

The *ideal* MEMS curriculum

- **Actually, there are multiple curricula**
 - One course vs. multiple courses
- **One approach**
 - **1. General survey course (senior level)**
 - Multiple domains and fundamental physics therein
 - Surface science, cell bio, physics, engineering
 - Intuition of how scaling changes things
 - **2. Hands-on fabrication course**
 - **3. Advanced systems-level design course (grad)**
 - **4. Specialized courses at PhD level**
 - Fluid mechanics, Surface science, etc. for MEMS
 - **Modeling and simulation integrated throughout or as separate course**

Top 5 challenges/practices

- **Integrating Design into MEMS course**
 - Understand of limitations of fab, software
- **Integrating Labs/Foundry into courses**
 - **Challenges**
 - **Cost in terms of time & money**
 - How do you pay for it w/o using research funds
 - Students in fab are time-intensive
 - Course needs to *keep* moving
 - **Practices**
 - **Students do design, TAs do fab**
 - but students want hands-on experience
 - **Separate design and fab into two projects**
 - Design is unconstrained
 - Fab is already worked out

BioMEMS/Microfluidics

- **Microfluidics and BioMEMS only partially overlap**
- **Top challenges**
 - **Microfluidics:**
 - **Multiple length scales when dealing with many microfluidic domains**
 - **No compromise between microfluidics survey course and microfluidics science**
 - **BioMEMS**
 - **Huge pedagogical difference b/t biology and engineering science**
 - **Hypothesis-driven biology vs. engineering science**
 - **No governing equations for biology but systems/quantitative biology may have solution**
 - **Need BioMEMS textbook & homework problems**
 - **Gap of teaching engineers open biology problems and teaching biologists understanding of MEMS**
 - **Need standards for a bioMEMS curriculum**
 - **Needs to reach beyond EE, ME into school of science**

BioMEMS/Microfluidics

- **Top practices**
 - **Unify curriculum from biology side rather than device side**
 - **Genome → mRNA → cell → tissue → organism**
 - **Team-teaching with biologists**
 - **Workshop to combine both communities for teaching**
 - **Make engineers critically evaluate bioMEMS papers**
 - **Is Device an appropriate use of MEMS?**
 - **Stick to quantitative topics in BioMEMS**
 - **e.g., electrophoresis**
 - **but maybe give awareness of “other” issues**
 - **View microfluidics from scaling point of view**
 - **start at continuum and How to fix and eventually abandon N-S**