

Mitchell S. Fineman, MD  
Section Editor



Jason Hsu, MD  
Section Editor



## Chandelier Illumination: Shedding New Light on Scleral Buckling

Scleral buckling, a time-honored technique for repairing rhegmatogenous retinal detachments, has changed very little since the 1960s, when Harvey Lincoff, MD, combined silicone sponges with cryotherapy. While scleral buckling has a very high success rate, the advent of vitrectomy has shifted vitreoretinal surgery away from this tried-and-true procedure.

The ASRS Preferences and Trends (PAT) Survey<sup>1</sup> shows that from 2005 to 2013, routine recommendation of a scleral buckle fell from 27% to 9%, while the choice of a vitrectomy without buckle increased from 31% to 54%.\*

### Panelists



**Maria H. Berrocal, MD**  
Berrocal & Associates  
San Juan, Puerto Rico



**Tamer H. Mahmoud, MD, PhD**  
Duke University Eye Center  
Durham, North Carolina



**Paul Hahn, MD, PhD**  
NJ Retina  
Teaneck, New Jersey



**Manish Nagpal, MD, FRCS(UK)**  
Retina Foundation  
Ahmedabad, Gujarat, India

More recently, the concept of using chandelier illumination along with a wide-angle viewing system has been proposed as an intriguing modification when performing primary scleral buckles. Perhaps incorporating the view we're used to with vitrectomy will rescue scleral buckling from going the way of the dodo bird. We interviewed several experts who have been performing this technique to find out more.

**What attracted you to the idea of doing chandelier scleral buckles? Do you now do all your straight buckles using a chandelier, or do you still use the “traditional” method? If you use both methods, how do you choose when to use a chandelier?**

**Maria Berrocal:** I have been doing all my buckles under the microscope for the past 15 years, as I feel that the view for passing sutures through sclera and draining is significantly enhanced. In that scenario, the Achilles heel of the procedure is localizing and examining the retina only with the view of the indirect ophthalmoscope. When I saw a video of the view with a chandelier and the BIOM wide-angle viewing system (Oculus Surgical Port St. Lucie, FL), it was obvious that this was the way to go. I now do all my buckles with chandelier and wide-angle viewing—the view is simply so much better.

**Paul Hahn:** I was excited to try a twist on the traditional approach to see if there were any distinct advantages. For me, there are 2 irreplaceable advantages of chandelier buckling. The first relates to the directional, oblique lighting provided by the chandelier in contrast to the diffuse illumination of the indirect ophthalmoscope.

Vitrectomy surgery with a light pipe taught us that dynamic shadowing from a moving light pipe can provide enhanced visualization of subtle pathology that might be washed out otherwise. Similarly, the chandelier provides intraocular focused illumination that can be manipulated to provide dynamic shadowing and visualization of subtle retinal breaks.

The second advantage is the high magnification provided by the surgical microscope coupled with the wide-angle viewing (WAV) system, in contrast to the limited magnification of the indirect. Although chandelier buckling also provides advantages of posture and education to trainees, I reserve it for retinal breaks that are difficult to detect in

**‘I now do all my buckles with chandelier and wide-angle viewing—the view is simply so much better.’**

—Maria H. Berrocal, MD

\*For a 65-year-old patient with a pseudophakic retinal detachment, -3.00 myope, ½ clock-hour-size flap tear at 11:00 anterior to the equator, 45% detached, macula-on, fellow eye with poor vision

the office, usually pseudophakic pinpoint breaks or small atrophic holes in a high myope.

Prior to chandelier buckling, I would have a low threshold to perform a vitrectomy for difficult-to-see pathology. Now, I consider a chandelier buckle. The majority of buckles for routine horseshoe tears I still do “traditionally.”

---

**‘The chandelier provides intraocular focused illumination that can be manipulated to provide dynamic shadowing and visualization of subtle retinal breaks.’**

—Paul Hahn, MD, PhD

---

**Tamer Mahmoud:** I was first exposed to the technique at surgical conferences abroad and felt it was worth considering. My first case was about 5 years ago and was, to the best of my knowledge, the first case in the United States. It was very exciting that day to have the resident, the fellow, and me sharing the same visualization without switching hats.

