

Massachusetts Institute of Technology  
Harvard-MIT Division of Health Sciences and Technology and  
Department of Electrical Engineering and Computer Science

HST.410J/6.07J

**Projects in Microscale Engineering for the Life Sciences**

**Homework Assignment #4**

Issued: March 6, 2007

Due: March 13, 2007

---

For this week's homework, please read the Rodriguez paper that is posted on our website (<http://umech.mit.edu/6.07J/index.php> in the Handouts section). Write short paragraphs addressing each of the following issues (which we will also discuss in class on March 8):

1. Discuss the strengths of the microchip counter for counting CD4 cells over previous techniques. What are its weaknesses? Is this technique a useful application of micro-scale engineering? Why or why not?
2. Does the microchip counter work as effectively as previous cytometry techniques mentioned by the authors? What evidence do the authors present to show that the microchip counter works effectively? Are you convinced by their arguments?
3. What aspects of the CD4 counting system could be improved in your opinion (e.g., the optical techniques used, the fluid delivery system, etc.)?
4. If the authors are correct in their assertion that this novel device may reduce costs of HIV monitoring by more than ten-fold, then is this microfluidics device going to have a dramatic impact in helping save lives in the fight against HIV/AIDS? Why or why not? What else needs to be done to get this device into widespread clinical use?
5. One concern in developing diagnostic tools is the rate of false-positives (the test returns a positive result although the patient is disease-free) and false-negatives (the test returns a negative result although the patient has the disease). If we take flow cytometry as the "gold standard", what are the rates of false-positives and false-negatives for this new technique? How would you establish a threshold CD4 count to maximize the effectiveness of treatment?