Message from the director

This year marks the fifth and final year of Oberlin’s current grant from the Howard Hughes Medical Institute (HHMI), which seeded the creation of the Center for Learning, Education and Research in the Sciences (CLEAR) and provided the funds to start or scale up all of the programs in our purview. These include: the Quantitative Skills Center, a drop-in center staffed by peer tutors providing assistance for courses and assignments involving numbers and computation across the curriculum; Oberlin Workshop and Learning Sessions (OWLS), which offer peer-led instruction to supplement lectures and model effective learning strategies in a variety of introductory and intermediate science and math courses; and curriculum-development grants and workshops to support faculty efforts to expand quantitative and interdisciplinary approaches.

Although these activities have been foundational to CLEAR’s work, the creation of a center that interfaces with all of the natural sciences division has brought additional and unexpected, yet welcome, outcomes. Early in the Center’s existence, we were approached by faculty in Gender, Sexuality and Feminist Studies about partnering on programming at the intersection of science and society. The result is the ongoing Roots & STEM series, which has also benefited from collaboration with the Multicultural Resource Center (MRC). Roots & STEM events in 2015-16 included a symposium on science, social engagement and social justice, and in September 2016 CLEAR, the MRC, and the Department of Chemistry and Biochemistry jointly hosted Dr. Carlos Crespo-Hernández of Case Western Reserve University. He both gave a talk on his research and took part in a lunchtime meeting with students about diversity in the physical sciences and his personal journey. The Allen Memorial Art Museum (AMAM), interested in connecting with science faculty more meaningfully, also approached CLEAR early on to collaborate on a brochure for an exhibit of Edgar Edgerton’s photographs, to which several faculty from the division of natural sciences contributed. Since then, CLEAR and numerous science faculty have partnered with the AMAM and its world-class collections and resources.

Looking back at the first four years of CLEAR, we in the HHMI leadership team at Oberlin – and many students, faculty, staff, and recent alumni with whom we have spoken – find that the Center has made a lasting impact on Oberlin and become part of the fabric of campus. We hope to further the visibility and impact of the Center across campus. To that aim, in fall 2016 we have initiated outreach events targeted to partners that engage a broad range of students, including the Career Center, Multicultural Resource Center, Student Academic Services, Athletics, and the offices of the Dean of Students and International Student Services. In addition, we are excited that Oberlin was one of 96 colleges and universities nationwide invited to submit a full proposal to HHMI’s 2016 “Inclusive Excellence” grant competition and look forward to ways that CLEAR will continue to support diversity and inclusion in the sciences.

It has been a fruitful first four years. We hope that you will join us in celebrating accomplishments of 2015-16 and participating in programming – described in the newsletter – planned for the 2016-17 academic year.

-Marcelo Vinces
In conjunction with a 2015-16 yearlong focus on persistence in Science, Technology, Engineering, and Mathematics (STEM), CLEAR and the Center for Teaching Innovation and Excellence (CTIE) hosted a talk and faculty workshop by Mary Pat Wenderoth (University of Washington) on “Incorporating Active Learning in the Classroom” on May 9, 2016. Twenty-six faculty and staff members from 14 departments participated. Dr. Wenderoth’s talk summarized the research results that provide robust data on teaching methods that increase student achievement. Dr. Wenderoth and colleagues recently published a meta-analysis of 225 papers that compared student performance under active learning versus lecturing in undergraduate courses across the STEM disciplines. The results indicate that, on average, students are 1.5 times more likely to fail when being lectured to than when taking the same course with an active-learning component, and that active learning increases exam scores by almost half a standard deviation. Post-talk, a faculty workshop engaged participants in discussion of the way even small changes can close the gap between our teaching and student learning.

Curricular Development

Over the HHMI grant period, curriculum-development grants have supported the launch or revision of 28 courses. These range from quantitative skills-oriented seminars for first-year students and revised introductory Physics labs, to upper-level courses in Biochemistry, Biology, Geology, Neuroscience, Statistics, Environmental Studies, and Psychology. The breadth of classes will ensure a lasting impact on the curriculum. Many of the revisions involve interdisciplinary themes; four sets of supported courses involve faculty from more than one department. As part of their application for competitive curriculum-development funding, faculty provided an assessment plan for their project. CLEAR aided faculty in their assessment efforts, helping build a positive view of assessment that will extend beyond the grant period.