The resident and fellow enjoyed that fantastic widefield view and appreciated how easy it was to localize breaks and apply perfect cryotherapy. Initially, I alternated between the 2 methods, reserving the chandelier buckles for the more difficult-to-localize breaks, but moved a few years back to exclusively using the chandelier buckle technique.

**Manish Nagpal:** The phenomenal view we get through vitrectomy viewing systems makes me wonder why we continue to do buckling with an indirect ophthalmoscope (IO). The IO is cumbersome to use during surgery and magnification is always a challenge.

Moreover, we are a teaching institute with a fellowship program. With the decreasing number of buckling procedures overall, it was becoming more difficult to teach buckling procedures to the fellows. Despite connecting the IO to a video camera, it was still not easy to demonstrate various steps such as cryo, localization, placement of buckle, and managing complications through that view.

Once I realized this was possible using a chandelier illumination, it was a boon for showcasing the surgical steps in the theater as well as recording and using it for teaching purposes. I do 100% of my buckling cases using the chandelier system. There is no going back.

**Can you describe your technique for chandelier-assisted buckling? What is your preferred chandelier and why? When do you insert the chandelier? Where do you place the chandelier in relation to the detachment and breaks? In cases where you wish to drain subretinal fluid, what is your favorite method?**

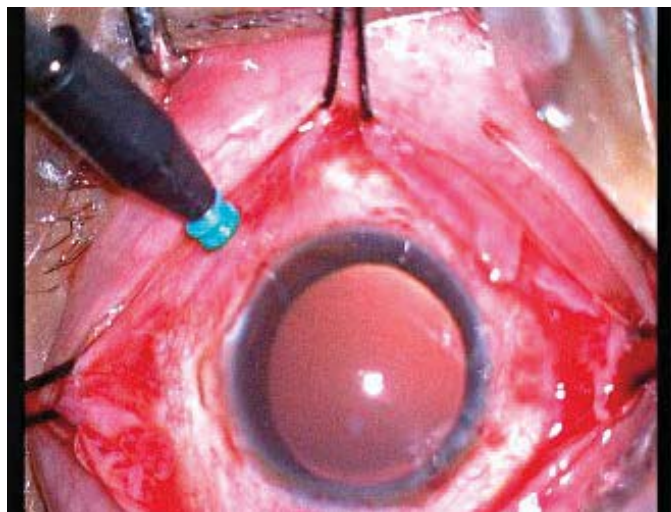
**Maria Berrocal:** I place the chandelier 180 degrees away from the area of breaks, ideally in the superior retina. I prefer the Alcon 25-gauge chandelier (Alcon Laboratories, Inc, Fort Worth, TX), but I use it with a valved cannula, so that if the chandelier comes off with manipulation, vitreous does not come out. I examine the retina doing scleral depression myself, localize the breaks, and apply cryo if I am not planning to drain. I then place the scleral buckle and tie it.

If I decide to perform drainage, I drain by doing a cut down under the microscope, cauterizing the choroidal bed, and scratching it with a 30-gauge needle. In drainage cases if I do not want to use cryo, after the retina flattens, I use a lighted curved laser probe through the cannula where the chandelier is placed and laser the flattened breaks.

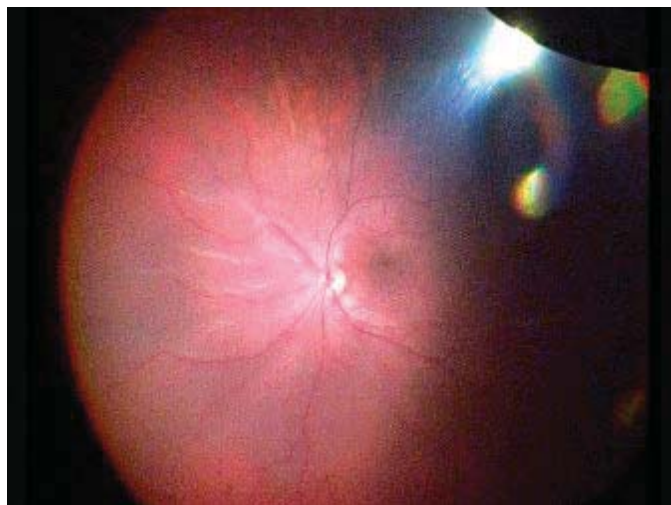
I inspect the retina with the chandelier and BIOM to make sure the buckle placement and height are ideal and make any necessary adjustments. I then remove the cannula, making sure the eye is slightly soft to reduce the chances of vitreous incarceration.

