



engineeringworldhealth

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**Annual Report**  
**October 2014 - September 2015**



## Letter from the Board Chair and the CEO

Dear Friends,

At Engineering World Health, we believe successful development comes from open dialogue and a strong spirit of collaboration. We hope you will join with us as EWH educates and engages engineering students around the world to work with and learn from global colleagues – all while making concrete contributions to health.

Here's a quick look at what EWH accomplished in 2015:

**SUMMER INSTITUTE:** Rwanda, Tanzania and Nicaragua. In 2002, our founder Dr. Bob Malkin took 10 students to Haiti to use their engineering skills to repair medical equipment. Today, the Summer Institute has become EWH's signature program and a stunning example of the power of global exchange. In 2015, 67 students from 31 universities, carrying passports from 10 different countries, traveled to Nicaragua, Tanzania, and Rwanda to successfully repair 885 pieces of hospital equipment, worth an estimated \$1.8 million. They worked in over 30 hospitals as well as rural clinics.

As they worked, students discovered the globally interconnected ways in which health care happens in the developing world. In one hospital in Nicaragua, two students repaired the hospital's only means of performing cervical exams: a colposcope manufactured in West Berlin. In another hospital in Tanzania, Danish students translated German instruction manuals into English for an anesthesia machine so their hospital's surgeons could perform safe surgeries. Experiencing the strange patchwork of global health firsthand gives students a deeper understanding of the impact they have as engineers.

Assigned to hospitals in groups of two or three, students work closely with technical staff, lab technicians, nurses, and doctors. They learn to listen to local perspectives as they interview hospital staff about each hospital's needs, and they learn new ways of approaching challenges as they seek creative solutions in low-resource settings. Their interactions become a global exchange of information. Students teach hospital staff how to use new devices; they translate manuals and instruct technicians in device maintenance. At the same time, students learn the significance of medical device design choices when "just buying a new one" isn't an option.

**JANUARY INSTITUTE:** Guatemala, Nepal and Cambodia. In 2015, in partnership with Rochester Institute of Technology and George Mason University, EWH created a three-week program in Guatemala during students' January break. In this program, partnering schools provide students with technical training during the fall semester so that they arrive in-country ready to work. For 2016, we have added another program: the January Institute in Nepal, which is open to Summer Institute alumni only. And, in partnership with the University of New South Wales, this coming year we'll partner 18 Australian students with our biomedical engineering technician trainees in Cambodia.

**TRAINING BIOMEDICAL ENGINEERING TECHNICIANS IN THE DEVELOPING WORLD:** The World Health Organization and other researchers tell us that at any given time, from 40 to 70% of

equipment in developing world hospitals is not functioning. A major reason is the absence of trained technicians to maintain and repair the equipment to keep it in working order. In partnership with the GE Foundation, local hospitals, and technical schools, EWH has created training programs in five countries – Rwanda, Honduras, Ghana, Cambodia, and Nigeria – and just launched a new program in Ethiopia. We bring local BMETs to international standards, and train instructors so that we leave behind a self-sustaining educational program.

**STUDENT PROGRAMS:** EWH’s Chapters engaged university students from 45 different universities around the world. This international network of engineering and science students hosted guest speakers and lecturers; used EWH Kits to teach hands-on technical skills in workshops; brought STEM activities to hundreds of K-12 students; organized independent service trips to Haiti, Peru, and Vietnam; and participated in “hackathons” to brainstorm solutions to global health challenges. Eleven teams competed in our annual Design Competition, which challenges students to design an inexpensive medical device for very low-resource settings. This year’s winning team, from the University of Texas at Austin, also won third prize in the National Institute of Health’s DEBUT challenge for their FreePulse design: a low-cost, durable, reliable patient monitor.

**STEM (Science, Technology, Engineering, and Math) for K-12 students:** With generous support from the Biogen Foundation, our North Carolina-based team developed new global health-oriented projects (including an exercise to design an Ebola-protective suit for healthcare workers) and led 1,000 students and 300 teachers through these challenges.

Looking ahead to 2016, we are excited to launch a partnership with the Technical University of Denmark as we continue to expand the global exchange of biomedical knowledge.

