Promoting STEM Education in Community College Students via Research

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As a high school teacher with Southwest Schools and Cypress-Fairbanks ISD she has taught AP Biology, Pre AP Biology, as well as regular Biology for 6 years. As a Teacher Development Specialist with Houston ISD, she has coached science teachers on effective educational strategies at various campus around the

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Promoting STEM Education in Community College Students via Research

Abstract

The REU (research experience for undergraduates) can be a formative and beneficial experience for students in STEM (Science, Technology, Engineering and Math) majors. These programs most often select the top undergraduate students to perform research at prestigious universities. The REU that is the topic of this paper takes another approach in order to broaden the participation of community college students in STEM majors and careers. The Nanotechnology REU with a Focus on Community Colleges brings the top students from local two year campuses to a top-tier university for a 10-week research internship. Students traditionally underrepresented in STEM fields including minorities, females, first generation to attend college, and economically disadvantaged are targeted for participation in this REU program. Each REU intern is matched with a nanotechnology research laboratory and a postdoc or graduate student mentor. The REU intern group meets weekly to share experiences as well as to receive guidance on navigating the campus, managing the demands of research, working with their mentors and faculty, and acquiring the skills and experience to assimilate in a four-year university. Throughout the program, participants deepen their understanding of the scientific concepts of their research and practice sharing their research projects. Each student creates a presentation and poster of their research and results to disseminate at a campus-wide symposium to an audience that includes students, faculty, and the community. Beyond the REU program, past participants are tracked to follow up on their achievements and academic and career path such as transition to four-year universities and STEM degree acquisition.

The program has been offered most summers since 2010 for up to 10 students each summer. Area community colleges work with the university to publicize the REU program and bring in a high number of applicants. Using a rubric to rank the applications, the top applicants are interviewed to probe students' motivations and interests and final participants are selected. The program is evaluated by an external assessor via surveys, focus groups, interviews, and attendance at the poster presentation and review of the students' posters. This paper addresses the details of the program, the findings of the evaluation to date, and the program's successes and sustained impact.

Background

Undergraduate research has been demonstrated to play a major role in influencing students' decisions to pursue graduate school and research careers.[1-5] This is particularly important in recruiting a new and diverse community of research scholars. Community college students represent a rich pool of potential scientists and engineers because they serve a higher percentage of the underrepresented minorities (URM) and first generation college students (i.e., students whose parents did not have any postsecondary education) than four-year institutions.[6-9] For example, Houston Community College (HCC) awards more Associates Degrees to minorities than any other two-year college in the country.[10] These schools educate almost half of all students in Higher Education.[8] However, the transfer rates to four-year colleges are low (21%) and the academic track to a BS or PhD degree in STEM fields is often not well defined.[7-9, 11]

Therefore, this REU program is designed to provide students in the large community colleges of the Texas Gulf Coast region with intensive exposure to STEM research and support for success at the undergraduate and graduate levels.

The Nanotechnology Research Experience for Undergraduates (REU) with a Focus on Community Colleges concentrates exclusively on students at two-year colleges where 100% of the participants originate from schools with limited STEM research opportunities. These students are integrated into a community of scholars and provided a research experience not attainable at their primary academic institution. While community college students may be eligible to participate in any NSF REU programs, they often self-select out of the application process because they are not aware of the opportunity or they do not feel that they can compete with students who are attending four-year schools. REU programs that reach out to community college students have been demonstrated to successfully bridge the transition from two-year to four-year institutions and from undergraduate to graduate school. Examples of these include NSF REU Site in Physics Applications in Astronomy and Biology at CUNY Queensborough Community College and the Centers to Advance Community College Students in Science and Engineering, Electrical Engineering, and Computer Science at the University of California, Berkeley.