**Paul Hahn:** I think any chandelier would work well. For pseudophakic patients, I place the chandelier approximately 180 degrees away from the pathology. I use the rigid chandelier with one hand to simultaneously torque the eye and illuminate the pathology, while using my other hand to hold a depressor or cryo probe.

For phakic patients, I place the chandelier within 90 degrees so I can provide bright illumination without interference from the crystalline lens. After opening the conjunctiva and isolating muscles, I place the chandelier and use the wide-angle viewing system to visualize and treat the pathology. This is a dynamic process with constant adjustments



**Figure 1.** Placement of a 25-gauge chandelier light. Images 1-4 courtesy Manish Nagpal, MD, FRCS(UK).



**Figure 2.** View of the fundus through a wide-angle viewing system, demonstrating the inferior retinal detachment.

using the chandelier, cryo probe, and microscope magnification to achieve optimal visualization.

I then remove the chandelier and suture the sclerotomy to prevent vitreous prolapse during placement and suturing of the scleral buckle, which can exert high pressure within the globe. If I perform needle drainage of the subretinal fluid after placement of the buckle, I typically cut the sclerotomy suture, reinsert the chandelier, and use a 25- or 26-gauge needle within the bed of the buckle to drain under direct visualization with the WAV system. If I perform a cut-down for drainage, I do not use direct intraocular visualization.

**Tamer Mahmoud:** The best way to understand the technique is to think in terms of visualization; follow the same steps you would for a traditional scleral buckle, but use the chandelier and the microscope for visualization instead of the indirect ophthalmoscope when needed.

I initially used the 29-gauge dual chandelier from Synergetics, Inc (O’Fallon, MO) when I had multiple breaks at different locations in phakic patients, as well as the 25-gauge from Alcon, but I feel now that almost any chandelier will work. The chandelier is inserted right after isolating the muscles so we can start the depressed exam to determine the number and location of the breaks and apply cryotherapy.



Figure 3. Scleral depression with localization of the break.



Figure 4. Cryopexy being performed.

If we divide the vitreous cavity to nasal 180 degrees and temporal 180 degrees, I like to place the chandelier on the same side of the main breaks away from the bullous part of the detachment. This allows for better visualization.

For drainage, the chandelier technique allows great widefield visualization and therefore can be a much safer method. I use the closed technique of a 26- or 27-gauge needle on a TB syringe with the hub out. After I pull up on the buckle to increase the pressure, I slide the needle under the buckle at the maximum height of the fluid and gradually introduce it in the subretinal space with the bevel out to avoid any retinal incarceration. As the fluid drains, I can see the fluttering motion of the neurosensory retina as it approaches the needle, which is then withdrawn.

**Manish Nagpal:** The only difference between traditional buckling and the chandelier technique is placing the chandelier and doing the whole surgery under a microscope. After isolating the muscles, I place the chandelier and then use my contact widefield lens to visualize inside and do the sequential steps of cryo, localization, placement of localizing stitch, passing the buckle, and external drainage, followed by placing the remaining sutures for the buckle.

I use the Alcon 25-gauge chandelier, as we were already using it for our routine vitrectomies and haven’t tried any others. I typically place it in the inferotemporal or superotemporal quadrant based on the location of the break. It’s ideal to place it in the quadrant exactly opposite the primary break. But nasal quadrants create ergonomic difficulties due to the nasal bridge touching the fiber optic; hence, I stick to the temporal quadrants. I choose the quadrant with maximum fluid to localize and drain all my cases with a needle.

**‘For drainage, the chandelier technique allows great widefield visualization and therefore can be a much safer method.’**

—Tamer H. Mahmoud, MD, PhD

**What advice can you offer those who are thinking about trying this technique for the first time? Are there any potential pitfalls?**

**Maria Berrocal:** If a surgeon is not used to doing buckles under the microscope, I would recommend first doing a couple of cases under the microscope with indirect viewing just to get comfortable with the microscope viewing and mobilization of the globe by the assistant. I would then start with a simple case with a partial detachment, pseudophakia, and good visibility.

A potential pitfall is that the chandelier can come out during movements of the globe; to avoid this, I prefer valved cannulas. Vitreous incarceration can occur if the cannula comes out and if the intraocular pressure is elevated during removal of the chandelier cannula.