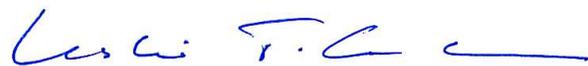
Engineering World Health’s goal is to inspire, educate, and empower the biomedical engineering community to improve healthcare delivery in the developing world. Much work remains to be done, but with so many who give so generously of their time, talents, and funds, we know we can do it.

We thank you for taking this journey with us. We are grateful for any support you can offer.

Sincerely yours,



*Michael R. Tracey, Ph.D.  
Board Chair and President  
Vice President, Research &  
Development  
Codman Neuro*



*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.

**EWH 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.

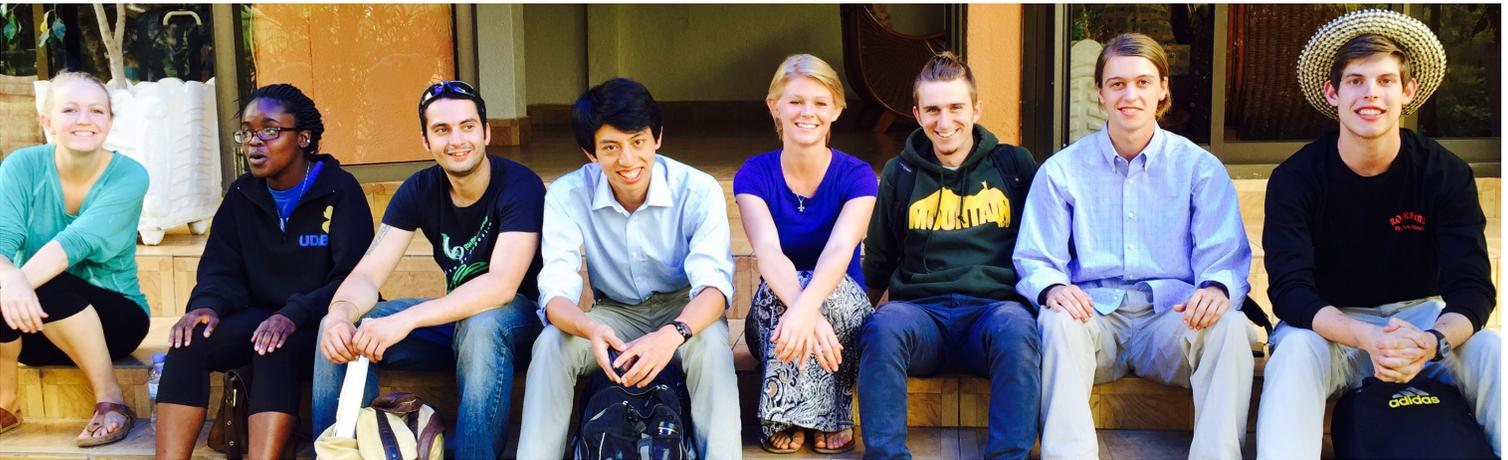


## Summer Institute

As much as 80% of medical equipment in developing countries is donated by developed countries. Despite the best intentions of donors, the hospitals which receive the medical equipment often have no equipment support staff, or have only a few overworked technicians struggling to find the proper parts needed to keep equipment operating.

Summer Institute participants work in partner hospitals to fix broken equipment or install unused medical technology. Equipment problems can often be solved cheaply using local supplies. EWH trains SI participants to understand the equipment, evaluate the problem, and develop creative solutions. SI participants also train local staff, empowering them to use and maintain equipment, thus creating lasting improvements to our partner hospitals.

In Summer Institute 2015, 67 participants carrying passports from 10 countries (including Denmark, Australia, China, Nigeria, & Guatemala) came from 31 different universities to bring unique biomedical engineering skills and knowledge to hospitals in need.



### Nicaragua

Twenty-four students repaired 259 pieces of equipment – microscopes, incubators, anesthesia machines, surgery lamps, and many others. They also completed several special projects, including designing and building an oxygen concentration & temperature analyzer.