A substantial amount of research over many years has examined undergraduate student retention and why students leave STEM majors.[12-17] Challenges that prevent minority students' persistence in STEM education include: lack of role models, inequitable academic preparation, lack of a student peer group, and inadequate advising.[18-21] For minority students or first generation college students in the physical sciences at the nation's research institutions, the lack of role models and inadequate advising are particularly problematic since few faculty members are of an URM.[21] Minority students, often the only URM in their department, are generally isolated and not likely to seek out advice or tutoring from non-minority advisors. Relationships with minority advisors are valuable and more sustaining, even if an advisor or mentor is from another discipline or another institution. This pathway via REUs focused on community colleges will lower the barriers for entry into graduate school, especially in the sciences and engineering for URM and economically disadvantaged students**.** The future of US science and technology depends on recruiting, training, and supporting this diverse population.

Program Information

The purpose of the Nanotechnology REU with a Focus on Community Colleges is to broaden the participation of Americans in STEM careers by recruiting community college students into a 10-week REU at Rice University. This unique program provides the first generation, underrepresented minorities in STEM who are enrolled in the Texas Gulf Coast community colleges with highly engaging research in the field of nanotechnology, a strength of Rice University and a field that excites many undergraduates with the promise of significant advances in the immediate future.[22]

This program of undergraduate research for community college students has the following goals:

- To educate community college students about STEM research careers.

- To provide experiences in research laboratories and demonstrate the excitement of STEM careers.
- To promote effective inter-institutional partnerships between Rice University and community colleges in the Texas Gulf Coast region.
- To facilitate the development of engineering students from underrepresented groups and economically disadvantaged populations.
- To build and maintain mentoring relationships with our participants.

Targeted Student Participants

Community colleges are a critical pathway into higher education. Many highly successful US scientists started their academic careers at community colleges, including Uri Triesman, J. Craig Venter, Chemistry Nobel Laureate Bruce Merrifield, and National Medal of Science recipient Richard Tapia. This pathway is particularly important for traditionally URM. Nearly one-fourth of Hispanics with doctorates started their higher education at a community college, according to the Chicano Studies Research Center at the University of California at Los Angeles.[12] Moreover, the National Center for Education Statistics (2005)[23] reports that first-generation college students comprise 45% of the public community college population nationally. These students, compared to traditional students, tend to come from low-income families, are generally older and of Hispanic ethnicity, have lower degree aspirations and more family responsibilities, receive less parental support for higher education, and are less likely to major in STEM.[23-25] The underrepresentation of first-generation college graduates who pursue graduate degrees is particularly striking; they enroll in graduate programs at one-quarter the rate of students whose parents have a college education.[25] Participation in a research internship, where the applications and relevance of their academic studies are obvious, may ease certain cultural, social, and educational transitions.

By specifically targeting community college students in the Texas Gulf Coast area, this program will engage an untapped student population in discovery-based research. These schools include HCC, San Jacinto Community College (SJCC), Lonestar College System (LSCS), Galveston Community College (GCC), College of the Mainland (CM), Wharton Community College (WCC), Alvin Community College (ACC), and educate a diverse pool of talented future researchers who might not otherwise have the resources or opportunities to pursue careers in research. Of the over 70,000 HCC students, a majority are economically disadvantaged and more than two-thirds are URMs as shown in Table 1. Furthermore, over 25,000 HCC students are enrolled in STEM courses. In addition to HCC's large enrollment, the other Texas Gulf Coast community colleges serve over 100,000 students. This is a large and growing talent pool as community colleges offer an affordable alternative to the increasing costs of four-year colleges.

Table 1. Demographics of Targeted Schools; data from [a,b,c,f]Fall 2016 and [d,e]Fall 2015.

School	Student body	Gender		Ethnicity						
		Male	Female	African American	Asian	Hispanic	White	Other	International	Am Indian
HCC[a]	71,417	42%	58%	28%	10%	33%	14%	3%	11%	0.3%
LSCS[b]	85,661	40%	58%	15%	7%	38%	32%	7%	N/A	0.2%
SJCC[c]	28,998	44%	56%	10%	6%	55%	25%	1%	2%	0.6%
ACC[d]	5,116	44%	56%	12%	N/A	32%	49%	7%	N/A	N/A
WCC[e]	7,416	45%	55%	12%	12%	37%	37%	2%	N/A	N/A
CM[f]	3,995	43%	57%	16%	3%	29%	51%	2%	N/A	N/A

