



engineeringworldhealth

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**Annual Report**  
**October 2015—September 2016**



## Letter from the Board Chair and the CEO

### Dear Friends,

This past year, in 8 countries, Engineering World Health volunteers, students and professionals put their skills to work to improve health care and save lives.

**In Engineering World Health's Summer and January Institutes**, what our students and volunteers do is anything but glamorous: together with local hospital staff, they work against the odds to repair hospital equipment in extremely resource-poor environments and build local capacity to sustain it.

The work is likely to be - literally - gritty. Often dusty. Usually hot. Always challenging. And absolutely necessary to save lives.

**Here's a glimpse of their work:** Our students have fixed surgical beds and lights while patients waited for surgery. They've repaired incubators that are immediately used to save infants' lives. They've fixed a surgical unit's only suction pump, installed its only anesthesia machine. They've allowed for diagnoses by bringing microscopes and centrifuges back into service, and prevented illness by repairing autoclaves and installing hand sanitizers. There is a long list: **In 2016 the participants in our programs fixed 1,211 pieces of equipment worth an estimated \$2.4 million.**

In Nepal, undergraduate and graduate students, along with alumni of our Summer Institute program (a number of whom took 3 weeks' vacation time to participate) worked in hospitals within a 12-hour radius of Kathmandu, many in earthquake-affected areas, repairing and installing life-saving equipment.

Before spending 5 weeks in hospitals in Rwanda and Tanzania, our students first intensively studied local languages (Swahili and Kinyarwanda). In Rwanda, one team designed a cart for transporting oxygen canisters, and hired a local welder to build it. Previously, these canisters were being carried on someone's shoulders, at great risk of explosion to himself and others.

In Guatemala and Nicaragua, our 34 Summer and January Institute participants spent from 3 to 5 weeks in clinics and hospitals fixing everything from blood pressure cuffs to oxygen concentrators to ultrasound machines to anesthesia machines.

EWH partnered with the University of New South Wales, Australia (UNSW), to build a program in Cambodia that will continue to bring student volunteers to this Southeast Asian country, where the need for trained medical professionals remains immense after years of violence.

**EWH's participants have grown well beyond our original U.S. borders.** In 2016 our Summer Institute students included young women and men from 25 countries, including participants from Uganda, India, Nigeria, Rwanda, Turkey, Venezuela, Mexico, Bangladesh, Saudi Arabia,

United Arab Emirates, Korea, Australia and several Scandinavian countries. Most of our participants receive scholarships.

Here at home, with support from the Biogen Foundation, **we have developed and refined STEM curricula** that can be used by teachers at middle- and high-school levels to enable students to experience hands-on engineering work and learn about the technical needs of healthcare delivery in less-developed countries. Our staff also worked with schools in North Carolina to deliver lessons directly to students, and to train teachers.

Members of our nearly **50 University Chapters**, in the US and abroad, use EWH-designed kits and lessons of their own design to reach out with STEM education in their local communities.

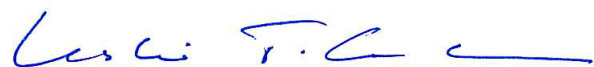
Thanks to generous friends at Tensentric, we were able to give cash prizes to the top three creative teams who entered the **EWH Design Competition**. Our winners personified the international character of our organization, hailing from the University of New South Wales, The University of Toronto, and Washington University of St. Louis.

In the developing world, **we build sustainable capacity**. So many countries suffer from an inadequate supply of biomedical engineering technicians. In Nigeria and Ethiopia, with support from the GE Foundation, **we are partnering with local governments and schools to train engineers to become teachers of BMETs** – ensuring that, in the future, there will be a trained workforce for this vital service. In 2016 EWH was able, as planned, to turn our BMET training programs over to local partners: the University of Puthisastra in Cambodia and the Integrated Polytechnic Regional Centre in Rwanda will independently continue to supply this critical training to future generations.

We are grateful to our students, volunteers, colleagues, and donors for their work and their support. We are proud to help those who give of their time and energy, enthusiasm and skill, to improve the future of health care in some of the world's most resource-poor communities.