*“We were able to put some 40 pieces of equipment back into service over five locations, the majority of which was laboratory equipment (centrifuges, for example). We’ve come away from the experience feeling that we have really made a significant impact to the healthcare system in the region that wouldn’t have happened if we weren’t sent as part of the SI programme, an opportunity that I am very grateful to have been able to experience.”*

*-Deanna Hood, Robotist at EPFL, Switzerland*

## Tanzania

Our 27 students repaired 423 pieces of equipment, including defibrillators, oxygen concentrators, ultrasounds, and a dental chair. They completed special projects such as installing mosquito nets, cleaning up equipment graveyards, and building a paging system for patients.

*“All of the 10 ORs had only one working automatic anesthesia machine to share when we first arrived, else they used manual ventilation balloons. When we left, all of the ORs had working automatic anesthesia machines with quick start guides!”*

*-Morten Madsen, Technical University of Denmark*



*“I loved working with people from other countries and getting their perspective on biomedical engineering.”*

*-Lael Wentland, University of Washington*

## Rwanda

SI Rwanda hosted 16 students. They repaired 203 pieces of equipment, including centrifuges, sterilizers, electrosurgery units, and infant warmers. Students also improved BMET workshops and built a playground.

*“Seeing the joy and relief on doctors’ faces when we returned functional devices made me feel like I had done some good and that the time spent to get there was worthwhile. These skills and lessons will follow me through the rest of my life.”*

*-Anne Wolff, Tulane University*



## January Institutes

In an effort to create more opportunities for university students to gain engineering experience in low-resource settings, we launched the first-ever Winter Institute in Guatemala. Our partner schools, George Mason University and Rochester Institute of Technology, trained students during the fall semester in troubleshooting and equipment repair. Then, the students spent three weeks working in small groups in hospitals in Guatemala. In addition to GMU and RIT students, EWH invited Summer Institute alumni to participate as on-the-ground assistants, using their experience to mentor new students.

Their response was overwhelming. Alumni of the Summer Institute program are not only capable of helping, they are ready and waiting to put their skills to use again in developing country hospitals. In answer to our alumni's enthusiasm, EWH is creating an SI alumni-only three-week program in Nepal, scheduled for January 2016.

As we increasingly work on both sides of the equator, and host students from both hemispheres, these three-week programs will now be the January Institutes.

### Guatemala

Fourteen students repaired 48 pieces of equipment over three weeks, including bilights, hospital beds, ECGs, and a dialysis machine. Four students were from Rochester Institute of Technology, five from George Mason University, and five were Summer Institute alumni.



*"The infant warmer looked so bad, I could tell the problem right from the start. We made a new push button and gave it a new light, and gave it some love. Five minutes later there was a baby in it."*

*-Lindsay Demblowski, Rochester Institute of Technology*

## 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 2015, 45 student chapters from universities all over the world affiliated with EWH.

Boston University	University of Arkansas
California Polytechnic State University-San Luis Obispo	University at Buffalo
Case Western Reserve	University of California-San Diego
Chung Yuan Christian University	University of Colorado-Boulder
Clemson University	University of Connecticut
Cornell University	University of Guelph, Canada
DeVry University	University of Florida
Duke University	University of Ghana
Elon University	University of Illinois-Chicago
Georgia Institute of Technology	University of Iowa
ITESM Monterrey, Mexico	University of Missouri-Columbia
Johns Hopkins University	University of New South Wales, Australia
Lovely Professional University, India	University of Portland
Makerere University, Uganda	University of Rochester
Northwestern University	University of Science & Technology, Yemen
Pontifical Catholic University of Peru	University of Texas at Austin
Purdue University	University of Toronto
Robert Morris University	University of Wisconsin
Rochester Institute of Technology	Vanderbilt University
Royal Melbourne Institute of Technology, Australia	Virginia Commonwealth University
Technical University of Denmark	Virginia Tech
Texas A&M University	Washington University-St. Louis
	Yale University