Data Sources:HCC: http://www.hccs.edu/district/about-us/oir/quickfacts; LSCS: http://www.lonestar.edu/images/ Demographics _ Official_Day_Fall_2016(1).pdf; SJCC: http://www.sanjac.edu/sites/default/files/ SJC_Certified_ Fall2016_FallFacts.pdf; ACC: http://www.alvincollege.edu/Portals/0/userfiles/documents/about/ie/factbook/2015-2016%20Fact%20Book%20Final.pdf?ver=2016-06-22-083542-387; WCJC: http://www.wcjc.edu/About-Us/administration/offices/institutional-research/documents/Student-Demographics-Fall.pdf; CM: http://build.com.edu/uploads/sitecontent/files/opear/FactSheetFall2016.pdf

Student Recruitment and Selection

A major thrust of the student recruitment effort includes informing the community college faculty and students about the REU and the steps students need to take to enter a STEM field. Our office has established a strong relationship with local community college colleagues who facilitate student recruitment. For example, Rice faculty and graduate students routinely give presentations to community colleges about STEM opportunities. Faculty at the Gulf Coast region community colleges are key recruiters to our program.

Students are selected based on a rubric that has been refined over the years that takes into consideration the courses students have taken (preferably two semesters of calculus, chemistry and calculus-based physics), their grades in those courses, two faculty letters of recommendation, and a written response to the question about why they are interested in the research experience. A primary component of our initial selection rubric was the number of science and math courses they had taken and how they had performed in those classes. In year one of this project, we required that students must have taken a year of college calculus, physics, and chemistry to participate. However, we quickly observed that most of our applicants did not have these courses. Therefore, we modified our selection criteria so that we would not overlook students with great potential. The new rubric puts more weight on the teacher recommendation with an emphasis on work ethic and "grit", students' grades in the science classes they had taken, and their veteran status.

Of the first 20 students who have participated in our program, 45% had not taken calculus-based physics. Math is also a significant problem because many students are taking algebra courses. This highlights a real problem with our educational system: students, typically economically disadvantaged or URM who say they are interested in STEM careers, are not taking the courses they need to take to achieve their goals. It also is one reason why the participants in our program find when they transition to four-year institutions, many of their credits do not transfer and they find themselves a year behind (i.e. are classified as a sophomore rather than a junior). We have

also learned that it is important to let students know that they have not been accepted because they may need more science or math coursework and encourage them to reapply by directly sending them the application in the following year**.**

One advantage of recruiting from local area community colleges is that these students can come to campus for face-to-face interviews. The most promising applicants are invited to campus for an interview. This is an evaluative process where we can help ensure that the students have the motivation and commitment to take on the research challenge.

Research Focus

Nanotechnology, the focus of this REU, is a compelling topic for recruiting students into STEM fields because it integrates physical sciences and engineering with applications in energy, medicine, and environmental health. Real-world problems, such as developing inexpensive alternative energy systems, diagnosis and treatment of cancer, and water purification systems for developing nations, are particularly relevant and motivating topics to students. The multidisciplinary study of nanotechnology brings together scientists from chemical engineering, environmental engineering, bioengineering, chemistry, physics, biology, biochemistry, and other fields. The result is an REU that has a common theme and also provides students with a wide range of choices in their individual research projects. The research areas of our REU students span the range of nanotechnology including the synthesis and characterization of new nanomaterials; application of nanomaterials to air and water purification; photonics and plasmonics; application of nanomaterials in medical imaging, diagnosis, and treatment; and developing nanomaterials for clean energy. Engineering new nanomaterials and understanding the relationship between their physical properties and their structure at the nanometer scale require the use of state-of-the-art tools such as atomic force microcopy (AFM), scanning tunneling microscopy (STM), scanning electron microscopy (SEM), Raman spectroscopy and nanolithography. These are tools that the REU students are trained on and use throughout their summer research internship. The theme of nanotechnology provides students with exposure to multiple research topics and the nanoscale and technologies used to provide a common framework for the program. The REU participants work with leaders in the field of nanotechnology who are also very active in educational outreach and diversity issues.