*Michael R. Tracey, Ph.D.  
Board Chair and President  
Vice President, Research &  
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*Leslie J. Calman, Ph.D.  
CEO  
Engineering World Health*





## Our Mission

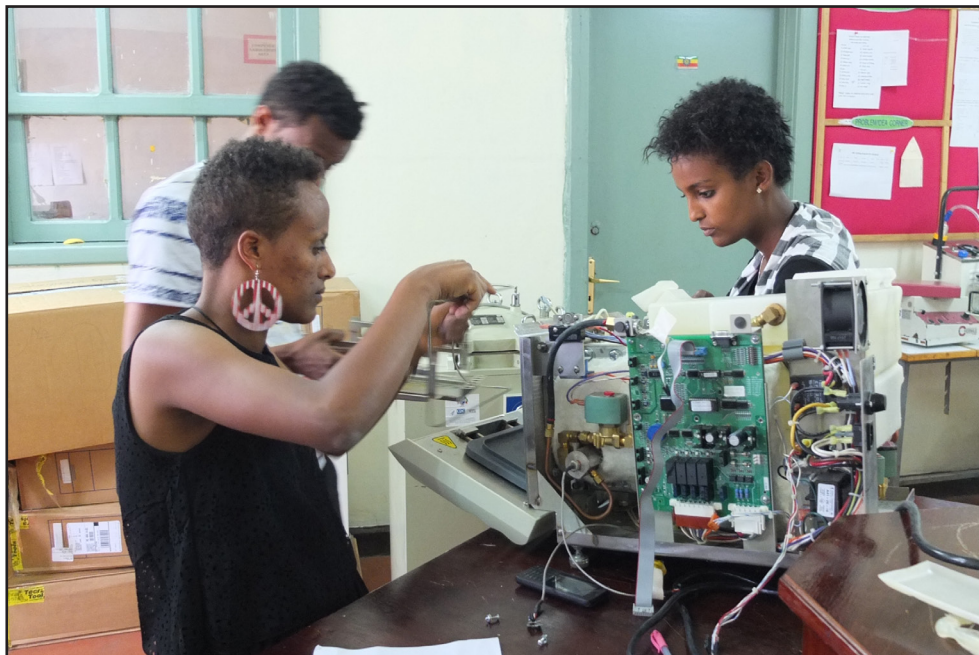
*To inspire, educate, and empower the biomedical community to improve healthcare delivery in the developing world.*

**Engineering World Health:**

- Provides students from around the world with the life-changing educational experience of repairing vital medical equipment in the world's most resource-poor communities.
- In collaboration with local partners in Asia, Africa, and Central America, creates locally-sustainable training programs for biomedical engineering technicians (BMETs).
- Engages the next generation through K-12 STEM (science, technology, engineering and math) curricula, university chapters, and design activities to improve global health.

**EWB believes we have a responsibility to stay true to these values:**

- Ensuring a scientifically-based and creative educational experience.
- Leaving the communities in which we work with greater capacity than we found them.
- Finding workable solutions through innovation and creativity.
- Serving while partnering with local educators, hospitals, and clinics.
- Promoting self-reliance and capacity building.
- Providing challenge without compromising safety.



## Summer & January Institutes

The EWH Summer & January Institutes recruit exceptional students to live and work in developing countries, fixing equipment, training and learning from staff, and experiencing first hand what low-resource hospitals need so that as they go forward in their engineering careers, they can creatively meet those needs.

In 2016, EWH expanded the number and variety of our programs, and the number of students and volunteers who served. We also gained new and international university partnerships.

Our 3-week January session in Nepal hosted 14 Summer Institute alumni, who were able to hit the ground running. In Guatemala, our partners George Mason University and Rochester Institute of Technology trained students on campus so that they, too, arrived ready to the work.

A new program in partnership with the University of New South Wales in Sydney, Australia, enabled students to spend 2 months on the ground in Cambodia during January and February (summer in Australia!). The Technical University of Denmark trained students from 4 Scandinavian countries in preparation for their 6 weeks in Nepali hospitals.

