Dr Rafael Verduzco giving a tour of his lab to REEMS participants

The REEMS Programme: discovering untapped talent

To many, materials science represents a fairly inaccessible, complicated topic of science requiring a highly academic approach. **Mr Bartlett Sheinberg's** Research Experiences and Exploration in Materials Science (REEMS) Programme aims to overcome this – contextualising materials science for community college students. The programme's approach also aims to instil confidence in these students and provide them with skills to help them progress in their academic careers.

Materials science is a topic involved in every facet of life. From the car you drive to work, to the clay on the white cliffs of Dover, materials are everywhere and have a significant impact on life as we know it. Understanding the extent of this impact is critical and should be accessible to whomever is interested, regardless of academic background or financial status.

Delivering materials science to serious-minded students is vital not only for developing the next generation of materials scientists and engineers, but for generating a technically prepared workforce. The study of materials provides an academic umbrella under which community college students can appreciate concepts in the physical and biological sciences, engineering and computational science. An introduction to materials provides an important context for appreciating their coursework and generates an invaluable self-confidence as they move forward to complete their undergraduate degree and transition to graduate school or into the technical workforce. It is in this area that Houston Community College's (HCC) Mr Bartlett Sheinberg, and his increasingly popular REEMS Programme, prevail.

OPENING DOORS

This programme – entitled Research Experiences and Exploration in Materials Science (REEMS) – is funded by the Division of Materials Research at the National Science Foundation (NSF) and is aimed at bridging the gap between community college and university for talented students at HCC who will be transferring primarily into engineering, the physical and biological sciences, and computational analysis.

As Mr Sheinberg describes it himself: "The REEMS programme gives students an opportunity to see first-hand the broad scope of materials science. These experiences combine academic experience with recognition of the roles which materials can play in solving important societal issues and lay the foundation for the identification of interesting and meaningful

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career opportunities. Academic and career exploration really is the key objective of the REEMS programme. We provide the means for students to take the first steps towards exploring academic pathways and potential careers."

FINDING THAT SPECIAL SOMETHING

Following the programme's success since its inception in 2015, Mr Sheinberg's role as mentor, ambassador and principal investigator has become ever more important in identifying ideal candidates. Each autumn, students are recruited and, through a highly competitive process, are selected for the following year's summer research experience. During the autumn semester an additional cohort of students is recruited to apply for entry into the seminar series "Impact of Materials on Society" (IMOS). Over the autumn semester, REEMS staff provide a series of seminars on university transfer opportunities, networking opportunities with materials professionals, and one-on-one transfer guidance. The REEMS programme welcomes students across all academic interests and majors.

During the recruitment process, for either the summer research experiences or into the IMOS seminar, students' grades are an important indicator. However, their attitude towards their study and a demonstrated interest in discovery are critical selection criteria.

"Many students come into my office and say, 'I really want to do such-and-such', and one of the things I've always tried to do is identify those students who possess that intangible gleam in their eye. One of the objectives of the REEMS programme is to quantify what that gleam in the eye means in terms of their future academic pursuits and their ability to appreciate the opportunities which the REEMS programme provides as they consider their futures."

THE IMPORTANCE OF DIVERSITY

HCC is an open admission institution which provides students with a cost-effective education during their time at Houston Community College and supplies a second chance for those students to prove themselves academically, as well as the opportunity to enhance their maturity level, so that they can succeed in their upper division work. Community colleges, across the United States, are home to a highly diverse population of individuals from different nationalities, backgrounds and situations. Many of these students do not realise their own potential talent and abilities – REEMS provides that opportunity.

Because of this, Mr Sheinberg offers an individual approach to interviewing each REEMS applicant to ensure that there will be a demonstrated mutual benefit for the student and opportunities provided by the programme. He said: "Applicants might have a great academic background and our selection of students is based upon **why** they want to become involved in the REEMS programme and what their expectations are from it. I like to make sure that there is an overlap between what the programme can offer, and what the student hopes to take out of it.

The programme forced me to become a better, more vigorous student and, although I found it hard at first, I truly appreciate what it, and Dr Sheinberg, has done for me

REEMS student Raymond McCoy presents his poster from the 2016 REU

"At HCC, you have a population of roughly one third African-Americans, one third Hispanics and the final third made up of both Caucasians and Asians. Funding agencies, universities and employers are interested in looking at students who originate from diverse cultures, are highly motivated and have demonstrated a strong work ethic. REEMS plays a role in identifying these talented students."

For Dr Megan Robertson at the University of Houston, one of REEMS' partner institutions, having this diversity is a real benefit. She said: "My university has a significant number of students who transfer from community colleges, so this is an important avenue for us. We have a lot of students who work while they're at school, or maybe they're the first person in the family to go to university – that sort of experience.

