

Turning Ideas Into Products

Part 2 of 2 parts. Dealing with companies and taking your idea to market.

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Part of who we are as vitreoretinal surgeons involves an inner drive to constantly push ourselves and explore the boundaries of our field's potential. Innovation and ingenuity play major roles in our careers, and naturally we strive to be a part of that process. If you are like us, this desire started early in your training and only strengthened as you advanced through your training. Eventually, we learned what exists today, what has been attempted and has fallen short, and what innovation gaps still need to be filled. Finally, we are in a position to contribute. The purpose of this article is to help us turn our ideas into reality. Last month we explored some of the basic concepts involved in protecting your ideas by applying for a patent. In this issue we turn to dealing with companies to take our inventions to market. For this, we have again called on 3 seasoned veterans in our field; they are leaders who have paved the way and who have now graciously agreed to share their advice.

- Nikolas J.S. London, MD; Andre J. Witkin, MD; and Alok S. Bansal, MD

SHOULD YOU GO TO A COMPANY WITH YOUR IDEA?

Emmett T. Cunningham Jr., MD: Definitely not before it's filed, and companies will typically tell you they don't want to hear about your idea until it's granted. Most will pay very little attention until a patent is granted.

HOW DO YOU KNOW HOW MUCH YOUR IDEA IS WORTH?

Dr. Cunningham: It's hard, and it depends on what the patent is for and how valuable you and your lawyer think it is. The value increases the further along the patent process you are—a granted patent is worth a lot more than an idea that has only been filed as an invention disclosure.

Patents are typically not worth a whole lot more up front than the cost of processing them. However, agreements can be back-ended so that if the patent delivers you can get milestones or a royalty. If you look at ideas across the board, most ideas produce no value; the ones that get a patent usually get a little more than the processing fees up front, and are back-ended with milestones and royalties; and it's a rare patent that gets a huge price up front. So if you invest your \$20 000 to \$40 000, you might see nothing for 10 to 15 years. On the other hand, if you built a device and take it into clinical use in 100 humans, that's worth a lot more than a patent.

Paul E. Tornambe, MD: It is not so much what you think your product is worth as how much capital are you willing to put at risk. You may have a terrific product, but if it isn't manufactured properly or marketed properly it may not be worth much. On the other hand, it may not be worth much today but may be worth a lot tomorrow.

Eugene de Juan Jr., MD: You almost never know how much an idea is worth. You probably think your idea is worth more than it is—just like your children are more beautiful than anybody else's children. Value has a lot to do with the market and the problems that it solves. How big is the problem that it solves? How severe or widespread is the disease or condition it addresses?

For example, a treatment that can make a blind person see with an intraocular prosthesis: Even though this device may provide only crude vision, that is worth tremendous value because it is taking someone from no light perception to bare light perception to some form of vision. The motility and other abilities that crude sight confers is a huge value. So this intervention has a lot of value, but there are not many patients at the stage that need the device. On the other hand, if you have a new drop for dry eye that works only 10% to 20% of the time, that could be worth \$800 million dollars in sales every year. It depends on how common the disease is, how severe it is, what competition there is, etc. This requires a

market analysis that is done primarily by business people. Doctors are not very good at this kind of assessment.

HOW LONG DOES IT TAKE TO TAKE AN IDEA TO PRODUCT?

Dr. Cunningham: From an idea written on a napkin to a patent can be 2 to 4 years. It varies depending on how aggressively you push it. While the patent is being processed, you can be developing prototypes and doing panel studies, etc., but I would say most products that are not surgical tools are in the 5 to 15 year range. Tools can be a lot faster, obviously.

Dr. Tornambe: At the Sarasota Vitreo-Retinal Update Course several years ago I listened to Frank Koch describe the multiport illumination system (MIS), in which vitrectomy cannulas are combined with illumination. The concept was great, but the cannula was 19 gauge. I sketched a 26-gauge torpedo light on a napkin and showed it to Peter Luloh, President of Insight Instruments, which manufactured the MIS. He liked the idea, and I had a prototype in 2 weeks. I could not have done that by myself while in active private practice.

Dr. de Juan: I applied for the patents for what has become the Argus intraocular retinal prosthesis (Second Sight) with Mark Humayun, who was a medical student at the time, and my next door neighbor, Howard Phillips, who was an engineer. That patent was submitted, reviewed, issued, and it expired 17 years later, and the first commercial device was implanted in November 2011. The whole process was probably 20 years. The patent expired before the first commercial sale. Now that was a fairly complex project, but it's an interesting example.

The company that was established for that product, Second Sight, was chosen to receive Patent No. 8 000 000 from the US PTO for the Argus II. It was cited as a "driver of our nation's economic growth and job creation" because of the importance and innovation of the prosthesis.¹ Now that company has over 100 patents that protect the technology.

HOW INVOLVED CAN OPHTHALMOLOGISTS BE IN TAKING THEIR IDEAS FORWARD AFTER THEY ARE TAKEN OVER BY A LARGE COMPANY?

Dr. Cunningham: You can be very involved in the patenting because you have to liaise with the lawyer and review all the materials, application, and feedback from the patenting agency. After that it becomes challenging to be any more than a consultant. If they like your patent and are willing to license it, they are often willing to make you a consultant at some level. This can vary from being

an ad hoc consultant to having a retainer, depending on how valuable the patent is to the company.

