Separation of neural stem cells by whole cell membrane capacitance using dielectrophoresis.

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Public Summary:
Whole cell membrane capacitance is an electrophysiological property of the plasma membrane that serves as a marker for stem cell fate potential, thus predicting what type of mature cells will be generated from stem cells. Neural stem and progenitor cells (NSPCs) that differ in ability to form neurons or astrocytes are distinguished by membrane capacitance measured by dielectrophoresis (DEP). Differences in membrane capacitance enable the enrichment of neuron- or astrocyte-forming cells by DEP, showing the separation of stem cells on the basis of fate potential by membrane capacitance. NSPCs sorted by DEP need not be labeled and do not experience toxic effects from the sorting procedure. Other stem cell populations also display shifts in membrane capacitance as cells differentiate to a particular fate, clarifying the value of sorting a variety of stem cell types by capacitance. Here, we describe methods developed by our lab for separating NSPCs on the basis of capacitance using several types of DEP microfluidic devices, providing basic information on the sorting procedure as well as specific advantages and disadvantages of each device.

Scientific Abstract:
Whole cell membrane capacitance is an electrophysiological property of the plasma membrane that serves as a biomarker for stem cell fate potential. Neural stem and progenitor cells (NSPCs) that differ in ability to form neurons or astrocytes are distinguished by membrane capacitance measured by dielectrophoresis (DEP). Differences in membrane capacitance are sufficient to enable the enrichment of neuron- or astrocyte-forming cells by DEP, showing the separation of stem cells on the basis of fate potential by membrane capacitance. NSPCs sorted by DEP need not be labeled and do not experience toxic effects from the sorting procedure. Other stem cell populations also display shifts in membrane capacitance as cells differentiate to a particular fate, clarifying the value of sorting a variety of stem cell types by capacitance. Here, we describe methods developed by our lab for separating NSPCs on the basis of capacitance using several types of DEP microfluidic devices, providing basic information on the sorting procedure as well as specific advantages and disadvantages of each device.