**Paul Hahn:** As vitreoretinal surgeons, we are very comfortable with visualizing the retina under the surgical microscope with WAV systems. It is relatively easy to become facile with this technique, but with all new techniques, it may be prudent to start with a simple horseshoe tear where you can easily convert to a traditional approach if any issues arise.

As mentioned, I think the most important part is thoughtful placement of the chandelier to best illuminate the pathology, accounting for phakic status. I like to use the chandelier to help position the eye, and I use the muscle sutures instead if needed.

**Tamer Mahmoud:** I used to say, “Try it first in a case where you need a buckle but have difficulty localizing the breaks with less-than-optimal visualization.” However, after gaining more experience and having taught many fellows, I feel that your first case should be an easy, straightforward detachment. This allows you to get a better feel for how to use the chandelier and the microscope instead of the indirect ophthalmoscope in a case where you don’t have to worry too much about other complicating issues.

Once you get used to the flow—usually after just 2 or 3 cases—you can then use the chandelier technique for every case. Here are the main points to be aware of and get used to when doing your first case:

- The technique allows maneuvering under the microscope with either a contact or noncontact visualization system (depressed exam, localizing breaks, cryotherapy, drainage) using the muscle sutures without having instruments inside the eye to control eye movements.
- After treating the breaks and once you’re ready to put the buckle on, take the chandelier off and plug the cannula. This moves the chandelier out of the way, secures the cannula, and helps improve efficiency.
- Plan anterior-chamber paracentesis to lower the pressure prior to any removal or introduction of the chandelier to prevent vitreous loss through the cannula. This is particularly important after pulling on the buckle and prior to introducing the chandelier back in the cannula for visualization of the cryo, buckle height, relation to the cryo, and pulsations at the disc—before injecting gas and prior to the final removal of the chandelier.
- Always suture the sclerotomy site to avoid any vitreous prolapse under higher pressure or loss of any injected gas.

**Manish Nagpal:** Be aware that the fiber optic needs to be taken care of while moving the muscles and passing external sutures. The safest way to do this is to remove the fiber optic from its cannula every time any external maneuver is carried out.

Also, remember to switch off the light source for the chandelier whenever it is removed from the eye and to avoid blood staining the tip. In case the light remains on, the blood tends to stick to it and at times, it is difficult to reinsert the chandelier inside the cannula.

**Some people may feel that chandelier scleral buckles are unnecessary and perhaps even more dangerous to perform than a traditional buckle due to the more “invasive” use of a cannula. What are your thoughts?**

**Maria Berrocal:** The only added cost of the chandelier buckle is the chandelier and a lighted laser probe if cryo is not used. The advantages include:

- Reduced operating time, as visibility for localization and for suturing is improved and there is no need to change between loupes and the indirect scope
- Fewer complications from drainage and suturing, as the view through the microscope is significantly better than with loupes
- The assistant’s or fellow’s ability to see the retina for localization, drainage, cryo, or laser

Most complications that occur during a traditional scleral buckling procedure stem from poor visibility: perforation, bleeding during drainage, missed breaks, retinal incarceration during drainage. The poor-visibility

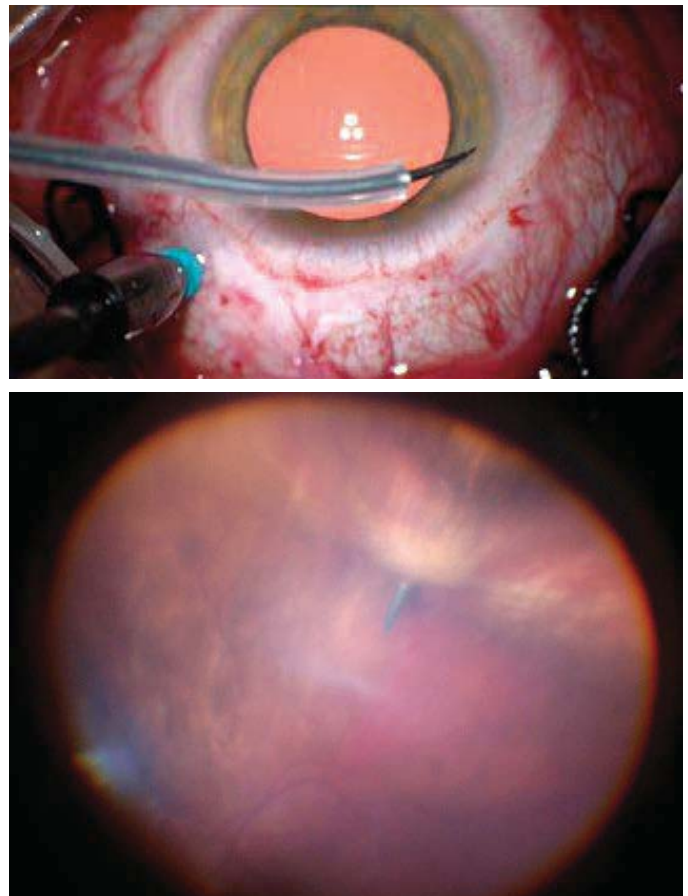
issue is resolved with chandelier use, thus reducing these complications. The procedure is invasive, and there is a potential risk of endophthalmitis or vitreous incarceration and traction from the sclerotomy wound.

