

Seeing Small and Aiming Big: the Development and Clinical Impact of Optical Coherence Tomography

Optical coherence tomography (OCT) is a technology invented in 1991 to image small critical tissue structures throughout the body with micrometer resolution. It is widely used in the management of eye and coronary heart diseases. OCT received broad attention when its inventors received the prestigious Lasker-DeBakey Clinic Medical Research Award and the National Medal of Technology and Innovation. For me, it was the culmination of 3 decades of work as an engineer, clinician, and translational researcher.

I will present OCT from an inventor's perspective. The physical principles will be explained with illustrations on measuring the time-of-flight of light with interferometry. I will tell the story of the aha moment when the idea of OCT came to my mind, as well as the rapid pace of development that made OCT a clinical reality. The biggest applications of OCT in the management of eye diseases will be shown. Recent advances made at OHSU that enable OCT to advance beyond the imaging of tissue structure to the detection of blood flow and photoreceptor function will be described.

OCT is still a rapidly developing technology. The technical capabilities have improved in many aspects, but the most astounding has been the continual improvement in imaging speed, which has doubled approximately every 2.5 years over the past 3 decades. The technological advances have made more and more clinical applications feasible. I will present a vision for the broader applications of OCT, which includes imaging the eye to assess brain and cardiovascular diseases ("Oculomics"), as well as direct OCT imaging of other target organs such as the heart, skin, digestive tract, brain, ear, and teeth.