Agreements with companies can also include diligence covenants, specifying that if the company is not diligently pursuing the idea, investing in it, doing studies per some plan that you agree upon, they have to give it back. You can also ask to be on a team that decides how the product goes forward, but that's unusual. The notion is that once the company has bought it, it's theirs.

Dr. Tornambe: It depends on the inventor's background. Most of the time you need a partner. If you have an engineering background, a business degree, and some cash, you may want to assume the entire project. We have formed a company called Poway Retinal Technologies, which consists of a person who worked for a large company on the business side, an engineer familiar with ophthalmology, a product development person who knows federal regulations, myself, and an ENT physician. (It's amazing how much crossover there is between eye and ENT instruments.) The more I wish to take out, the larger the financial investment I have to make.

Dr. de Juan: The inventor can be as involved as he or she wants to be. They should be involved early on because they have the best understanding of the concept. Separating an idea from the inventor early on is a bad thing, because the ophthalmologist understands why he did it, why it's important, and why he's passionate enough about the idea to get the patent and develop it. The ophthalmologist or inventor should want to stay involved until the technology is commercially viable.

As an example, I had to use prototype 25-gauge vitreous surgery instruments that we made at Johns Hopkins University for 2 years before I convinced Bausch + Lomb to commercialize it. Alcon then picked up the idea and made it much more successful, and now that represents a very significant percentage of vitreoretinal cases. But now it has taken on a complete life of its own with all the improvements—the 25+ products, high-speed cutters, chandeliers, instrumentation, etc. At that point it didn't matter if I was involved or not. That technology is getting better and better every year.

WHAT ARE THE MOST SIGNIFICANT INNOVATIONS YOU HAVE SEEN DURING YOUR CAREER, AND WHAT WILL BE THE MOST SIGNIFICANT INNOVATIONS IN THE COMING DECADES?

Dr. Tornambe: Polyfluorocarbon liquid (PFCL) has become one of the greatest "instruments" for the vitrectomy surgeon. Of course the modern vitreous instruments are masterworks of engineering. I thought electric cutters would be the future, but pneumatic cutters have

now reached the cutting rates of electric cutters. Forced vitreous infusion was a great advancement so that one does not have to guesstimate how high or low the bottle should be. Steve Charles has brought more innovations to vitreous surgery than anyone else.

As for the future, I think we will be moving to pharmacologic manipulation of disease, with VEGF inhibition just scratching the surface. Stem cells will play a role in revascularizing tissue in diabetic retinopathy and possibly in treating glaucoma with ganglion cells derived from stem cells. Of course gene therapy is most promising to treat retinitis pigmentosa (RP) and other diseases. I also think that we will be moving away from artificial retinas to direct stimulation of the brain, bypassing the optic nerve pathway entirely.

Dr. de Juan: The most significant innovation I have seen during my career has been in the evolution of high-quality cataract surgery with phacoemulsification and small-incision intraocular lenses (IOLs). When I was training in 1980 we were still doing extracapsular cataract surgery, and IOLs still weren't perfect. But we rapidly evolved to very good posterior chamber IOLs and modern phaco.

Obviously, the establishment of vitrectomy in the late 1960s and early 1970s was vital. By the time I was part of that in the early 1980s there was tremendous development. The advent of effective anti-VEGF therapy made treatment possible for diseases including age-related macular degeneration, diabetic retinopathy, vein occlusions—things that we had only poor treatments for previously.

Looking to the future, I like these minimally invasive glaucoma surgery devices that allow the surgeon to essentially do a needle stick and cure the glaucoma. That is going to have a big impact. I think daily drops are going to go away, and we will be using sustained delivery, for instance in the form of punctal plugs. There is a technology in development called encapsulated cell therapy (Neurotech), which provides sustained delivery of ciliary neurotrophic factor (CNTF) and has shown promise in preventing RP from progressing. What is happening in Philadelphia with RPE 65 is a grand success for gene therapy in general and its use in ophthalmology in particular. Hopefully there will be much more of that.

I love the retinal prosthesis. I think advanced electronics are going to have a big impact going forward in prosthetic devices. Accommodating IOLs and contact lenses are another fascinating area of potential development. I am very excited about these technologies.

Ophthalmology is a wonderful place. I think in many instances we lead the way in developing new technologies, in part because we can see the organ, it's accessible, and sight is so valuable.

WHAT DROVE YOU PERSONALLY TO BE INVOLVED IN THE FIELD OF INNOVATION?

Dr. de Juan: I liked it from the beginning. I thought it was cool that people had thought about and developed things that make my life better. Working with Robert Machemer at Duke University gave me a place to be involved in that process myself. There was a lab there with a clever machinist who developed many of the technologies that came out of Duke. I started working with the engineers there, then created what we called the MAD-LAB—Microsurgery Advanced Design Laboratory—when I moved to Johns Hopkins, and then I expanded that at Doheny Eye Institute. Finally, I went outside the university for a lot of development, at ForSight Labs in Menlo Park, and started bringing more resources and more talent to these ideas. It's been a journey.

At least now people understand that you can do it. A lot of people are seeing that developing innovations is a viable alternative to a career in basic research. It's exciting, and it's valuable. More people are now asking themselves, "What can I do to make the world a better place, and how can I participate in it?" ■

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1. United States Patent and Trademark Office Issues Patent Number 8,000,000 [press release]. US Patent and Trademark Office. <http://www.uspto.gov/news/pr/2011/11-47.jsp>. Accessed January 17, 2012.