Nevertheless, the reduced risks of complications from the enhanced viewing, in my mind, more than compensate for the potential risks of chandelier use. As this technique becomes more popular, we will be able to assess the specific complications of chandelier use and their incidence, and determine ways to prevent them.

**Paul Hahn:** In my experience, and according to published case series with this technique, there have not been any additional complications associated with the chandelier use. However, I share concerns for potential complications and certainly, additional cost. For these reasons, I perform a traditional buckle for most cases and reserve the chandelier buckle for retinal detachments where I think a chandelier will improve visualization of subtle pathology and therefore outcomes.

**Tamer Mahmoud:** With more experience with chandelier buckles over the years, I don’t agree that they are unnecessary, and perhaps even more dangerous to perform than a traditional buckle, for the following reasons. You add only the cost of the chandelier. However, with more pinpoint cryotherapy, less tendency to miss breaks, and a much easier procedure that is more accepted and adopted by a newer generation of fellows used to the current technology of chandeliers, we are preserving the great technique of the scleral buckle.

*Continued on page 63*



**Figure 5.** An alternative method of external drainage is needle drainage under direct visualization. (A) A reverse bevel curved needle with a silicone sleeve is ideal for this maneuver. The silicone sleeve prevents the needle from penetrating too far into the eye while the downward bevel away from the retina lowers the risk of retinal incarceration. (B) The needle is advanced under the scleral buckle in the area of subretinal fluid for drainage under direct visualization using the chandelier and wide-angle viewing system. Images courtesy Jason Hsu, MD.

“Unnecessary” means to accept the status quo and resist adopting newer technology. I understand if surgeons who are used to traditional buckles, as I was initially, feel they don’t need to adopt this technique. They have something that works well in their hands, but I would argue:

- How about the new generation who can keep buckles alive? As noted, the ASRS PAT Survey shows a decreasing number of buckles done—and hence taught. With a much more rapid learning curve using technology they are used to, a newer generation of fellows will continue doing buckles.
- If you were trained to use the widefield system and chandelier to do buckles, and then I were to give you the indirect ophthalmoscope and ask you to start using that instead, how would you feel about it?

Think of the widefield cameras we have in clinic and how easy it is to see that picture of retinal detachment in 1 image, and have that same exact image in the OR; I doubt you can then consider using the indirect ophthalmoscope.

“Dangerous”? Safety is always a concern with any new procedure. With so many chandelier buckles done in the past few years around the world and discussed at surgical conferences, I am not aware of complications related to the technique—specifically regarding the light inside the vitreous cavity, or mild vitreous prolapse seen. I feel that we are now more confident about the technique and fellows graduating from programs that teach the chandelier buckles have adopted it early in their practice.

**Manish Nagpal:** Now with most people doing primary vitrectomies for all types of retinal detachments, I think the invasiveness of putting just a single 25-gauge chandelier

is nothing compared to a vitrectomy with 3 ports, fluid infusion, etc. I don’t think the chandeliers per se are expensive and the teaching avenues that chandelier use opens up are far superior to traditional buckling.


The fellows I teach have shown a lot more interest in buckling since I started doing chandelier-based surgery, as all the steps became visible to them in a similar fashion to vitrectomy. This technique allows you to perform surgery while sitting comfortably using the microscope, and hence is less likely to cause long-term cervical and lumbar postural problems for the surgeon.

