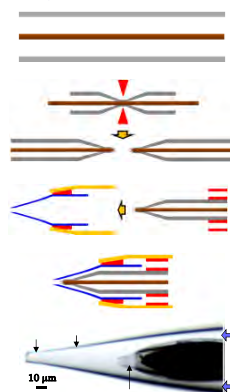
## 2. Bubble knife



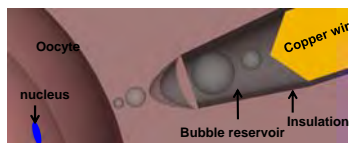
Fabrication of electrically-induced **bubble knife**

Magnified view around the tip of the knife

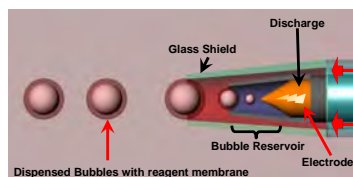
## 3. Injection bubble knife



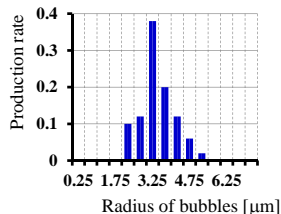
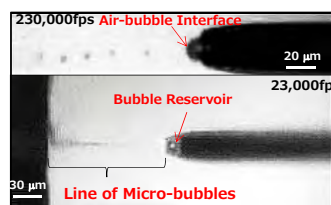
Fabrication method to produce **injection bubble knife**



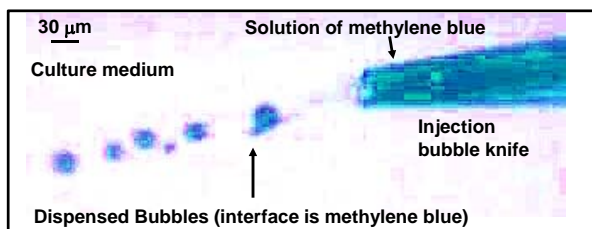
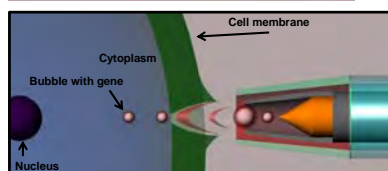
Conceptual diagram of the electrically-induced bubble knife and processing of cell



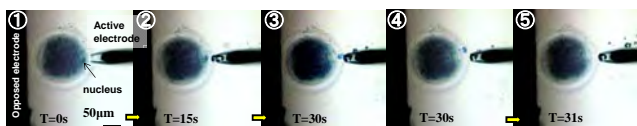
Conceptual diagram of the micro-bubble knife for injection (upper) and injection mechanism (lower).



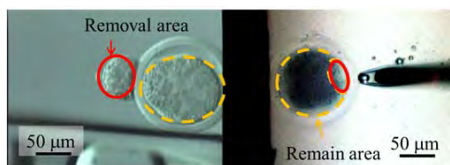
Photographs of mono-dispersed directional bubbles and the size distribution of bubbles



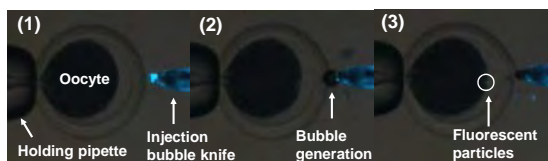
A photo of dispensed reagent-laden bubbles in the culture medium and its transportation in liquid phase without diffusion



Enucleation of oocyte by using bubble knife (nucleus is dyed by fluorescent dye)



Comparison of the removed area of bovine oocyte (left: conventional glass capillary, right: by using bubble knife)



Injection of fluorescent particles (diameter: 100 nm) into bovine oocyte.

## Patent Licensing Available

Patent No. : WO2013/129657

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