In 2015-16, four projects were funded through the final curriculum-development grant competition. Revised courses introduced in 2015-16 build on the theme of interdisciplinary science education with joint activities in three sets of classes: Biochemistry (Chemistry 374) and Religion, Ethics, and the Environment (Religion 248) on the biological impact and ethical implications of pesticide use; Environmental Studies 101 (Environment and Society), 322 (Energy and Society) and 354 (Ecological Communication) on electricity and water use in Oberlin, through vertically integrated modules; and a multi-disciplinary set of linked modules on the human experience of pain in Organismal Biology (Biology 100), Introduction to Comparative Literature (Comparative Literature 200), and Property and Possessions (History 303).

While we are pleased to have supported four clusters of linked courses, barriers to interdisciplinary education persist, particularly within STEM disciplines, given their verticality and rigidity comparative to the humanities and social sciences, commitments expected at the departmental level to disciplinary content, and the time needed for faculty to undertake major revision of course offerings. STEM/non-STEM partnerships proved more accessible and appealed to faculty within Oberlin’s liberal arts context as a way of advancing interdisciplinary learning. In fall 2017, as part of implementation of its recently approved strategic plan, Oberlin will launch a new initiative of theme-based course clusters that will bring together students and faculty from the College of Arts and Sciences and Conservatory of Music to explore complex topics and “grand challenges” of the 21st century from trans-disciplinary perspectives. STEM fields have much to contribute to this approach, and lessons learned from the HHMI group curriculum-development projects can inform these efforts, which will are expected to greater visibility to and recognition for cross-departmental teaching collaborations.

Find CLEAR on Social Media
The OWLS program now supports approximately 20 classes per year and is highly regarded by faculty and students, and being an OWLS mentor is seen as a desirable student leadership position. In fall 2015 CLEAR had 22 OWLS peer tutors for 10 courses in 5 departments. In spring 2016 OWLS supported 23 peer tutors for 11 courses in 6 departments. Total (unduplicated) enrollment in OWLS courses in 2015-16 was 1,011.

In surveys of courses served by OWLS, feedback from students who attended OWLS sessions was overwhelmingly positive, with students reporting that the sessions helped them reflect on and assess their own knowledge; complemented learning in classroom; provided opportunities for practice in groups; and were enjoyable.

In general, students who attend OWLS regularly receive higher course grades. In Environmental Biology (Biology 103), students who regularly attended OWLS sessions performed a full grade step higher than those who did not. One set of quantitative data CLEAR is tracking is the DFW rate (grades of D, F, or withdrawal) in courses served by OWLS. In Biology 103, for example, DFW rates have dropped from 14% in 2013-14 (before OWLS support for the class) to 4% in 2014-15 and 2% in 2015-16, both years in which the course had OWLS sessions. CLEAR notes that DFW rates are most useful for courses taught repeatedly by the same instructor, as in this case.

Students who attend OWLS most frequently go on to become OWLS leaders, advancing one of the grant aims of leadership development. Reflections by OWLS leaders clearly demonstrate the program’s impact on them professionally and personally. In reflections about their experiences, OWLS leaders most frequently noted: improvement in their ability to speak in public, facilitate groups, teach, and practice leadership skills; better understanding of the course material, broader perspectives of their own learning; and improved ability to explain complex scientific concepts.

The academic and broader benefits of these peer-mentoring initiatives are recognized by faculty, with — as expressed by a tenure-track faculty member to CLEAR Director Marcelo Vinces — OWLS representing an interdisciplinary cohort of peer educators that facilitates community among different majors. The same is true for the QS Center, with both staffed by a diverse group of students (60% women, 14% URM in 2015-16) from different majors (16 in 2015-16).

“OWLS helped me not only to learn the material better, but also to improve on my public speaking and teaching/leadership skills. Since I began running OWL sessions my sophomore year, I have gained so much more confidence in my ability to speak in front of others, and in my ability to help other students understand course material.”

“I feel like I was really able to help make students feel less stressed/worried about their assignments. I also feel like I taught a lot of students to break problems up + approach them step-by-step well.”

“OWLS have been very effective so far. I have been to every session and I would say OWLS greatly supports and aids my learning of the material. Delia and Ben [the OWLS leaders] are awesome and very very helpful!”