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



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



*UCSD, EWH's 2015 Chapter of the Year, hosted the HealthHacks Hackathon.*

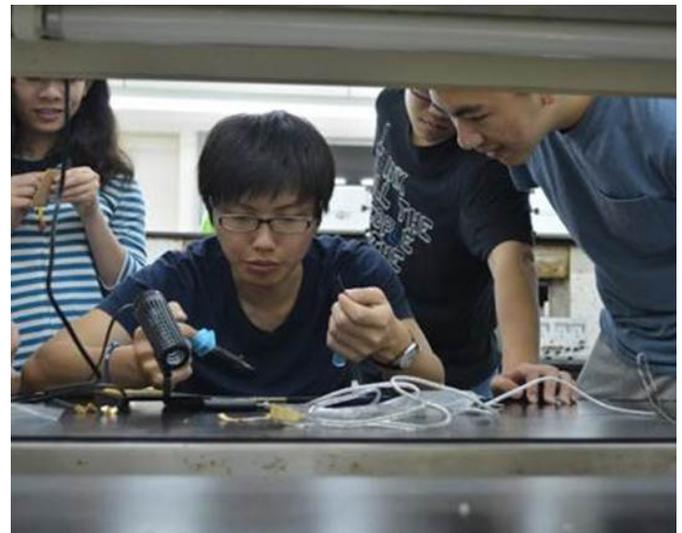


**STEM Outreach** - University students volunteer to teach K-12 students, sometimes using EWH-designed Kits, introducing young students to the possibilities of biomedical engineering careers.

The UCSD Chapter partnered with Casa Familiar to connect 150 low-income students with passionate UCSD engineering students. Our Cornell Chapter taught local Girl Scouts how to solder, and our CYCU Chapter in Taiwan co-hosted a STEM Camp for 60 students.

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

Many Chapters organized workshops and Kit builds to improve students' understanding of welding, 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. Teams may also conduct their own research to find useful projects. Eleven teams competed in the 2015 Design Competition.

The 2015 winners are:

*1st place: University of Texas at Austin Chapter, Low Cost Patient Monitor*

*2nd place: Virginia Tech Chapter, Pulse Oximeter*

*3rd place: University of New South Wales Chapter, Multi-Colored LED Otoscope*

## STEM K-12 Education

EWH continued its partnership with the Biogen Foundation in 2015 to reach over 1,000 elementary, middle, and high school students with activities such as designing an air-conditioned glove for Ebola healthcare workers and a test lung for ventilators. Additionally, EWH trained 300 teachers so that learning can grow exponentially. The EWH STEM program introduces young students to the challenges of healthcare delivery in developing countries and demonstrates through hands-on learning how science, technology, engineering, and math can help to solve these global challenges.

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



*Summer Institute Tanzania participants brought STEM education to The School of St. Jude in Usa River, Tanzania. Together with local students, they built Optical Heart Rate Monitor Kits and demonstrated the power of engineering to create positive change.*

*With our “Protect the Pump” activity, students design and build a protection device for a medical suction pump that will prevent fluid from getting into the motor and destroying the pump.*

*Check out these middle school students at Wilson, North Carolina’s engineering camp testing their devices!*



## BMET Training & Centers of Excellence

While our Summer Institute teaches 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 strengthen 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 six countries – Rwanda, Honduras, Ghana, Cambodia, and Nigeria, with a new program beginning in Ethiopia – to train local hospital workers and students to become fully qualified BMETs. Each program includes a three- to four-year curriculum, which then becomes an accredited academic program, and each is specially designed to fit the needs of the local population. We also train future trainers who soon take over the program, with the ultimate result that we leave the countries we work in with a sustainable source of well-trained BMETs.

### Highlights of 2015:

- *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.



We are currently training 19 BMET students in partnership with the Lagos University Teaching Hospital. The program now has a fully functioning training center, with all the locally built work benches and stools in place, and the necessary tools available.



- *Cambodia* - 79 students are in training, along with faculty who are in training to become the new teachers of the program. The first cohort will graduate in April 2016.



BMET Cambodia has developed strong mentorship through EWH's on-the-ground staff and, now, local faculty visiting each student in their hospitals to assist and guide students' learning in a real world environment.

The Cambodian BMETs are now also operating the new Center Of Excellence (COE). Thanks to the GE Foundation, this state-of-the-art biomedical workshop is well equipped and will serve as a top-notch location for repairing equipment and training future BMETs.



- **Rwanda** - 61 students have graduated from the BMET Rwanda Training program and now work in hospitals throughout Rwanda. Together with our educational partner, IPRC, 157 more students are currently in training. Since the program started in 2009, Rwanda has progressed from a country with almost no trained BMETs to a country with 218 BMETs trained or in training, working in hospitals to improve the health system.