And, with our tried-and-true partners at Duke University and Texas A&M University, we continued to serve in Tanzania, Rwanda, Nicaragua and Guatemala.



*“We got 3 out of 4 ventilators to work again. They weren’t necessarily the hardest fixes, but the hospital director seemed really appreciative to have them working. The hospital had received them as a donation, but they arrived broken.”*

*- Maddy Lockwood, Guatemala*

We are very proud of the results:

Our 126 participants in 2016 carried passports from 25 different countries, including the US, Denmark, Australia, Norway, Canada, India, Korea, Tunisia, Uganda, Rwanda, Mexico, Turkey, and Nepal.

Working in Nicaragua, Guatemala, Tanzania, Rwanda, Nepal, and Cambodia, our participants repaired 1,211 pieces of equipment, worth an estimated \$2.4 million. Equipment repairs ranged from blood pressure cuffs and power cords to dentistry chairs, infant incubators, and ultrasound machines.

EWH worked in 15 hospitals during the January Institutes, and 37 hospitals during the Summer Institutes. In addition to repairs, each team completed a special project in order to substantially impact their hospitals. Students built and painted playgrounds for pediatric wards, cleaned out storage rooms and created workshops, and installed a sink in a maternity ward, just to name a few.



*"I had never thought of the role of an engineer in this capacity. This program taught me how hands-on and personal engineering can be, especially in a hospital. As soon as we would fix something, it would go into use. We took a motor from an oxygen concentrator shell and put it in a suction pump, then rewired it and glued on a pressure gauge we found, used a screw from an old wheel chair and wheeled it back to OR where it was immediately used."*

- Os Nakayama, Tanzania



*"Most of the medical equipment in Rwanda is donated and most of the time it doesn't even work. Engineers can make their designs cost effective and provide access to new equipment for under-developed countries."*

- Grace Bagabe, Rwanda

*"We saw immediate need for the sink we installed. Before, the nurses had to go outside to wash their hands. Now everything is inside. We saw a huge improvement, and the nurses were very grateful."*

- Jenny Hong, Rwanda



*"The hospital has made leaps and bounds winning hearts of many needy people and bringing smiles to their faces, yet the hospital has its own set of challenges to accomplish more and meet the growing and changing demands of the people with time. As a Biomedical Engineer I am looking forward to going back to the hospital to support it to achieve its goal and tackle the challenges together in any possible way I can."*

- Laxman Bhusal, Nepal





*“Our most meaningful accomplishment was the phototherapy lamp we repaired. In the ICU there are all these preemies. I was a preemie and I have a twin: we both used phototherapy. My partners and I were able to fix the phototherapy light with new support and new lightbulbs. When we returned it, the nurse was really happy, and she said, ‘But it’s not for me, it’s for the children.’”*

- Jewell Brey, Nicaragua/Guatemala



## Student Programs

**University Chapters** raise awareness among students regarding healthcare challenges that beset the developing world and the medical technology issues unique to resource-poor settings. Participation in EWH Chapters helps students connect to a global network of biomedical engineers committed to solving health challenges and introduces them to ways they, too, can make a difference.

In 2016, 45 student chapters from universities all over the world affiliated with EWH.

### US Chapters

Arizona State University  
 Binghamton University  
 Boston University  
 California Polytechnic Institute-San Luis Obispo  
 Clemson University  
 Cornell University  
 Duke University  
 Elon University  
 George Washington University  
 Johns Hopkins University  
 North Carolina State University  
 Northwestern University  
 Purdue University  
 SUNY at Buffalo  
 Syracuse University  
 Texas A & M University

University of Arkansas  
 University of California-Berkeley  
 University of California-San Diego  
 University of Connecticut  
 University of Florida  
 University of Illinois-Chicago  
 University of Portland  
 University of Texas-Arlington  
 University of Texas-Austin  
 University of Texas-Dallas  
 University of Wisconsin  
 Washington & Lee University  
 Washington University in St. Louis  
 Vanderbilt University  
 Virginia Commonwealth University  
 Virginia Tech

