Lecture 8:
Introduction to BioMEMS: from historical background to current research

- p1
Genomics (genes) -> Post-genomics (DNA) -> Proteomics -> Cellomics

- p2
Bio-chip can be used for diagnosis, treatment, substituting insertion.

- p6
Gravitational force could not be used.

- p7
At pump, bubble control is the point.

- p11
Pressure generated by heat evaporation of inner fluid actuates the system. (very quick process)

- p16
Why elctro osmotic flow is more efficient?

1. Pressure drop is less than pressure-driven flow in micro-channel.
2. Velocity is linear function of potential.

- p25
Here is the system layout of Prof Goodson's project. We can see that the whole system was on one chip and there are several important components like the macro scale heat exchanger system. They are Micro channels in the evaporator region which sits on the chip, heat source; Condenser region and electrokinetic pump providing the driving force of the fluidic medium. Let's talk about the EK pump first. EK pump controls flow by electrical potential across a porous medium, which generates a force that induces the liquid to flow. The electroosmotic flow (EOF) is generated in the charge double layer that forms in the first few nanometers of the liquid/dielectric interface. Solvated ions move under the influence of an applied external field, carrying the bulk liquid by viscous drag. The electroosmotically-driven flow rate, QEOF, is directly proportional to the applied voltage and the zeta potential of the porous pump medium. The maximum

pressure generated, PMAX, is inversely proportional to the square of the pump medium's pore diameter. Therefore, by optimizing the pump medium's pore size and zeta potential, and controlling the applied voltage.

There is a company from Sandia lab research group focus on EK pump application. The animation can help us understand the physical phenomena behind that.