



## FIP International Year of Light Student Fellow

### *Honorable Mention*

*By Wenjiang Fan, University of Virginia*

As a member of OSA at UVa chapter and as a PhD student in AMO physics, the laser is a common tool that I use everyday in the laboratory. Though laser plays a crucial role in my studies and career, what sets it apart is how its medical usage influenced my life, or rather, the life of a childhood friend.

I still remember the carefree, sunny days of my childhood in which I spent every afternoon after school in the playground with my little sister. Jessica was not actually related to me, but I loved her and took care of her as if we were closer than actual siblings – if such a thing were possible. Though fifteen years has passed since the day her life changed forever, vivid memories still come back to me every time I pick up a laser in my experiments. I think of her, her eyes, and how this little piece of simple technology gave her a second chance at life.

At the tender age of six, Jessica was diagnosed with cataract in one of her eyes, a disease she should not have gotten until much later in her life. By the time her parents noticed that she could not see well in one of her eyes, it was already almost too late, as her illness had already taken a permanent toll on her vision. Now the only miracle that her parents and doctors could hope for after her cataract surgery is for her vision to recover enough to be of an aid her good eye, as monocular vision would impair her from doing many activities such as sports, destroying her sense of balance and hand-eye coordination. The lack of perception in depth and decreased peripheral vision would severely limit her life especially when she starts driving and becoming more independent from her parents.

Jessica eventually had cataract surgery, but that is not the main focus of this essay. It is the technology of the *secondary cataract surgery* that captured my admiration and respect. In cataract surgery, the patient's cloudy lens, which is responsible for the blurry and dim vision symptoms, is fragmented with ultrasonic vibrations and removed with a thin tip with suction abilities. An artificial lens is then replaced between the iris and the cornea of the eye, where the natural lens used to be. In 10-30% percent of cataract patients, however, secondary cataract can develop as tiny particles or cells of the original cataract grow behind the artificial lens on the supposedly clear tissue bag that holds it in place, blocking light path to be back of the eye and making the patient's vision blurry once again. The section of the eye that needs to be fixed is not located on the surface of the eye or even near the surface of the eye. For an ophthalmology surgeon to reach the problematic spot, he needs to bypass both the cornea and the lens before reaching the small, white spots that are responsible for the blurred vision. A surgery like that

would not only be risky, but also highly invasive and followed by a long healing period. With laser technology, on the other hand, eye care professionals are able to clear the cloudy, waxy section of the tissue by just focusing a laser beam there, making it possible to perform the surgery right in the office with minimum discomfort for the patient. The beam from the laser shines through the cornea and artificial lens without doing any harm; once it is focused on the membrane behind the artificial lens, it destroys the opaque cells there, creating a clear path between the front and back of the eye. This procedure is called YAG (yttrium aluminum garnet) laser posterior capsulotomy, which is a simple process that takes only a few minutes doing minimal damage to the rest of the eye so that clear vision is returned immediately.

After her surgeries, Jessica's vision returned to normal with very little complications. She still has sight in both of her eyes today, which has helped her excel in school and live a relatively normal life. With a relatively simple piece of technology powered by yttrium aluminum garnet, the ophthalmologist gave my sister her sight back. And in a way, they gave me my sister back, because I saw her grow up into a successful, confident woman now also pursuing her PhD.