In addition, EWH is training 11 faculty members who will help transition the program into a longterm sustainable endeavor run by IPRC.



We have also started to see how a reputable training program can positively impact an entire region. IPRC has accepted students from neighboring Uganda, Tanzania, and Kenya. In May 2015, our Rwandan team created the Rwanda Association of Medical Engineering (RAME). RAME's conference drew BMETs and Ministry Officials from Kenya, Uganda, Rwanda, Tanzania, and Burundi, creating a truly international exchange of biomedical knowledge.



- **Honduras** - Started in 2010, the Honduras BMET Training program has been a great success. In 2014, EWH transitioned the program to our educational partner, the *Instituto Nacional de Formación Profesional* (INFOP), and it has been a fully self-sustaining operation for over a year.

INFOP continues to train and graduate BMET students. They are now accepting high school graduates, thus building a strong foundation for the next generation of health care in Honduras.

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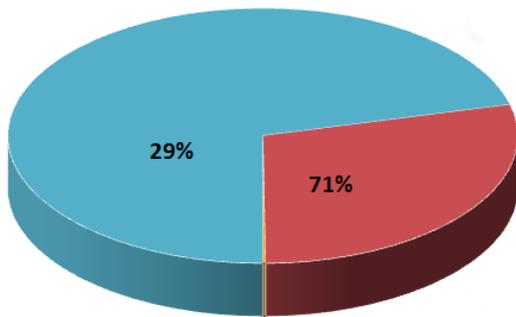
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## Engineering World Health Statements of Financial Position

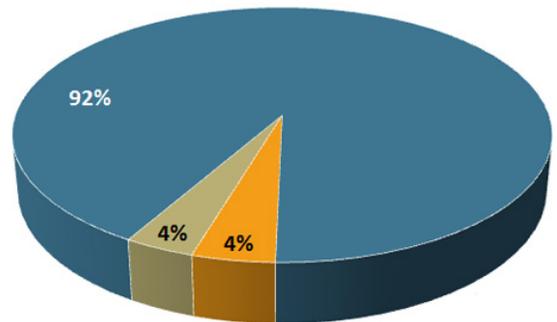
Statement of Activities	FYE 9/30/15	FYE 9/30/14
<b>Revenue, Support, &amp; Other Income</b>		
Grants & Contributions	\$1,423,367	\$1,538,268
Program Fees	576,340	564,643
Investment & Other Income	(3,479)	17,707
<b>Total Revenue, Support, &amp; Other Income</b>	<b>\$1,996,228</b>	<b>\$2,120,618</b>
<b>Expenses</b>		
Program Expenses	\$1,654,122	\$1,676,750
Management & General	77,789	73,075
Fundraising	65,916	92,487
<b>Total Expenses</b>	<b>\$1,797,827</b>	<b>\$1,842,312</b>
<b>Net Assets</b>		
Change in Net Assets	\$198,401	\$278,306
Net Assets at Beginning of Year	\$1,552,855	\$1,274,549
Net Assets at End of Year	\$1,751,256	\$1,552,855

*Income*



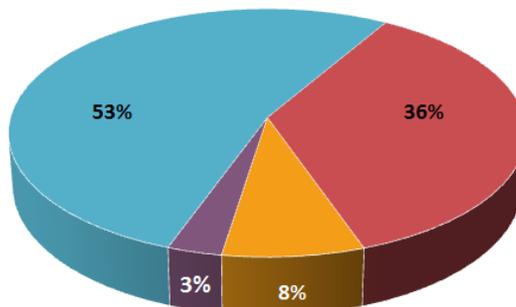
•Grants, Contributions •Program Fees •Investment & Other

*Expenses*



•Program Expenses •Management & General •Fundraising

*Spending by Program*



•BMET Training •Summer Institute •Student Programs •Other

## 2015 Funding Partners

### Foundation and Corporate Donors:

BD Medical	Max & Victoria Dreyfus Foundation
Biogen Foundation	MedTech
Derfner Foundation	Ronda E. Stryker & William D.
FJC	Johnston Foundation
GE Foundation	The Donald & Alice Noble
Hamilton Roddis Foundation	Foundation
International Foundation	

*Special thanks to the Wallace H. Coulter Foundation for the early and generous support that enabled us to grow.*

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