

FUZZY FIBER: BEHIND THE SCENES



A dialectic of hypothesis, experience, and resolution produced a new solution.

BY KHALID LAFDI, PHD

Since the introduction of guarded filtration surgery, the leading cause of failed glaucoma drainage surgery is fibrosis and scarring in the sub-Tenon and subconjunctival space. Although they are considered the gold standards of surgical intervention, these procedures require diligent follow-up in the early postoperative period to minimize failure and optimize efficacy.

Glaucoma surgeons have addressed this need in many ways, including with the intraoperative and postoperative use of antimetabolites such as 5-fluorouracil and mitomycin C. These agents enhance bleb management by suppressing fibroblast growth factor 2 (FGF-2) and other growth factors responsible for postoperative pathogenesis. By suppressing FGF-2 and inducing apoptosis, the likelihood of a patent fistula and diffuse, unscarred bleb is increased.

Although it is the preference of many glaucoma surgeons, use of mitomycin C may be associated with risks of cataract formation, hypotony, hypotony maculopathy, and other complications. Thus, my colleagues and I at the University of Dayton Research Institute (UDRI) Materials Research Center considered the following question: As these complications are rooted in the cytotoxic effect of the antimetabolite, is suppression of FGF-2 possible without inducing a cytotoxic effect?

A CLOSER LOOK AT CARBON

It is known that carbon has antiembolic properties. For this and its demonstrated biocompatibility, carbon

is the predominant material used in the construction of mechanical heart valves. However, such antiembolic properties are a nonsequitur to this investigation because failure of glaucoma drainage devices (GDDs) is commonly related to fibrotic encapsulation and not a loss of tube patency.

As carbon inhibits FGF-2 and VEGF pathogenesis, we wondered whether the biocompatibility properties of carbon could be paired with its FGF-2 and VEGF suppression qualities in an application that improves the efficacy of GDDs and glaucoma surgery. Because silicone stimulates the production of FGF-2, we pursued experiments to determine whether a carbon material might sufficiently suppress fibroblast growth and find utility in GDD implantation and glaucoma surgery. In its preferred embodiment, this concept would apply a secure coating of a carbon-based material to current and future devices, regardless of substrate material and/or geometric configuration.

Experiments were designed to evaluate fibroblast growth on eight varied samples differing in substrate material

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and material constitution. Results of these experiments suggested that, irrespective of substrate material (eg, carbon fiber, PMMA, silicone, etc.), samples with less exposed surface area were subject to greater encapsulation (data on file with UDRI and Mobius Therapeutics). It was hypothesized that a sufficient relationship exists between exposed surface area and the ability to suppress FGF-2 to inhibit fibroblast encapsulation.

The challenge of increasing exposed surface area in a microscopic device is found in its material construction and material configuration. A pure carbon veil deposited upon a substrate would have little effect on suppression of fibroblast growth. A veil of carbon nanotubes deposited upon a substrate increases the exposed surface area by thousands of times and inhibits fibroblast formation without increasing the overall dimensions of the device. Inspired by this discovery, UDRI researchers grew carbon *hairs* from the nanotubes, creating what we call *fuzzy fiber*. As this increases the surface area by a multiple of millions

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GETTING IT ALL DONE



Effective time management warrants a proactive, not reactive, approach.

BY KATHRYN COLBY, MD, PHD

Let's acknowledge the challenge of maintaining a balanced life. For most of us, this is a chronic and ongoing problem. Naturally, there are times when life goes well and everything is in balance. Then, there are times when the opposite is true. But life is a marathon, not a sprint. In order to establish some balance in our busy lives, it is important to take a proactive approach to time management.

MAKE THE MOST OF YOUR TIME

Know yourself. You have a finite amount of working time in each day. Knowing yourself and understanding the way in which you operate is crucial to making the most of that time. Ask yourself: *Which tasks are the hardest for me? Which are the easiest? At what time of day am I at my best? What stands in my way of getting things done?* After determining the answers to these questions, make it a point to tackle your hardest tasks when you are at your best.

For example, I find it challenging to sit down and start writing a manuscript. I know this about myself, so I do everything I can to make the task as easy as possible. Once I get started, it is a pretty straightforward process. Therefore, I try to plan the right time to sit down and begin—even if my writing is not perfect, at least I have gotten started.

Block time in your schedule. I find that blocking time in my schedule is an effective way to make time to tackle specific tasks (Figure). For example, recently when I had to work on a talk, I set aside 2 hours in my schedule,

which allowed me to stand at least a fighting chance at getting it done.