*As we’ve heard from our experts, chandelier-assisted scleral buckling may be the needed modification for the new generation of vitreoretinal surgeons. It adapts the technological advancements we’ve seen in wide-angle viewing systems and endoillumination for scleral buckling. Having performed this technique ourselves, there is no question that the transition from “traditional” buckling to chandelier buckling is intuitive, given our experience from vitrectomies.*

*From a teaching standpoint, chandelier buckling is fantastic for residents and fellows to simultaneously see how the procedure*

**‘The fellows I teach have shown a lot more interest in buckling since I started doing chandelier-based surgery...’**

—Manish Nagpal, MD, FRCS(UK)

*is performed. Compared with an indirect ophthalmoscope, the view and magnification are phenomenal, making it easier to localize and treat even subtle pathology. We hope you have a chance to give this technique a try.* 

#### References

1. Stone TW, Mittra RA, eds. *ASRS 2013 Preferences and Trends Membership Survey*. Chicago, IL: American Society of Retina Specialists; 2013.
2. Seider MI, Nomides RE, Hahn P, Mruthyunjaya P, Mahmood TH. Scleral buckling with chandelier illumination. *J Ophthalmic Vis Res*. 2016;11(3):304-309. doi:10.4103/2008-322X.188402.

#### For Further Reading

1. Nagpal M. Buckling surgery using wide field vitrectomy visualization along with chandelier lighting. Paper presented at: Vail Vitrectomy 2013; March 16-20, 2013; Vail, Colorado.

#### Financial Disclosures

**Dr. Berrocal** – ALCON LABORATORIES, INC: Speaker, Investigator, Honoraria; ALIMERA SCIENCES: Speaker, Honoraria; ALLERGAN, INC: Advisory Board, Speaker, Honoraria; HEMERA BIOSCIENCES, INC: Other, No Compensation Received; REGENERON PHARMACEUTICALS, INC: Stockholder, Stock.

**Dr. Fineman** – PHYSICIAN RECOMMENDED NUTRICEUTICALS: Consultant, Honoraria; THROMBOGENICS, INC: Consultant, Investigator, Grants.

**Dr. Hahn** – GENENTECH, INC: Advisory Board, Honoraria; SECOND SIGHT MEDICAL PRODUCTS, INC: Consultant, Honoraria.

**Dr. Hsu** – GENENTECH, INC: Investigator, Grants; OPHTHOTECH CORPORATION: Consultant, Investigator, Grants, Other Financial Benefit; OPTOVUE INC: Consultant, No Compensation Received; SANTEN PHARMACEUTICAL COMPANY, LTD: Investigator, Grants; UCB, INC: Consultant, Other Financial Benefit.

**Dr. Mahmoud** – ALCON LABORATORIES, INC: Investigator, No Compensation Received; ALIMERA SCIENCES, INC: Advisory Board, Honoraria; DUTCH OPHTHALMIC USA: Advisory Board, Honoraria; GENENTECH, INC: Investigator, No Compensation Received; SPARKS THERAPEUTICS INC: Advisory Board, Honoraria.

**Dr. Nagpal** – ALCON LABORATORIES, INC: Speaker, Honoraria; ALLERGAN, INC: Speaker, Honoraria; BAYER HEALTHCARE PHARMACEUTICALS: Speaker, Honoraria; NIDEK CO, LTD: Speaker, Honoraria; NOVARTIS PHARMACEUTICALS CORPORATION: Speaker, Honoraria; TOPCON MEDICAL SYSTEMS: Speaker, Honoraria.

