

Advances in injection and extraction to/from living cells with nanopipettes

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Abstract:

Nanopipettes have been used as a tool to connect macro-world to nano-world. They can be used to inject materials such as proteins and also can be used to extract ions, DNA and RNA to/from living cells. Moreover, nanopipettes can be used as a scanning probe for microscopy such as scanning ion conductance microscopy and scanning electrochemical microscopy.

In this journal club, I introduce a paper on a single-cell injection platform based on nanopipettes using scanning microscopy techniques to detect cell surfaces, and voltage pulses to deliver molecules into individual cells [1].

Then I introduce the other paper on single-cell nanobiopsy to extract minute amounts of total RNA and mitochondrial DNA from a single cell and to analyze the nucleic acids for the next generation genomic sequencing techniques [2].

Finally, I introduce a paper on a method to fabricate carbon nanoelectrodes whose radius can be precisely tuned within 5-200 nm, and the nanoelectrodes can be functionalized using established electrochemical methods [3].

The application of these techniques is by no mean limited to biological measurements and we can envision their application in the emerging field of nanoscale interfacial science.

References:

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3. Paolo Actis, Sergiy Tokar, Jan Clausmeyer, Babak Babakinejad, Sofya Mikhaleva, Renaud Cornut, Yasufumi Takahashi, Ainara López Córdoba, Pavel Novak, Andrew I. Shevchuck, Jennifer A. Dougan, Sergei G. Kazarian, Petr V. Gorelkin, Alexander S. Erofeev, Igor V. Yaminsky, Patrick R. Unwin, Wolfgang Schuhmann, David Klenerman, Dmitri A. Rusakov, Elena V. Sviderskaya, and Yuri E. Korchev, "Electrochemical Nanoprobes for Single-Cell Analysis", *ACS Nano* **8**, 875-884 (2014).