Oberlin Workshop and Learning Sessions

OWLS Feedback

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ABRCMS 2015

CLEAR facilitated presentations by seven students at the Annual Biomedical Research Conference for Minority Students (ABRCMS) in Seattle in November 2015. The Oberlin team included students Cassie Dean, Gai-llyn Gabriel, Jess Hubert, Khalid Taylor, Mina Huerta, Peace Iyiewuare, and Zoii Barnes-Scott and faculty and staff Afia Ofori-Mensa, Gunnar Kwakye, Leslie Kwakye, Marcelo Vinces, and Siobhan Robinson. All of the students presented posters of their research, except Mina Huerta, who was selected to give an oral presentation. Cassie Dean and Khalid Taylor won awards in the neuroscience division, an increasingly competitive area. ABRCMS offered opportunities for students in all fields in the natural sciences and engineering to present oral or poster talks and attend seminars by researchers, keynote talks, and professional-development sessions. The group also had the pleasure of meeting Oberlin alumna Dr. Brandy Pickens ’99.

Student Awards

Jennifer Jimenez ’17 (QS tutor)
HHMI EXROP Fellow
Jimenez, a biology major and chemistry minor, was accepted to the HHMI Exceptional Research Opportunities Program (EXROP) for summer 2016. Collaborating with David Ginsburg at the University of Michigan, Jimenez was part of an investigation of the components of the mammalian blood-clotting system and the genetics behind disorders such as hemophilia. Her project focused on the role of the COPII secretory pathway in hematologic diseases by using the genome-editing technology known as CRISPR to modify COPII genes in human cell lines.

Holden Lai ’15 (Former OWLS leader)
NSF Graduate Research Fellowship
Lai won a National Science Foundation Graduate Fellowship award for Chemistry of Life Processes. He is now attending Stanford University.

Louisa Liles ’18 (Former OWLS/QS tutor)
Dalai Lama Fellow
Rising third-year Louisa Liles will combine her background in performing arts with focused studies in mathematical economics to bring hands-on arts enrichment to disadvantaged youth in Dallas as a 2016 Dalai Lama fellow. Liles, a native of Plano, Texas, is using the grant to build a model for high-quality instruction in dance and music for children in West Dallas, an impoverished region that has long been plagued by environmental and institutional racism.

Benjamin Rabin ’16 (Former OWLS leader)
Fulbright ETA Poland

continued on next page...
Still Going STRONG

Now in its second year, the Science and Technology Research Opportunities for a New Generation (STRONG) program represents Oberlin’s commitment to meeting the needs of students from a variety of backgrounds and experiences and helping them succeed in STEM fields and research. Through a summer residency program, a cohort of 11 students entering their first year get a head start on settling in and making connections with faculty and staff across campus. The program offers early exposure to campus and the city of Oberlin and helps STRONG scholars build relationships with faculty, students, and staff who can help reinforce their academic and personal success. The program targets admitted students who identify as either first-generation college students, Pell Grant-eligible, women, or people of color.

STRONG scholars are paired with faculty who serve as research mentors. During the four-week summer residency, each scholar works full time in a research group with current Oberlin students who are conducting projects under the guidance of the faculty mentor. Scholars have the opportunity to continue in the same research group for their first Winter Term project.

The program benefits include a $2,000 stipend for full-time work in a professor’s research group through the month of July; fully funded housing and dining for the summer, as well as a $400 benefit to cover round-trip travel to and from Oberlin for the summer residency; and a book award to offset the cost of course textbooks in the first year.

With their first year behind them, STRONG scholars and faculty mentors agree that the program has been transformative. For students, the emotional support, academic advising, and early lab skills made transitioning from high school to college much less daunting. For faculty, the program identifies talented and motivated research students with the potential to collaborate with faculty on research throughout their years at Oberlin.

OSRI: Oberlin Summer Research Institute

In summer 2016 the Oberlin Summer Research Institute sponsored professional-development and social activities for more than 100 students conducting research on campus, the large majority of whom were pursuing research in the natural sciences. OSRI programming helped build community among students and faculty across departments and gave students opportunities to discuss and reflect on their research. A partnership of the Office of Undergraduate Research and CLEAR, OSRI hosted many well-attended events that enriched students’ experiences of living and conducting research in Oberlin during the summer, including a visit to Cleveland museums, blueberry picking, a bike ride to Elyria, a student panel, and workshops on research ethics, working effectively with mentors, and other topics.