## RESEARCH AND DEVELOPMENT >> Continued from page 51

Financial Benefit; JOHNSON & JOHNSON: Consultant, Investigator, Grants, Other Financial Benefit; KALA PHARMACEUTICALS, INC: Consultant, Other Financial Benefit; KANGHONG SAGENT PHARMACEUTICAL: Consultant, Other Financial Benefit; KODIAK SCIENCES INC: Consultant, Other Financial Benefit; NEUROTECH INC: Investigator, Grants; NOTAL VISION: Consultant, Other Financial Benefit; NOVARTIS PHARMACEUTICALS CORPORATION: Investigator, Grants; OCUDYNE, INC: Consultant, Investigator, Grants, Other Financial Benefit; OCULAR THERAPEUTIX, INC: Board of Directors, Other Financial Benefit, Stock Options; OPHTHOTECH CORPORATION: Investigator, Grants; OPTOS PLC: Consultant, Other Financial Benefit; OPTOVUE, INC: Investigator, Grants; QUARK PHARMACEUTICALS, INC: Consultant, Other Financial Benefit; REGENERON PHARMACEUTICALS, INC: Consultant, Investigator, Grants, Other Financial Benefit; REGENXBIO, INC: Consultant, Other Financial Benefit; RETROSENSE THERAPEUTICS, LLC: Consultant, Other Financial Benefit; ROCHE USA: Consultant, Other Financial Benefit; SCIFLUOR LIFE SCIENCES: Consultant, Investigator, Grants, Other Financial Benefit; SHIRE OPHTHALMICS: Consultant, Other Financial Benefit; STEALTH BIOTHERAPEUTICS: Consultant, Other Financial Benefit; TAIWAN LIPOSOME COMPANY, LTD:

Consultant, Other Financial Benefit; THROMBOGENICS, INC: Investigator, Grants; TYROGENEX INC: Consultant, Investigator, Grants, Other Financial Benefit; VALEANT PHARMACEUTICALS INTERNATIONAL, INC: Consultant, Other Financial Benefit; VOYAGER THERAPEUTICS, INC: Consultant, Other Financial Benefit.

**Dr. Ho** – AERPIO THERAPEUTICS: Advisory Board, Consultant, Honoraria; ALCON LABORATORIES, INC: Advisory Board, Consultant, Investigator, Speaker, Grants, Honoraria; ALLERGAN, INC: Advisory Board, Consultant, Investigator, Grants, Honoraria; BEAVER-ENDO OPTIKS: Advisory Board, Honoraria; DIGISIGHT TECHNOLOGIES INC: Advisory Board, Stock Options; GENENTECH, IheierNC: Consultant, Investigator, Speaker, Grants, Honoraria; NEUROTECH INC: Advisory Board, Consultant, Stock Options; NOTAL VISION: Consultant, Honoraria; ONL THERAPEUTICS: Advisory Board, Honoraria; OPHTHOTECH CORPORATION: Investigator, Grants; PANOPTICA, INC: Consultant, Investigator, Grants; PRN PHARMACEUTICAL RESEARCH NETWORK, LLC: Advisory Board, Stock Options; REGENERON PHARMACEUTICALS, INC: Advisory Board, Consultant, Investigator, Speaker, Stockholder, Grants, Honoraria; REGENXBIO, INC: Consultant, Honoraria; SECOND SIGHT MEDICAL PRODUCTS, INC: Consultant, Investigator, Honoraria.

**Dr. Rosenfeld** – ACHILLION PHARMACEUTICALS, INC: Consultant, Honoraria; ACULELA INC: Consultant, Investigator, Grants, Honoraria; APPELIS PHARMACEUTICALS: Stockholder, Stock, Stock Options; ASTELLAS INSTITUTE FOR REGENERATIVE MEDICINE: Investigator, Grants; CARL ZEISS MEDITEC: Consultant, Investigator, Grants, Honoraria; CELL CURE NEUROSCIENCES LTD: Consultant, Honoraria; CHENGDU KANGHONG BIOTECH CO, LTD: Consultant, Honoraria; CODA THERAPEUTICS, INC: Consultant, Honoraria; DIGISIGHT TECHNOLOGIES INC: Stockholder, Stock Options; GENENTECH/ROCHE: Advisory Board, Investigator, Grants, Honoraria; GLAXOSMITHKLINE: Consultant, Investigator, Grants, Honoraria; HEALIOS KK: Consultant, Honoraria; HEMERA BIOSCIENCES, INC: Consultant, Honoraria; HOFFMAN-LA ROCHE INC: Advisory Board, Honoraria; MAC REGEN: Consultant, Honoraria; NEUROTECH INC: Investigator, Grants; OCUDYNE, INC: Consultant, Stockholder, Stock Options; OCUNEXUS THERAPEUTICS, INC: Consultant, Honoraria; TYROGENEX INC: Consultant, Investigator, Grants, Honoraria; UNITY BIOTECHNOLOGY, INC: Consultant, Honoraria.