Term Project and Report (BioMEMS, Fall 2008)

- Work as a group of two on one of the topics listed below.
- **Presentation 1 (Nov. 25)** - Critical review of the paper assigned to the topic. Each group should prepare a 15-20 min presentation on your review of the assigned paper and allow 5 min for questions
- **Presentation 2 (Dec. 4)** - Review of the sate-of-art technologies related to the selected topic and present your new ideas, designs or applications. Each group should prepare a 20 min presentation on your review and allow 5 min for questions
- **Report (Dec. 11)** - The report should cover (i) the background, (ii) comprehensive review of the start-of-art technologies of the selected topic, (iii) your new ideas and designs, and (iv) discussions (including answering the questions assigned by the instructor). The length of the report is up to 15 pages (single spacing, 12 font size).
  - **Each student needs to submit her/his own report.**
  - **Report Format:** I decide not to use the standard NIH R21 format (due to the larger diversity on the scope of the topics) so that you have the flexibility in formatting your report.

Topics:

1. **Next-Generation DNA Sequencing**
   - Critical Review:
     "Genome sequencing in microfabricated high-density picolitre reactors"; Nature V.437; p.376 (2005)
   - Presentation 2: Review of the related technologies
     i. Pyrosequencing (Roche/454 Life Sciences: Genome Sequencer FLX)
     ii. Sequencing by synthesis (Illumina: Solexa)
     iii. Sequence by ligation (ABI: SOLiD)
     iv. Others
     v. Discuss your own ideas, such as new designs, modified designs, and/or new applications

2. **Droplet-based Digital Microfluidics**
   - Presentation 1: Critical Review of
     "Design of microfluidic channel geometries for the control of droplet volume, chemical concentration, and sorting"; LabChip, v4, p292 (2004)
   - Presentation 2: Review of the technologies for coalescence of droplets
     i. Decompressing emulsion droplets favors coalescence (PRL, v100, p024501 9; 2008)
     ii. Pillar-induced droplet merging (LOC, v8, p1837, 2008)
     iii. Others
     iv. Discuss your own ideas, such as new designs, modified designs, and/or new applications

3. **Isolation of circulating tumor cells (CTC)**
   - Presentation 1: Critical Review of
     "Isolation of rare circulating tumor cells in cancer patients by microchip technology": Nature, v450, p1235 (2007)
   - Presentation 2: Review of microfluidic cell sorting technologies
     i. Antibody-based
     ii. Size exclusion-based
     iii. Others
     iv. Discuss your own ideas, such as new designs, modified designs, and/or new applications

4. **Digital PCR**
   - Critical Review:
     (1) "Transcription factor profiling in individual hematopoietic progenitors by digital RT-PCR"; PNAS v.103; p.17807 (2006)
     (2)"Digital PCR" , PNAS, v96, p9236 (1999)
   - Presentation 2: Review of the related technologies
     i. Quake's valve based microfluidic digital PCR
     ii. BEAMing Technology

iii. Microfluidic droplet-based digital PCR
iv. Others
v. Discuss your own ideas, such as new designs, modified designs, and/or new applications