Benjamin Rabin, a history major and chemistry minor, was awarded a Fulbright English Teaching Assistantship in Poland. Rabin plans to apply to medical school following his fellowship and is exploring a possible career in oncology or infectious diseases.

Vera Rudi ’16 (Former OWLS leader) Watson Fellow
Rudi, an aspiring neuroscientist and accomplished pianist and film actor, will immerse herself in meditative cultures in Thailand, India, Japan, and South Africa to enrich her scientific understanding of the ways meditative practices affect cognitive control.

The Celebration of Undergraduate Research

The 2016 Celebration of Undergraduate Research took place on October 2. The event is an annual partnership between the Office of Undergraduate Research and CLEAR. Over the course of the daylong academic conference, almost 90 Oberlin students – from 35 programs and departments in the College and Conservatory – presented posters and talks about research they conducted on campus and at various sites around the country during summer 2016. Fifty-six students presented their research at the poster session, and 32 students gave talks highlighting their research. The keynote address, “Activism Meets Scholarship: The Long Road to Marriage Equality in Rowan County,” was delivered by Bernadette Barton ‘88, Professor of Sociology and Women’s Studies at Morehead State University. The 2016 Celebration event is organized in conjunction with the National Academy of Sciences Symposium, scheduled for October 27 and 28, 2016.
On May 6, 2016, America Reads and the Prospect Elementary School parent-teacher organization hosted the third annual STEM Night at the Oberlin College Science Center. More than 60 children engaged in interactive science demonstrations and experiments. Leading activities were faculty, staff, and students from Chemistry and Biochemistry, Computer Science, Environmental Studies, Geology, Math, Neuroscience, Physics, Psychology, and Technology in Music and Related Arts. The Black Scientist Guild and Get With the Program (which creates content, products, and offers services that generate interest and participation in STEM fields among kindergarten-fifth grade students, with a particular focus on girls and children of color) were also involved. STEM Night was sponsored by grants from the Bill Long Foundation, the Bonner Scholars Program, and the College’s Bonner Center for Service and Learning.

The 2016-17 year will be a busy one for Roots & STEM events. On September 22, 2016 Dr. Carlos Crespo-Hernández of Case Western Reserve University presented two sessions: “Diversity in the Physical Sciences: A Personal Journey,” a lunchtime talk with students, and “DNA + Light: From Nucleic Acid Bases to Modifications that Enable Damage to Carcinoma Cells” a chemistry talk open to the public. Dr. Crespo-Hernández’s visit was coordinated by CLEAR, the Multicultural Resource Center, and the Department of Chemistry and Biochemistry. Plans are in development for spring 2017 visits by Claude Steele (Executive Vice Chancellor and Provost, the University of California, Berkeley) and Mark Connolly (Associate Research Scientist with Wisconsin Center for Education Research at the University of Wisconsin, Madison).
Neuroscience in the Art Museum

Lodewijk (Oidie) Kuijpers ‘15, a studio art and neuroscience double major, worked at the College’s Allen Memorial Art Museum (AMAM) as a student assistant and docent, and, after graduation, as a full-time Curatorial Assistant in the Office of Academic Programs. Oidie’s neuroscience seminar paper was on multisensory perception in painting. Oidie contributed the following:

“The museum has welcomed many neuroscience courses and continues to do so each semester. These course visits, which are often featured more than once in a semester’s syllabus, have included different exercises aimed at giving neuroscience students both a way through which to approach works of art and a means through which to better understand their neuroscience course material. There have been sessions purely focused on building students’ visual acuity, helping them to critically read visual data and to understand the importance of the image as a communication tool, as well as the complexities of the visual process itself and the benefits of continued close looking. For instance, a neurotoxicology course discussed toxins, such as lead - and the ramifications of these existing in art works and decorative objects - as both a metal alloy and pigment.

To offer another example: perceptual and cognitive neuroscience courses have discussed the brain processes, which affect aesthetic valuations and how these valuations evolve through continued viewing and acquisition of knowledge about a work of art.

Although what neuroscience students have done at the AMAM is theoretical, and we cannot be sure of the conclusions we have reached, neuroscience course visits to the museum offer an opportunity for students to theorize as to how certain felt sensations are produced in the brain, and how brain processes might physically affect our cognitive state. At the AMAM students work backwards from a felt sensation to the neural processes that might create it. Much like working in a lab, these museum visits are hands-on, require active problem solving, collaboration, and teamwork.

