

LINKING ENGINEERING AND MEDICINE THROUGH THE CENTER FOR BIOMEDICAL MICROSYSTEMS

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Abstract *Biomedical microsystems (BioMEMS) integrate microscale sensors, actuators, microfluidics, micro-optics, and structural elements with computation, communications, and controls for application to medicine for the improvement of human health. Derived from the microfabrication technology used to make integrated circuits, BioMEMS is expected to revolutionize the way medicine is practiced and delivered. This talk presents an introductory overview of three exciting new opportunity areas of BioMEMS in medicine. These are surgical microsystems (intelligent micro-invasive surgical tools), diagnostic microsystems (biochips and related microinstrumentation), and therapeutic microsystems (health care management systems). Some representative examples based on work carried out at the University of Minnesota will be presented including 1) MEMS in precision surgery - ophthalmology, 2) MEMS in OBGYN - vitro fertilization, 3) MEMS in orthopedics - microarthroscope, 4) DNA amplifiers - microchip based PCR, 5) bioanalytical instrumentation - mass spectroscopy, 6) combinatorial chemistry - drug discovery arrays, and 7) autonomous therapy management systems micropumps and micro-needles for transdermal drug delivery.*

Index Terms *Biomedical Microelectromechanical Systems, piezoelectric devices, intelligent surgery, medical Microsystems.*

INTRODUCTION

The underlying theme of this talk is the highly multi-disciplinary nature of BioMEMS (engineering, science, and medicine) derived through creative research partnerships. Strategic collaborations and shared ownership of ideas among academia, industry, and health care providers creates a strong opportunity for bringing new technologies into the operating room, clinic, and home. This provides an exciting education and research environment for students at all levels. The case examples to be summarized in this talk point out a new model for academic-government-private partnerships needed for effective research in multi-disciplinary high-technology disciplines.

BioMEMS TECHNOLOGY

This talk will focus on successful applications in surgical, diagnostic, and therapeutic microsystems (see example in Fig. 1).

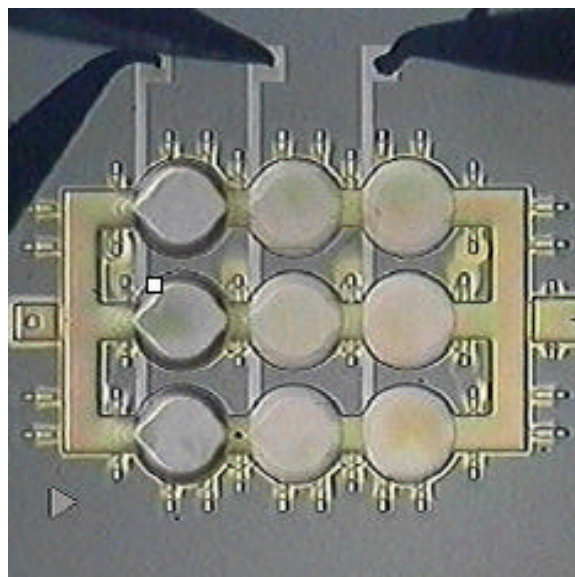


Fig. 1. Example of a BioMEMS – a three-stage peristaltic micromechanical pump used to drive liquids and gases. Each diaphragm measures 300 μm in diameter. This device has potential application in surgery (dispensing of contrast agents), bioanalysis (dispensing of reagents in lab-on-a chip applications), and therapy (drug delivery systems).

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