Program Components

The REU program has a strong infrastructure by combining extensive experience in STEM outreach and world class nanoscience, engineering faculty, and facilities. As outlined in Table 2, the overall program structure includes seminars about nanotechnology at community colleges as part of our recruiting process prior to the summer internship. Because community college students may need more support than the traditional REU participants, we offer additional mentoring and program structure to promote their growth.

Table 2. Overall Timetable.

Month	Events
Sept-Feb	Visit local community colleges; present an overview of the nanotechnology REU. Distribute applications to area community college instructors and students.
March 1	Application deadline.
March - April	Interview potential candidates and candidate selection.
June	Internship commences. Start weekly meetings about research experience with REU group. 1st poster workshop. Submit abstract of research project.
July	Weekly meetings on research experience with REU group. Explore careers via fieldtrip. 2nd poster workshop. Submit draft of poster and paper on research project.
August	Focus group and interviews. Present research poster at the annual colloquium.
Sept-June	Follow-up. Evaluate program.

On the first day of the program, participants complete orientation and safety training, obtain personal safety items, and meet with their lab mentors. Weekly meetings are held where REU participants meet with the program coordinators to make sure they are progressing in their research, share their research with the group, and provide support with challenges in the lab. The group meetings are a forum where students can present their research progress and discuss the next steps in their research. Each week, half of the students will prepare and present a short PowerPoint overview about their research experience over the previous two weeks. The REU peers will discuss research experiments, share ideas, and work on solving problems collaboratively. These meetings help push their research forward, allow the students to collaborate on their research experiments, help them learn how to participate in scientific questioning, and provide them with a framework for their research experience. It also fosters student-student relationships as they work together to plan their presentations and regularly learn about the group members' research experiences. In one expanded weekly meeting, the REU group takes a half-day field trip to tour a local industry or governmental partner to focus on career options.

At the conclusion of the 10-week research experience, the students present their research findings in a competitive formal poster session to research faculty, staff, and students at the Rice University Summer Research Colloquium. Participants complete assignments before each weekly meeting in order to be prepared for the final poster session on the last day of the program that requires an abstract submission. Two weekly meetings also include training on poster presentations from the Rice University Center for Written, Oral and Visual Communication.

Following their research experience, we keep in touch with the students to facilitate their transition to their new schools. We invite REU participants to apply for subsequent internships in this program and others as well as invite all participants back to campus for an annual open house and other symposiums that relate to their research projects.

Project Outcomes

Each year of implementation, data is collected on the applicants, participants, as well as the mentors and faculty that serve the REU students. We seek to determine if our goals are achieved, mainly if we have expanded participants' knowledge and views about STEM research careers and provided positive experiences in research laboratories that promote future interest and success. Relevant data regarding these outcomes are collected via surveys, interviews and focus groups to gauge the success of the REU program.

Applicants

This REU program is designed to broaden the participation of traditionally underrepresented students in STEM fields by providing research opportunities to a diverse pool of talented community college students who might not otherwise have exposure to careers in research. This REU program has recruited exclusively from two-year institutions with HCC being the home institution of the majority of students. It should be noted that HCC serves mostly economically disadvantaged students, as does our program. Initially we faced some challenges in recruiting large numbers of qualified applicants. However, over time, there has been tremendous growth and support of this program with increases in applications to the program, a growing reputation in the Houston community, and a broad engagement of Rice faculty in the program. Faculty connections were key for successful recruitment. Over the years, our application pool expanded to approximately 70 applications each year. As shown in Table 3, the applicant pool was very diverse. This increase was due to face-to face meetings at colleges with physics, chemistry, and math department chairs and faculty, as well as presentations about the REU in dozens of events to encourage students to apply. In addition, we have found that inviting faculty from our community colleges to the end-of-summer symposium is the most important factor in our recruitment process. When they observe their students presenting their research alongside students from highly competitive research institutions, they understand the impact of the program. The community college STEM faculty specifically recruit students in their classes to apply to the program and write recommendation letters that stand out in the pool of applicants. According to our external evaluator, most students learned about the program from their professors. The majority (56%) of applicants were from HCC, with Lone Star and San Jacinto comprising 28% and 10%, respectively.

Table 3. Applicant pool and demographics (N=336).