Visits to the AMAM have pushed neuroscience students like myself to consider the importance of continually asking questions, of approaching questions from different angles, understanding the interconnectivity of everything we do, and further provided a lens through which to engage with the arts.”

Student Skill Sessions

Student-centered workshops were held on various topics during the year. In fall 2015, three sessions were organized on spreadsheets and graphing with Excel, led by Marcelo Vinces and past OWLS leader Kendra Lian. Student Ren Wiscons, also an OWLS leader, led a workshop on using Adobe Illustrator for science.

CLEAR’s fourth annual Lab Crawl was held on October 30, 2015 to showcase the significant student-faculty STEM research that occurs at Oberlin and to help students explore research opportunities on campus. The 2015 Lab Crawl hosted 33 stations in 13 departments and an estimated 171 visitors. The fall 2016 Lab Crawl will take place on Friday November 18. Lab Crawl is an excellent opportunity for students to explore lab spaces, meet students and faculty conducting research on campus, and learn – from peers in a fun, informal setting – about the kinds and quality of research Oberlin undergraduates carry out on campus.
OSRI Lab Profile: Daniel Mukasa ‘19

Daniel Mukasa is a rising sophomore conducting research in the lab of Professor and Chair of Physics Stephen FitzGerald.

What kind of work is your lab doing over the summer?

Stephen FitzGerald’s research is focused on looking at the physical nature of metal organic frameworks (MOF’s). MOF’s can be imagined as microscopic sponges that have the capability of holding atoms such as hydrogen, nitrogen, or carbon dioxide, just how a sponge can hold water. Therefore, these gases can stick to the MOF and then be easily removed, either by an increase in temperature or an increase in pressure. One of the main points of interests with MOF’s is there use in the hydrogen storage industry. If we can produce hydrogen in an efficient manor and store it in a MOF, as opposed to a heavy hydrogen tank, we can us hydrogen as a safe zero emission fuel source. This could then ideally lead to us having cars run off only electricity and hydrogen gas.

What is your role in that work, as a student researcher?

As a student researcher I take care of most of the experimental aspects of the research. This includes conducting experiments and analyzing the data said experiments produce under the guidance of Steven Fitzgerald. Physicists are also generally known for answering why things happen in some way, so as common practice I also work with as much of the theoretical aspects of the research as I can understand. This generally involves studying quantum mechanics and occasionally doing some calculations to aid our research. This adds more clarity and purpose to the work we do in the lab.

What is it like to do summer research at Oberlin?

Research over the summer is always a great time. Since there’s no classes going on students can work on research without the constant stress of academia, which is what most people enjoy the most about their field of research. This allows for a lot more time in which you can become as immersed in research as possible, which is almost impossible during the school year. There’s also the benefit of being paid to do said research, which is a great plus on its own since you get paid for doing what you love.

What are your future goals in science?

Over the next year or so I’m planning on continuing an independent project that has a little to do with mathematical physics, special and general relativity, and computational modeling. Later I will likely go back to research with Professor FitzGerald again. After college I hope to become involved in more research at a graduate program in either mathematics or physics. Regardless of what subject I become most involved in, I want to participate in research that has a potential of making some difference to the world around us.

Read other lab profiles and find more information at:

oberlinclear.tumblr.com
facebook.com/oberlincollegeclear
twitter.com/oberlinclear

OBERLIN AND THE NATIONAL ACADEMY
OF SCIENCES (NAS)

Oberlin and the National Academy of Sciences: Celebrating the Impact and Promise of the Sciences at Liberal Arts Colleges, held on October 27 and 28, 2016, will be part symposium and part special reunion for NAS alumni. Returning alumni will interact with current students and faculty and share highlights of their professional journeys. Dr. Robert Singer ’66 and honorary doctorate ’16 (Chemistry, NAS 2013) and Dr. Larry Zipursky ’77 (Chemistry, NAS 2009) initiated plans for this event and served on the planning committee.

Twenty-two current members of the National Academy of Sciences earned undergraduate degrees at Oberlin; one NAS member attended as an undergraduate but left early to pursue graduate studies. This is an impressive accomplishment for an institution of Oberlin’s size and an achievement to which no other liberal arts college comes close.

The symposium will raise awareness of and celebrate the sciences at Oberlin and other liberal arts colleges. The event will include “TED talks” by NAS alumni, poster presentations by students, a career session, and reception.

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