In order to block time effectively, you must engage your staff. Let them know that, if you have time blocked off on your schedule, they should not interrupt you during that time unless it is urgent. Also, our electronic devices can be wonderful tools, but they are often distracting and can interfere with our productivity. Nonstop use of these devices creates a dopamine overload in the limbic system, putting us in a constant state of hypervigilance as we wait for that next ping. So, when you are trying to complete a challenging task, turn off your devices.

Take control of email. How much time do you spend managing email? Keep your inbox under control so that it doesn't control you. Dedicate a specific time to answer emails, but make sure it does not conflict with your peak performance time. For example, set aside 30 minutes in the morning and 30 minutes in the afternoon to answer emails. Consider setting an automatic reply that informs people you will not be checking your email until the end of the day, and, if a matter is urgent, they can call you. Alternatively, if you receive an email that you can respond to in 2 to 3 minutes, then go ahead and do so. If the message is more complex, then schedule a time to craft a response.

One of my pet peeves is the overuse of *reply all*. Reduce inbox clutter by avoiding the use of this feature. Simply reply to the individual who sent the email, unless it is absolutely necessary to include all of the recipients. In addition,

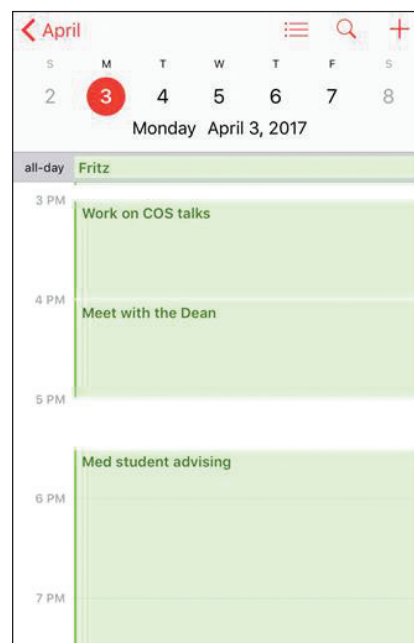


Figure. Dr. Colby uses time blocking to carve out time in her schedule to tackle challenging tasks.

being on duty 24/7 is not healthy, so be sure to put your phone away at night. Don't sleep with your phone, and, if you wake up in the middle of the night, resist the urge to pick up your phone and start answering email.

Use technology to stay on track. If you are data-driven, competitive, and at ease with technology, then using a productivity app might work for you. Some apps offer positive rewards, such as points or icons, to help users stay on top of a task (one popular app uses a pomodoro timer to track progress toward completing a task). These may be a useful productivity aid for some.

Ask for help. Know which tasks you can delegate and then make it a point to follow through. Train people

to help you with the tasks you can outsource. Whether your office staff, technicians, residents, or house cleaner, let other people help so that you can concentrate on what you truly need and want to do.

START WITH TAKING CARE OF YOU

Utilize coaching. Seeking coaching from colleagues can help us recognize our weak spots, exploit our strengths, and be as effective as possible. Coaching is not a sign of weakness but a sign of strength.

Turn to your peers. Look for opportunities to work on personal and professional development with your peers. I am a strong supporter of the Women in Ophthalmology meeting and try to attend every year. This is a great forum for networking and for realizing that you are not alone in the challenges you face. Seek opportunities to connect with others within your own institution, locally, or nationally.

Put on your own mask first. Take care of yourself before tending to others. This is not a luxury but a necessity. Be sure to get enough sleep, eat well, exercise, and meditate. There is a whole body of literature suggesting that meditation can positively influence brain chemistry and promote neuroplasticity. Cultivate your leisure activities, and take vacations. You do not want to end up as that 75-year-old physician who is ready to retire but doesn't know what to do with the rest of his or her life.

Stay connected. Our connections to others bring joy to the practice of medicine. It is important to connect with the people around you, be they family, friends, colleagues, or patients. (The latter can be life affirming as well.) Don't be an island.

Forget perfection. Perfection is not required to be a good physician, leader, spouse, or friend. We are all on a lifelong journey of personal growth. Sometimes the route is short and smooth, and other times there are bumps along the

way. Acknowledge your failings and limitations. It can be liberating to know that you do not have to be perfect to be good enough. Come to terms with your imperfections, but continue to work to make improvements.

CONCLUSION

Failures are bound to occur. Occasionally you break the bag, see endophthalmitis, or encounter a retinal detachment—these complications are often the most catalytic experiences, so make the most of them. Strive to live proactively, rather than simply reacting to things as they occur. Above all, remember to stay focused on what is most important in life. ■

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- Financial disclosure: None