School	%	Ethnicity	%
Houston Community College	56%	African American	21%
Lone Star Community System	28%	Asian	23%
San Jacinto Community College	10%	Hispanic	24%
Wharton Community College	3%	White	25%
Alvin Community College	1%	Native American	1%
College of Mainland	1%	Other	6%
Other	1%		

Participants

We have had a 100% acceptance rate, 100% completion rate, and 100% of participants presenting at one or more symposiums or conferences, as well as 100% transfer rate to four-year universities for the 2010-2013 cohorts. We strive to have our program participant demographics represent those of Houston's population, which is 52.9% White, 21.0% African American, 0.7% Native American, 6.5% Asian, 15.5% of other races, 3.3% from two or more races and 43.9% Hispanic or Latino of any race.[26] We come close to one of those goals with 18% of our participants being African American, as shown in Table 4. However, our participation rate among Hispanics is lower than our benchmark of Houston's population. This could be due to small numbers of students in our program (i.e. some years we had 62.5% Hispanic participants and other years we had 33% African American participants).

Table 4. REU Participant Demographic Summary.

Year	N	Gender		Race and Ethnicity				
		Female	Male	African American	Asian	Hispanic	White	Native American
Total	**38***	**50%**	**50%**	**18%**	**18%**	**34%**	**26%**	**3%**
2010	6	50%	50%	33%	17%	17%	33%	-
2011	6	50%	50%	-	50%	33%	17%	-
2012	8	25%	75%	-	13%	63%	25%	-
2013**	2	0%	100%	-	-	50%	50%	-
2015	10	60%	40%	30%	30%	30%	10%	-
2016	10	50%	50%	20%	-	40%	30%	10%

**Four Returning REU students; **No Cost Extension*

Participant Feedback

The students all had research projects on the nanoscale level and while the topics were varied, they shared common instruments and techniques. The weekly REU meetings became an important time for students to share ideas and to suggest different approaches. Because they all had similar backgrounds, the students did not feel intimidated to ask questions or express concerns. During meetings, students set up times to visit each other's labs and explore the campus. One major difference between this REU and the traditional REU program is that the recruitment was entirely from local two-year colleges. As a result, students were offered a higher stipend in lieu of room and board. Students were asked if they would want to stay in a dorm but none of the participants chose that option. Because our participants were local, tended to be older, and often had families, they already had permanent residences in the greater Houston area. In addition, we had planned to host some social events like museum trips and evening cookouts but found that the participants were more interested in activities that were directly related to science and engineering careers. Therefore, we focused on the industrial tours that served as great teambuilding experiences and provided students with insights into STEM careers. Our location in Houston, Texas provided us with exceptional access to corporate research and manufacturing facilities.

The surveys for the first iteration of the program, 2010-2013, were developed by the external evaluator and very specific to the program. Students' goals for the program included gaining research and graduate school experience, learning lab techniques and about nanotechnology, and collaborating with others. Mid-program interviews and focus groups were held with the participants, graduate students, and faculty along with pre-program and post-program surveys. In addition, the evaluator attended the Rice University Summer Research Colloquium and assessed the student posters and presentations. Some of the key findings were that all students agreed or strongly agreed with the statement: "My REU experience strengthened my professional interest in science and engineering." Students felt the REU positively impacted their interest and ability in STEM, with the following statements made by participants:

- This program allowed me to gain research experience and inspired me to study Electrical and Computer Engineering. Thanks to the program, I learned how to be a researcher and decided to study Ph.D. after graduation.
- Not only has this REU helped me to learn various techniques in a bio-engineering laboratory but how to work effectively on a research project, ranging from reading the literature to understand the concept of the project, planning the project, and doing multiple trials and errors experiments to get the best results, etc. It was a stepping stone for my journey in becoming what I want to be now.

All REU students expressed a potential interest to pursue a postgraduate degree, and 100% of students transferred to four-year institutions or went to graduate schools for the cohorts from 2010-2013. Follow-up data for the latter cohorts, 2015 and beyond, are not yet available.

