



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> <b>Benjamin C. Liu</b>	<b>Project Number</b> <b>J0508</b>
<b>Project Title</b> <b>A Home-Made Micro-fabricated Lab-on-a-Chip Device for Urinalysis</b>	
<b>Objectives/Goals</b> There are two goals for my project: 1) Develop an easy and inexpensive method to fabricate microscale devices (with feature size as small as 10 $\mu\text{m}$ ) at home. 2) Develop a homemade lab-on-a-chip device to fractionate urine sediment particles based on particle size difference and study particle morphology to conduct analysis on patients# urine samples.	
<b>Abstract</b> <b>Methods/Materials</b> The microchannel device was designed based on the principle of particle retention using microfilter structures with different pore sizes (10~100 $\mu\text{m}$ ) that sort and separate urine sediment particles based on size differences. As a urine sample flows through the channel, particles are separated by microfilter structures and sorted into different chambers. The purpose is to organize particles based on their size for easier and more accurate morphology analysis. The device, made of Polydimethylsiloxanes (PDMS), was fabricated at home using soft lithography and photolithographic techniques. Household appliances such as an oven and UV lamp were used during fabrication. Human urine samples were tested using my device under a microscope.	
<b>Results</b> A home-made fabrication method based on soft lithography was developed. The microchannel was designed using AutoCAD software to create a mask transparency. The mask was used to create a SU-8 mold using a UV lamp. PDMS microchannel devices were successfully fabricated using this mold in an oven. Microfilter structures as small as 10 $\mu\text{m}$ were created. Particles within the urine samples were trapped and sorted in different compartments of the microchannel by microfilters, resulting in better studies of the morphology of these particles, fewer misconceptions, and better analysis on patients# conditions. I was successful in sorting and separating various urine sediment particles (e.g. crystals, cells, casts, protein, and bacteria) based on their size difference, followed by morphology studies under a microscope in order to compare these particles in correlation to their patients# health condition.	
<b>Conclusions/Discussion</b> I discovered that it is possible to fabricate a cost-effective and efficient lab-on-a-chip device with 10 $\mu\text{m}$ features using household appliances. Using this method, I successfully designed, fabricated, and tested a microchannel device to sort and separate urine sediment particles based on particle size difference and study particle morphology for effective urinalysis.	
<b>Summary Statement</b> A homemade lab-on-a-chip device that fractionates urine sediment particles based on size differences and studies particle morphology was successfully developed for urinalysis.	
<b>Help Received</b> Father provided support and guidance. Used lab equipment at UC-Irvine under the supervision of Prof. Lee.	