Multi-purpose Impedance-based Measurement System
to Automate Microinjection of Adherent Cells

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The paper presents a multi-purpose measurement system developed to automate cellular microinjection. The system is based on measuring impedance between an injection solution in an injection capillary and cell culture medium where cells grow. The developed system can be used for detecting (i) a contact between a cell and the injection capillary, (ii) a broken capillary, (iii) a clogged capillary, (iv) an aged measurement electrode and (v) faulty injection solution. The system facilitates the development of an expert system for guiding cellular injections.

The paper first describes a capillary pressure microinjection technique and provides background for the development of the impedance-based measurement system. Next, the micromanipulation system, the impedance-based measurement system and issues needed to be taken into account in their integration are discussed. The paper also describes cell injection experiments performed for collecting data and presents the analysis of the data to identify features in the measurement signal which can be used to detect various events in cellular microinjection.