### International Chapters

Autonomous University of Mexico State  
 Chung Yuan Christian University, Taiwan  
 ITESM Monterrey, Mexico  
 Lovely Professional University, India  
 Makerere University, Uganda  
 Pontifical Catholic University of Peru  
 Technical University of Denmark

University of Ghana  
 University of New South Wales, Australia  
 University of Science & Technology,  
 Sana'a, Yemen  
 University of Sheffield, UK  
 University of Toronto, Canada  
 University of Twente, The Netherlands

EWH University Chapters provide students with the unique opportunity to participate in a variety of student programs:

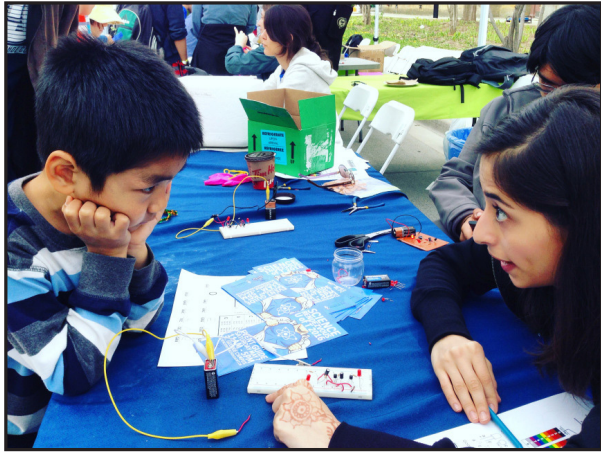


*University of Portland Chapter returned to Haiti on an independent volunteer trip.*



*University of Toronto, 2016's Chapter of the year, organized a global health symposium.*





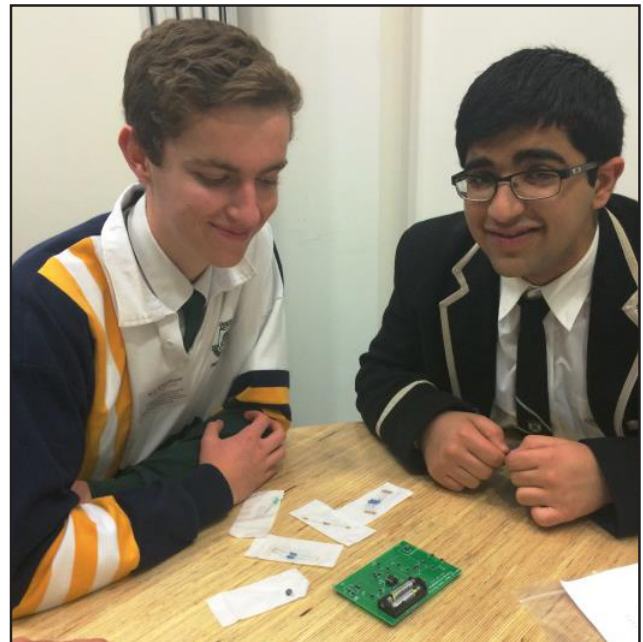
**STEM Outreach** – University students volunteer to teach K-12 students, sometimes using EWH-designed Kits. Lessons introduce young students to the possibilities of biomedical engineering careers.

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**Kits** provide understanding of important biomedical engineering concepts and introduce the hands-on electronic fabrication skills needed by both engineers and technicians.

Many Chapters organized workshops and Kit builds to improve students' understanding of soldering and circuitry.



**Design Competition** – EWH Chapters are invited to participate in our annual Design Competition for cash prizes. Through extensive interviews with healthcare providers in developing countries, EWH identifies healthcare needs specific to the developing world and then challenges teams to design new technologies that might deliver the most positive impact for patients in these settings. This year, EWH owes special thanks to Tensentric for its generous support of the Design Competition.