"Having this diversity is a really nice aspect of being in such a multicultural city, as it can offer new perspectives to research – I think there are only advantages to having that level of diversity in the programme."

REEMS students at the West Houston Center with staff members Dr Yibran Pereramercado and Dr Gizelle Davis – they are working on the scanning electron microscope, on loan for the REEMS Programme from JEOL, USA

IMPACT OF MATERIALS ON SOCIETY

During the spring term, the IMOS seminar provides a significant emphasis on contextualising and teaching students about the impacts of materials on society. This includes "broadening students' horizons" in terms of how materials have shaped cultures, geo-politics and technology advances over the past three to four thousand years.

Topics in this seminar series discuss the intersection of materials, technology, anthropology, economics and politics. Mr Sheinberg notes that IMOS plays an important role in helping students to realise their career path.

He said: "As an example, IMOS begins by exploring the cultural aspects of clay and the impact of it on cultures, and the evolution of the material to include superconductive materials. It's interesting to see how the transition changes student perceptions as we explore both technology, cultural developments and impacts.

"One of the results of this seminar is that students start to ask themselves: if I want to have a career in science, engineering or even materials research, what impact can I have on society as an engineer or a scientist? How am I going to impact society? What problems can I solve? The identification of societal problems and challenges and a realisation of the importance of materials science in solving those challenges is one of the key objectives of the seminar series."

TEAMWORK MAKES THE DREAM WORK

Mr Sheinberg also highlights the concept of teamwork as a key benefit from the programme, through the IMOS seminar series and preparation for the summer research experiences.

"Students who participate in the REEMS programme have an opportunity to participate in teamwork. One of the objectives of the programme is to demonstrate the value of working and contributing to team activities. The structure of the IMOS seminars incorporates lectures and group presentations by REEMS students. These presentations are based upon contributions from each team member, incorporating and articulating their results to fellow students, faculty and guests during the seminar and responding effectively to questions, on an individual basis and as a member of a team effort. These experiences are important for those REEMS students who participate in summer research and present their findings at the REEMS REU poster session at the end of each summer."

Mr Sheinberg noted that the REU experiences provide the first formal participation in team experiences for many of these students. They learn the importance of sharing results, seeking assistance from research staff and a realisation of their respective individual roles in addressing research challenges.

The REEMS programme is unique among conventional REU activities. REUs are generally sponsored by research universities and recruit lower and upper division students, often from community colleges. Students participating in the REEMS REU are recruited and placed in university research projects by REEMS staff, in close collaboration with research faculty. REEMS has established partnerships with regional universities and faculty from

the University of Houston, Rice University and the University of Texas Health Science Center – Houston. In 2016 twelve students participated in the REEMS REU and in 2017, with the addition of a new faculty member at Rice University, fourteen students will be participating in the REEMS REU.

IDENTIFYING TALENT

Mr Sheinberg describes how almost all REEMS REU students finish their summer research experiences with a high level of self-confidence, and the realisation that they have both academic potential and the talent to consider new and challenging academic and career pathways. The increase in confidence, tied with the realisation of their talent, are strongly influenced by each of the seven research faculty during their summer experiences. One of the objectives of the REEMS programme is to provide each student with the ability to determine their own academic and career futures.

This self-confidence is something Zeshan Rizvi, a member of the 2016 REEMS REU and the forthcoming 2017 REEMS REU, has experienced. He said: "When I first started the programme, I wasn't too sure exactly what I would get out of it – it seemed a little too good to be true, but it turned out to be the real deal. Initially, I found it a bit overwhelming with the duties and responsibility given to you. I also found it hard to get used to the workload and the vigorous routine of being part of a research programme and a research group, but eventually I learned to really enjoy it.

"For me, the experience I gained just from being a part of the research group, learning about what they do on the front lines of research on a daily basis, was the most important thing. The IMOS seminar and REU forced me to become a better, more vigorous student and, although I found it hard at first, I truly appreciate what it has done for me."

MAKING UNIVERSITY ACCESSIBLE

Another former REEMS student, Raymond McCoy, even said that without the programme, he would never have even considered going to university – seeing a life in the workforce for himself instead.

Above: Mr Bartlett Sheinberg, leader of the REEMS Programme

Left: Dr Megan Robertson's research group and REEMS students

He said: "I wasn't planning on going any further than my associate degree, but the programme sets you up with some great university contacts. It really amplifies the opportunities you receive going into the next stage of your academic career, and it sets you up with skills that make you distinct from other candidates going for jobs, positions, internships – whatever it may be."

However, Dr Robertson believes the programme does not only benefit the REEMS students themselves, but her lab as well. In fact, she was so impressed by the quality of the students she mentored last year, that she decided to keep them on.

