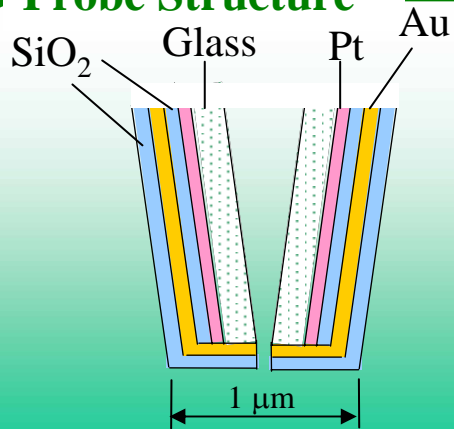


Measurement of Cellular Thermal Responses

Measurements of thermal responses in a biological micro-region, particularly a single cell, can provide new physiological information. Cellular heat productions with temperature changes are caused by reaction to certain physical or chemical stimulations. The aim of this study is to develop a micro-thermocouple probe based on a micropipette in order to measure the cellular thermal responses.

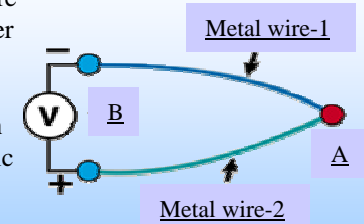
Probe Structure



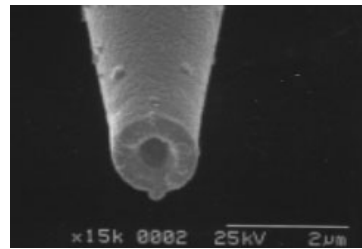
Using micro-fabrication techniques, Pt, SiO₂ as an insulating film, Au, and SiO₂ are deposited sequentially on a glass micropipette. The junction of Pt and Au is formed on the 1-μm-diameter tip, and thus the probe can be worked as a thermocouple.

What's a Thermocouple?

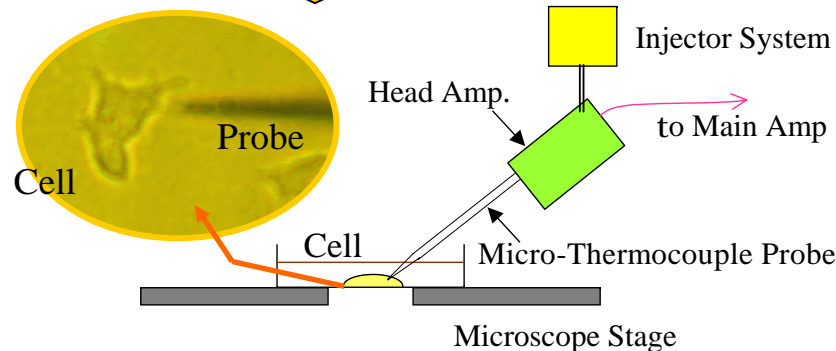
A thermocouple is constituted by pair of metals with their ends where one metal is in contact with another (point-A). Now, if the junction is heated (A) keeping the other cold (B), a voltmeter which is placed in the circuit shows the thermoelectric power generated in the circuit. Taking advantage of this phenomenon, called 'Seebeck effect,' temperature difference between A and B can be measured.



Measurement System



Scanning electron micrograph of the probe tip



The probe approaches to a cell using a micro-manipulation system. Since signals of cellular temperature changes are very small, they must be amplified. The probe based on a micropipette can also inject a substance into the cell. Therefore, the injection and the temperature measurement can be performed simultaneously.