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The 2016 winners are:

*1st place: University of New South Wales Chapter, Low Cost LED Surgical Lamp*

*2nd place: University of Toronto Chapter, Emergency Room Translation App*

*3rd place: Washington University in St. Louis Chapter, Water Out of Thin Air*

## STEM K-12 Education

With support from the Biogen Foundation, EWH further refined K-12 educational materials through a partnership with North Carolina Kenan Fellow educators. Kenan Fellows participated in two focus groups, providing EWH with valuable feedback to enable further integration of biomedical engineering concepts into K-12 classrooms. This feedback was used to create an hour-long workshop for K-12 teachers to share resources, concepts and methods for bringing biomedical engineering into their classrooms.

EWH continued to promote biomedical engineering in K-12 classrooms in the US. Over 300 elementary students built model circulatory systems and prosthetic arms while also learning about the challenges of healthcare delivery in the developing world. We worked with their teachers to provide them with a more in-depth understanding of biomedical engineering through professional development training sessions.

By inspiring children today to pursue STEM education and careers, EWH is helping to build future generations of biomedical engineers.



EWH spent much of 2016 working with teachers to bring STEM activities into more North Carolina classrooms. Here, teachers practice building EWH's Suit Up! activity to gain confidence before doing the activity with their classes.

EWH also participated in the 2016 US Science & Engineering Festival in Washington, DC, where we introduced hundreds of children, parents, and educators to biomedical engineering and how it can help solve health challenges.





## BMET Training & Centers of Excellence

While our Summer & January Institutes teach university students the impact of their engineering work and the value of good design in order to foster the next generation of engineers, EWH also works to build more sustainable healthcare systems right now.

In partnership with the GE Foundation, Duke University, in-country educational institutions, and local Ministries of Health, EWH has created Biomedical Equipment Technician (BMET) Training Programs in 7 countries – Rwanda, Honduras, Ghana, Cambodia, Nigeria, and Ethiopia – to train local hospital workers and students to become fully qualified BMETs. Each program is specifically designed to fit the needs of the local population. We also train future trainers to take over the program – as they have in Rwanda, Cambodia, and Honduras – with the ultimate result being that we leave the countries we work in with a sustainable source of well-trained BMETs.

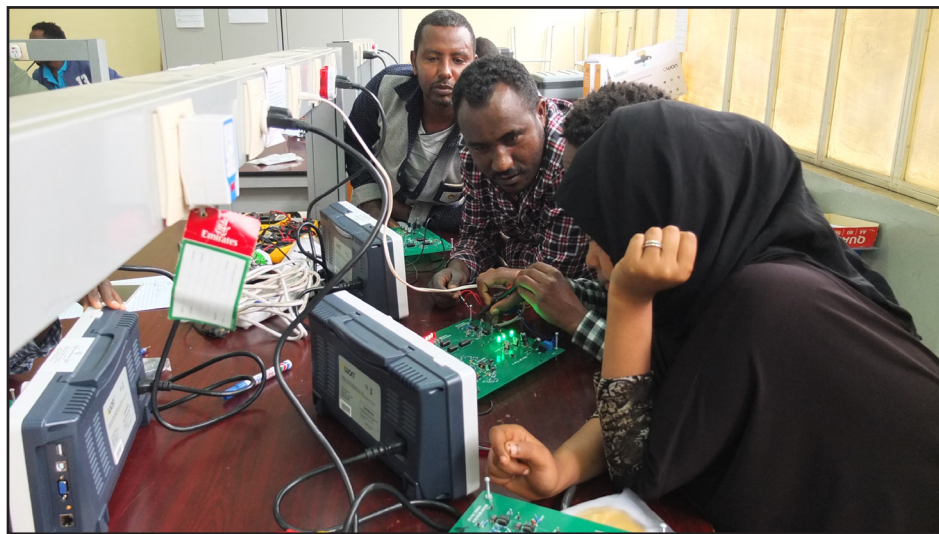
### Highlights of 2016:

*Nigeria* – In 2014, EWH launched a new BMET Training program in Lagos, Nigeria. With a population of over 173 million people, this booming nation needs a strong healthcare system with dependable infrastructure and well-trained staff at all levels.



Eighteen students are currently enrolled in the program. They attend classes at the Lagos University Teaching Hospital, and have already begun to prove to doctors and medical students there the value of BMETs.

