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Dear Sir or Madam:

Please find the attached invited manuscript, Micromanipulation of Chromosomes in Insect Spermatocytes, by Nicolas K.H. Lin, Ryder Nance, Jane Szybist, Alan Cheville, and Leocadia V. Paliulis. This is the first submission of this work to JoVE, and it is not currently under review by any other journal.

Micromanipulation of chromosomes has been a key method used in pivotal experiments that have illuminated the mechanism for chromosome congression, the spindle checkpoint, and anaphase chromosome movements. Using a small glass needle with a very fine tip, experimenters like Bruce Nicklas detached chromosomes from the spindle, applied forces to attached chromosomes, and repositioned chromosomes within the cell. Micromanipulation was key in revealing the role of tension in the spindle checkpoint (Li and Nicklas, 1995), in stabilizing chromosome attachments to the spindle (King and Nicklas, 2000) and also revealing the forces exerted on the chromosome during cell division (Nicklas, 1983).

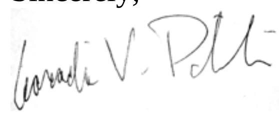
Micromanipulation experiments have been done by a small handful of biologist. One reason for this is that micromanipulators that move chromosomes well are rarely available in the marketplace. We have found that a joystick-controlled piezoelectric micromanipulator controls needle movement with no vibration, drift, or lag between joystick movement and needle movement. The micromanipulators designed by Ellis and Begg (Ellis, 1962; Ellis and Begg, 1981) were ideal for this purpose, but needed to be constructed by the experimenter or someone the experimenter consulted; and essentially required collaboration with engineers or a physics shop. Micromanipulators are currently commercially available and commonly used in electrophysiology, but none are readily useful for micromanipulation of chromosomes, as they often have problems with latency or lag in movement, or have controllers that are not able to accommodate movements required for moving chromosomes. Thus, scientists needed to build their own micromanipulators or modify a commercially available micromanipulator; a difficult and generally prohibitive task.

A group of undergraduate engineering students at Bucknell University, after learning from me about the problems described above, took on the task of constructing a micromanipulator using commercially-available components and 3-D printed parts. The micromanipulator has features not previously available, like adjustable sensitivity and a single joystick positioner for both coarse and fine movements. Plans are freely available via a website cited in our manuscript, and this has now allowed us to make demonstration of the technique available to researchers through JoVE.

While there has been a previously-published article on the technique of micromanipulation (Zhang and Nicklas, 1999), this new article features a new apparatus and approach, and will illustrate the technique much more clearly in video format. We think an article on micromanipulation will be of great interest to readers of JoVE. Micromanipulation experiments have great potential to reveal much more about the internal workings of the cell, and specifically about the movements of chromosomes. Micromanipulation can be combined with the use of small molecule inhibitors, or used in mutants to reveal key features of chromosome movements that have not previously been explored. We believe that this article will lead to some new and very exciting experiments.

Thank you for your consideration.

Sincerely,



Leocadia Paliulis
Associate Professor

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