During the three years that we have asked the pre-survey question: "Have you ever attended a research symposium, poster session, or given a presentation?" only two students have ever replied "Yes." One of those two students said that they had given an oral report in an English class. Consequently, one of the most exciting moments in our program was in 2012 during the annual Rice University Summer Research Colloquium, when one of our participants from San Jacinto Community College won first place in the poster competition. This recognition was awarded out of the 38 undergraduate posters submitted by students mostly from first tier research universities. The Rice University Summer Research Colloquium is a large event where hundreds of faculty, students, and postdoctoral researchers gather to learn about one another's work.

Building on the success of the first years of the program, the evaluation starting in 2015 included a quantitative analysis of data collected from pre- and post-tests measuring academic self-concept (ASC) and stereotype threat. The Personal and Academic Self-Concept Inventory (PASCI)[27] measures personal factors such as ASC, family and finances. The Social Identities and Attitudes Scale (SIAS)[28] is used to measure socio-cultural factors such as ethnic identity development, gender roles, community orientation, and role of religion. These surveys were selected as research findings[29] revealed that there are significant differences in educational attainment within the Hispanic community. The study concluded that four factors contribute to these differences: (a) personal factors, (b) environmental factors, (c) involvement factors, and (d) socio-cultural factors. Personal factors refer to background characteristics or pre-college variables, including high GPA and test scores, ASC, family support, and finances. Colleges and universities have continued to admit students based on high school GPA. However, according to Creighton,[29] evidence indicates test scores may not predict early college grades for Hispanic students as well as it does for White students, and that test scores, such as the SAT, are not

predictive of college GPAs, time to completion of degree, or likelihood of applying to graduate school. In addition to cognitive measures such as GPA, ASC is a non-cognitive personal factor that is predictive of the success of Hispanic students. Nora[30] provides evidence that ASC is correlated to GPA and that Hispanic students with the same academic background were more likely to achieve higher grades if they had greater confidence in their academic abilities. Analysis of pre- and post-test results of the PASCI and SIAS subscales for two REU cohorts (2015 & 2016) combined was completed, however there was only both pre and post data for 13 participants. Although the differences were not statistically significant, scores rose on the measures of self-concept, confidence, math identification, and gender identification. As desired, group means on gender stigma, ethnic stigma, and negative affect decreased. These initial results indicate a positive impact on ASC and stereotype threat for our REU participants. Moving forward we will work to ensure a higher response rate on survey completion in order to have enough data from which to draw conclusions.

Faculty and Mentor Feedback

This REU program had the substantial support of Rice University faculty with more faculty participating than was originally anticipated. Rice faculty were very engaged in mentoring community college students which led to more faculty wanting to participate in the REU than we had students. In 2012, we increased the number of participants from six to eight and the demand for our students still outreached our supply, hence starting in 2015 we had 10 REU students each summer. When interviewed by our external evaluator, all faculty communicated the success of the program and willingness to participate again. Although faculty commented that some community college participants were less prepared than other undergraduate researchers, faculty members were impressed by their enthusiasm to learn. A general sentiment was that the community college REU intern was more motivated and has been provided with better support than other interns working in labs. Faculty and graduate students noted that the experience had a very positive impact on the students and their research and that they benefited from the experience.

Student Successes

Past participants are finding success in their academic endeavors in STEM fields (Table 5). All of our participants from 2010-2013 have transferred from community colleges to four-year universities and some to graduate school. From the 2015-2016 cohorts, students have transferred to four-year institutions such as University of Houston, University of Texas at Tyler, and Texas A&M University. We will continue to follow up with all of these cohorts as they continue in their studies and academic pursuits.

Participants have presented their work at American Chemical Society meetings, Materials Research Society meetings, the NSF Engineering Education Awardees Conferences, the Council on Undergraduate Research (CUR) Conference of Research Experiences for Undergraduate Student Scholarship, the CUR Research Experiences for Undergraduates Symposium, the Annual Biomedical Research Conference for Minority Students, as well as numerous regional conferences. REU students have also co-authored multiple publications from their REU research as well as further research pursuits. Participants have earned scholarships and fellowships including a NSF Graduate Fellowship, Materials Research Science and Engineering Center Graduate Fellowship, Ken Kennedy Institute for IT Graduate Fellowship, and others.