*Ethiopia* – In 2015, EWH launched a one-year program to train instructors in Addis Ababa, Ethiopia. Of the 20 students currently enrolled, some already work as BMETs in local hospitals and need more advanced training, while others are training to become instructors of the program.



To ensure students receive well-rounded training, EWH combines lectures and lab work with group hospital visits and dedicated mentoring.

Experienced BMET instructors Libby Mills (the Country Coordinator), Gunalan Dass, and Larry Wright have served as the teachers and mentors for the Ethiopia BMET program, ensuring a dedicated team for this fast-paced program.



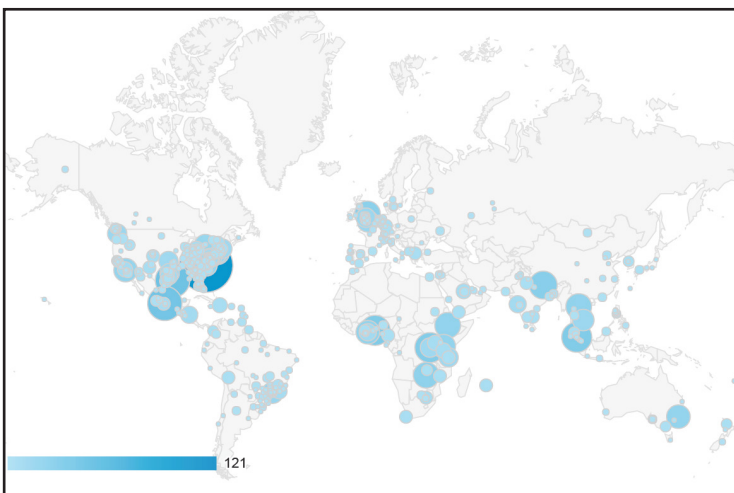


*Rwanda & Cambodia* – We have successfully transitioned these two programs to our local partners.

The University of Puthisastra in Cambodia began running the BMET Training program on its own in June 2016. Ten students from EWH’s first cohort graduated in September.



IPRC in Rwanda is now teaching three cohorts of BMET students, along with a group of part-time night school students. When we began the BMET Rwanda program in 2009, there were no trained BMETs working in the country. Today, there are trained BMETs in every district, with more graduating from IPRC each year.



*BMET Library* – In March of this year, EWH launched a digital, open-access library filled with resources for BMETs, with a focus on repairs in the developing world.

Over 1700 users have visited the library already, with Brazil, Malaysia, Rwanda, and Tanzania among our top 10 user-locations.

Since the launch, we have added troubleshooting videos as well as additional resources in Spanish.

