

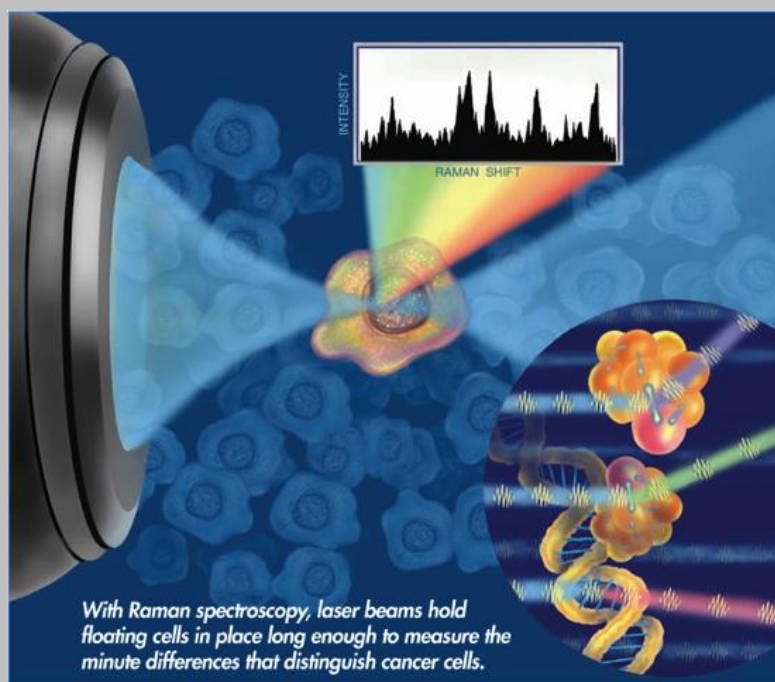
## Laser-focused on Curing Childhood Cancer

### KEATON RAPHAEL MEMORIAL FOUNDATION – PARTNERS IN RESEARCH

Since 2008, the Keaton Raphael Memorial Gift Fund has partnered with the NSF Center for Biophotonics Science and Technology (CBST) at UC Davis in support of fundamental research that promises to speed cancer diagnosis, improve treatment efficacy, and allow researchers a view of cancer at the sub-cellular level. CBST researchers are developing a breakthrough technology called Laser Tweezers Raman Spectroscopy (LTRS) that will allow clinicians, surgeons, and researchers to perform single live-cell analysis in order not only to diagnose and treat, but also to understand the mechanisms of cancer and its treatment. This partnership has already produced results that demonstrated that LTRS is able to discriminate between normal and leukemia cells in samples from pediatric patients.

### FUNDAMENTAL RESEARCH – THE PROMISE

A key advantage of the LTRS technology is that cells can be examined without the addition of fluorescent dyes, which are required in the current standard techniques. These dyes affect the structure of the cells being analyzed and may even kill the cells. The ability of LTRS to analyze **individual live cells** promises to give cancer researchers deeper insight into the fundamental mechanisms at work.



Raman scattering is the scattering of light off of the molecular bonds deep within a cell. As the incoming photons are scattered, they interact with the vibrational modes of the bonds, which changes their wavelength very slightly. By capturing the scattered photons with a high-resolution detector, these small wavelength shifts tell researchers about the chemical structure of the cell. The sensitivity of this technique allows for differentiation between cancerous and non-cancerous cells and very subtle changes in cell structure.

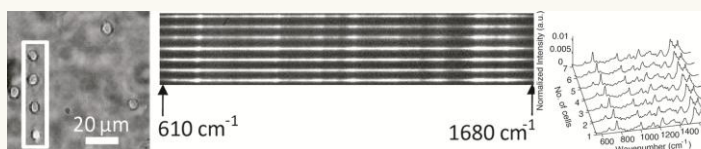
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*"Because of the support provided by the Keaton Raphael Memorial Foundation over the past 5 years, we have been able to make significant research progress in developing the next generation Raman spectroscopy systems for analyzing single cells and discovering new ways of diagnosing pediatric cancers, as well as new biological applications of these advanced optical tools."*

- James Chan, PhD, Center for Biophotonics Science & Technology, UC Davis

## ONGOING RESEARCH – THE NEXT STEPS



In order to diagnose and assess treatment of pediatric cancers, large populations of cells need to be analyzed. A major challenge in developing Raman spectroscopy technologies for pediatric cancer and other applications is the speed of analysis. Raman signals are sensitive but extremely weak, which means it takes a long time (1 minute or more) to analyze individual cells. While other more traditional cellular methods can analyze over 1000 dye-labeled cells per second, Raman spectroscopy has a much lower analytical throughput.

Through a new CBST program, the Ecosystem for Biophotonics Innovation (EBI), Keaton Raphael Memorial is sponsoring research to improve the throughput of Raman spectroscopy. Professor Chan's lab is developing a new system based on unique optical designs that will enable many cells to be analyzed simultaneously using multifocal laser tweezers. EBI researchers anticipate that these systems will open up new opportunities in pediatric cancer research that were not previously possible due to the current limitations of the technology.

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## LEVERAGED INVESTMENT

Through the Keaton Raphael Memorial Gift Fund, the Foundation has been an innovator in partnering with government funding agencies and research institutions to support fundamental research applied to technologies for diagnosing and curing pediatric cancers. Keaton Raphael Memorial recognizes the advantages of leveraging their research investment by participating in programs such as the Ecosystem for Biophotonics Innovation. Other agencies and organizations that have supported Laser Tweezer Raman Spectroscopy research besides Keaton Raphael Memorial include the National Science Foundation, Lawrence Livermore National Laboratory, the American Heart Association, and the National Institutes of Health Clinical and Translational Science Center at UC Davis.