Table 5. REU students' home institution, department for REU, and current status.

Student		CC	Dept*	Current Status
2010	1	HCC	CHBE, CHEM	Texas Tech (BS in Industrial Engineering;'14, M.S., Systems & Engineering Management); Manufacturing Engineer at BWX Technologies
	2	LSCS	MEMS	Texas A&M ('14, Chem Eng); Process Engineer at Flint Hills Resources
	3	HCC	CHEM	Texas A&M ('13); Schlumberger Process Engineer
	4	LSCS	CHEM	U Houston ('14, Chemistry)
	5	HCC	ECE	**Rice Univ (PhD candidate in Elec Comp Eng)
	6	SJCC	MEMS	UT Austin ('13, Elec Eng); Software Developer for VerseAl
2011	1	ACC	CHEM	U Houston ('14, Management Info Sys; minor, Math); IT Advisory Assoc at KPMG
	2	HCC	CHBE	U Houston ('15, Chem Eng)
	3	HCC	CHEM, CHBE	U Houston (Pharmacy)
	4	HCC	BIOE	Texas Tech (Pharmacy)
	5	LSCS	P&A, CHEM	***U Houston ('14, Chem Eng); Process Engineer at Chevron Phillips Chemical
	6	HCC	CHEM	**Returned for second REU year
2012	1	HCC	CHEM, BIOE	U St Thomas ('14, Bio); NYU medical school
	2	HCC	CHBE	U Houston ('15, Chem Eng)
	3	HCC	CHBE,CHEM	U Houston (Chem Eng)
	4	HCC	CHEM, CHBE	U Houston (Bio); Won prize at 2014 Animal Behavior Society Conference, Princeton U)
	5	SJCC	MEMS	Texas State ('14, Applied Math; minor Chem); Attending Duke U (PhD, Chem); NSF Graduate Fellowship; MRSEC Fellowship
	6	HCC	MEMS	SUNY Fredonia ('13, pursuing M.A. in teaching)
	7	HCC	P&A, ECE	***Returned for second REU year
	8	HCC	CHEM, CHBE	U Texas – Tyler (Electrical Engineering), Project Manager for Building Design/Construction Management
2013	1	HCC	CHBE	U Houston ('15, Electrical Engineering)
	2	HCC	ES	Texas A&M ('15, Physics)

*Chemical & Biomolecular Engineering (CHBE), Mechanical Engr & Materials Science (MEMS), Electrical & Computer Engr (ECE), Physics & Astronomy (P&A), Earth Science (ES); Chemistry (CHEM), Bioenineering (BIOE)

Continuation

The Nanotechnology REU with a Focus on Community Colleges is actively recruiting for the 2017 cohort. We will again bring the top students from non-university campuses to Rice University for a 10-week research internship. We plan to enroll 10 students with one returning from the prior year to serve as a peer mentor to the group. We have Rice faculty interested in hosting REU students and they are working with graduate student and post-doctoral mentors to plan summer research projects. We have been visiting Texas Gulf Coast area community colleges and are hosting an open house for interested applicants to meet and hear from past participants. We will engage students traditionally underrepresented in STEM fields including minorities, females, first generation to attend college, and economically disadvantaged. Through relationships with Houston area colleges and faculty, we will target the Hispanic population to be able to have the REU participant profile be representative of our area.

We will continue the program with a refined summer schedule of weekly discussions to meet the needs of the community college cohort as they acclimate to the campus, manage the demands of nanotechnology research, and build relationships with their mentor and faculty advisor. Each week the students will share their research progress and setbacks, practice presenting their project, and plan for the poster session. We are organizing an industry field trip, as well as the Rice University Center for Written, Oral and Visual Communication visit for poster planning and critiquing sessions. The Rice University Summer Research Colloquium will again be attended by our REU participants as they showcase their summer's work.

We continue to follow up with past participants as they transition to four-year universities and STEM degree acquisition. We ask them to share their academic successes and career path with us, as well as offer them opportunities to present their work and network at Rice University. From continuing contact, we see the great achievements of the REU students that started out in community college, successfully attain bachelor's degrees or beyond, and are continuing to pursue careers in STEM.

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