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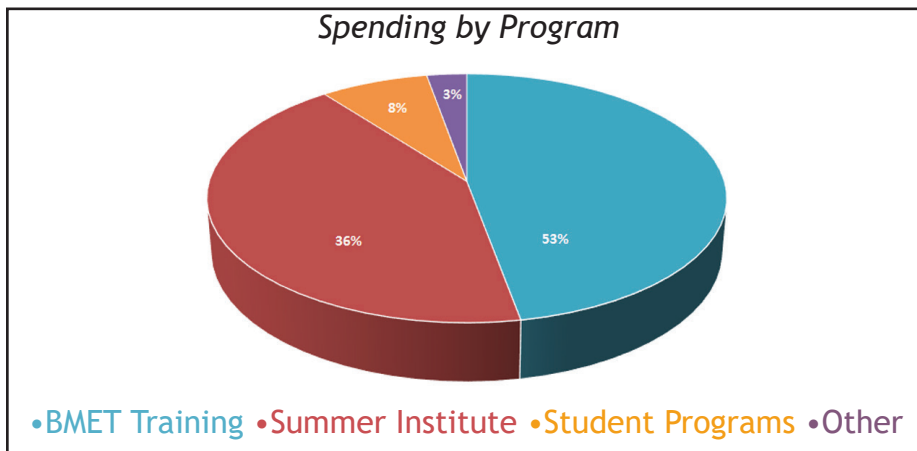
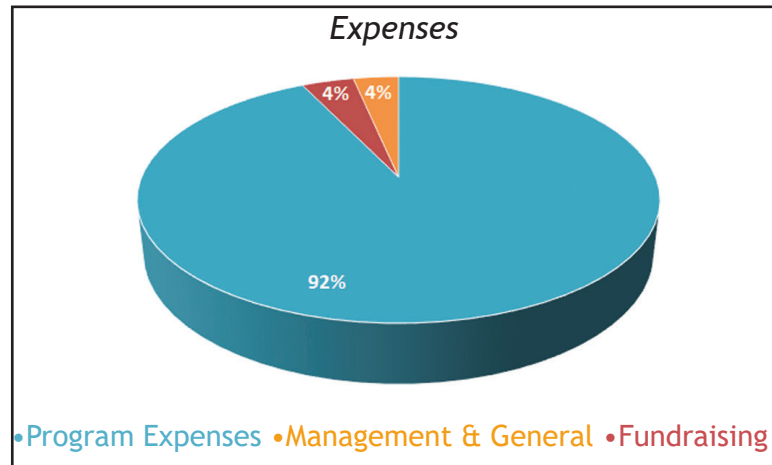
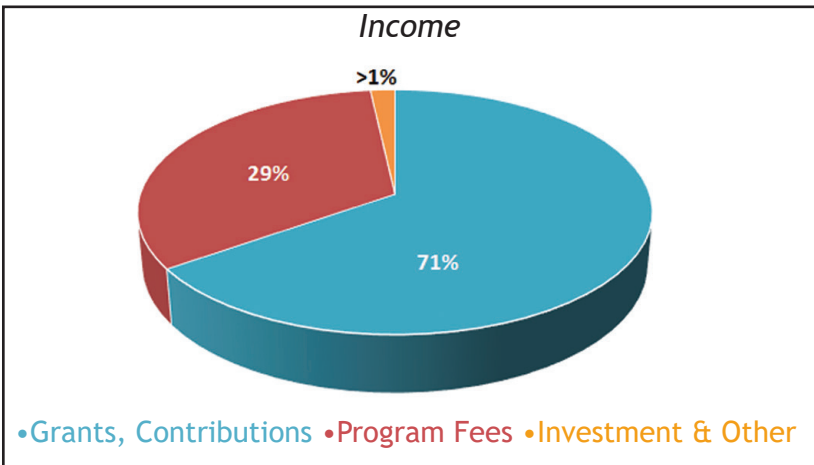
Robert A. Malkin, PhD, PE  
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Leslie J. Calman, PhD  
Engineering World Health, CEO  
Ex-Officio



## Engineering World Health Statements of Financial Position

Statement of Activities	FYE 9/30/16	FYE 9/30/15
<b>Revenue, Support, &amp; Other Income</b>		
Grants & Contributions	\$1,434,313	\$1,393,420
Program Fees	723,584	576,340
Investment & Other Income	38,853	(3,479)
<b>Total Revenue, Support, &amp; Other Income</b>	<b>\$2,196,750</b>	<b>\$1,966,281</b>
<b>Expenses</b>		
Program Expenses	\$1,779,071	\$1,653,765
Management & General	73,590	77,789
Fundraising	64,049	65,916
<b>Total Expenses</b>	<b>\$1,916,710</b>	<b>\$1,797,470</b>
<b>Net Assets</b>		
Change in Net Assets	\$280,040	\$168,811
Net Assets at Beginning of Year	\$1,719,146	\$1,550,335
Net Assets at End of Year	\$1,999,186	\$1,719,146



## 2016 Funding Partners

### Foundation and Corporate Donors:

Access Health Care Nepal	FJC
Assist International	GE Foundation
BD	Hamilton Roddis Foundation
Biogen Foundation	McKesson Foundation
Corning Foundation	The Donald & Alice Noble Foundation
Danaher	Tensentric
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*Special thanks to the Wallace H. Coulter Foundation for the early and generous support that enabled us to grow.*

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***Thank you to everyone who has supported Engineering World Health! Your generous contributions build a healthier future.***

*Saving Equipment Is Saving Lives*



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