She said: "The students I had last year were excellent and I managed to find a way to continue their work in my lab even after the summer programme was done. After all, the REEMS programme doesn't just provide an opportunity for them, it provides an opportunity for us as well. In the end, we could continue the work they had done over the summer, and we're even going to get a research publication out of their work."

FUTURE PLANNING

Mr Sheinberg looks forward to other community colleges and university partnerships emulating part of the REEMS programme. Part of his job is to work with interested community college and university partnerships to discuss funding and structural and programmatic aspects which are unique to each partnership. Mr Sheinberg mentioned that while he and his staff play an important role in administration of the programme, one of the critical components of the programme are the multi-faceted roles which each of the REEMS research faculty play in the process.

He said: "What has made it successful are the research faculty members. These are the people who really inspire the students – the linchpins that make this thing work. Students get a chance to meet with them, work in their labs, and it's sort of a double-edged sword in a way – on the one hand, the students feel a little bit intimidated, but on the other, they get to say, 'wow, this is really interesting' and eventually, 'I can do this'."

MR BARTLETT SHEINBERG: MENTOR

Gelareh Nobakht, a current REEMS student, somewhat disagrees with Mr Sheinberg's characterisation of his role, stating that Mr Sheinberg's tenacious energy and fatherly care for students is the reason the programme has proved so successful over the years.

She said: "He's like a father to us. He's the one who encouraged me to go to university and he has a lot of hope for me, and all his students. He provided recommendations for me, he focused me on universities that would be right for me – you cannot put a price on what he has done for me in the past two years. No one will help me in the same way he did."

Mr Sheinberg is like a father to us – you cannot put a price on what he has done for me. No one will help me in the same way he did

Sogol Gharaeimoghadam, another current REEMS student, can also vouch for Mr Sheinberg's fatherly persona, stating that his "really friendly personality … [and] helpful approach throughout the programme" had made it a "blessing getting to know him".

Similarly, Dr Zachary Cordero, the new research faculty mentor for two additional REEMS students at Rice University, agrees that the programme's success is down to Mr Sheinberg, predominantly due to his ability to identify and place candidates. He said: "I think credit is due to Bartlett (Mr Sheinberg) for attracting good students and for trying to put them on placements that he thinks are appropriate to them and their personalities. I specifically requested students who have an interest in tinkering, working with their hands, and have a natural proclivity for doing experiments, and Bartlett tried to connect me with students who aligned with those criteria. The programme has been successful mainly due to him."

ADDITIONAL BENEFITS

For Professor James Meen, the programme has been a positive not only for the REEMS students that he mentors, but also for the graduate and postdoctoral students he oversees at the University of Houston. He said: "It is a positive for the graduate students especially, because they have to explain to somebody with a limited amount of background what they're doing in the lab. It forces them to think about it and it makes them much better teachers in the future."

Dr Rafael Verduzco of Rice University agreed as well, stating: "The REEMS programme helps me and my graduate students in that it actually forces us to explain our science in a way that makes sense to somebody who isn't an expert in the field, because we are explaining it to people who are completely new to the topic. It is always helpful for us to learn how to do that more generally and more broadly."

REACHING OTHERS

In addition to his responsibility administering REEMS, and providing stewardship of existing West Houston collaborations and programmes, he is continually seeking new partnerships with community colleges, universities, professional societies and businesses to participate in a wide array of programmes focused on materials science education. Mr Sheinberg serves as the lead for the 2017 Materials Research Society Educational Symposium at the MRS autumn meeting that will focus on strategies for community college and university partnerships to develop lower division materials science educational programmes.

For information on attending or submitting a presentation abstract: http://www.mrs.org/fall2017/call-for-papers?code=BI1
If you would like to view the students' research posters or the abstracts from their projects, please contact Mr Sheinberg who will be happy to forward them to you.

Detail

RESEARCH OBJECTIVES

Mr Sheinberg's current research objectives focus on identifying, educating and serving as the Principal Investigator for students involved in Houston Community College's REEMS programme.

FUNDING

The REEMS project acknowledges financial support from the National Science Foundation, Division of Materials Research (Award 1460564) and additional financial support from the Houston Community College District Office.

COLLABORATORS

Professional Societies:
- Materials Research Society

Research Faculty Collaborations:
- University of Houston: Dr Jakoah Brgoch; Dr James Meen; Dr Megan Robertson
- Rice University: Dr Zachary Cordero; Dr Margaret Cheung; Dr Rafael Verduzco
- University of Texas Health Science Center – Houston: Dr Laura Smith Callahan

BIO

Mr Bartlett Sheinberg is the founding Director at the West Houston Center for Science and Engineering at Houston Community College which was established in 2006. He has served as a physics and engineering faculty member, and several administrative positions at Houston Community College for over thirty years. He currently serves as the Principal Investigator on Houston Community College's REEMS programme.

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