Maximizing Access to Research Careers Undergraduate-Science Training in Academic Research (MARC U-STAR) Program

Sailaja Koduri, Richard Okita, Shiva Singh, Alison Gammie

National Institute of General Medical Sciences, NIH
MARC U-STAR Program

The MARC U-STAR program is an INSTITUTIONAL undergraduate research training program that is designed to provide structured training to high-achieving, underrepresented students to prepare them for doctoral programs in biomedical research fields.

NIGMS Funding opportunity announcement (FOA):

MARC U-STAR Program

• 1977: MARC program started to develop strong undergraduate curricula in bioscience and to stimulate undergraduate interest in the biomedical sciences

• 1996: MARC program was recast to focus on junior and senior honors students and an emphasis on continuous improvement and specific measurable objectives

• 2013: MARC program clarifies that a majority of the MARC alumni nationally are expected to matriculate into biomedical Ph.D. program
Objectives

- Enhance diversity of biomedical research workforce
- Support activities at underrepresented (UR)-serving institutions that will promote, motivate, and interest UR students in careers in biomedical research
- Improve the academic preparedness of undergraduates for graduate school by strengthening science curricula at UR serving institutions
- Increase the number of MARC trainees who enroll in graduate programs leading to doctorate
- Utilizes the T34 Ruth L. Kirschstein National Research Service Award (NRSA) funding mechanism
The overarching goal of the NIGMS MARC U-STAR Program is to significantly increase the number of undergraduates from underrepresented backgrounds who earn the science baccalaureate and matriculate into and complete a biomedical science Ph.D. program.
A. Individuals from racial and ethnic groups that have been shown by the National Science Foundation to be underrepresented in biomedical research are: Blacks or African Americans, Hispanics or Latinos, American Indians or Alaska Natives, Native Hawaiians and other Pacific Islanders.

B. Individuals with disabilities, who are defined as those with a physical or mental impairment that substantially limits one or more major life activities, as described in the Americans with Disabilities Act of 1990, as amended.

C. Individuals from disadvantaged backgrounds, defined as:

1. Individuals who come from a family with an annual income below established low-income thresholds. These thresholds are based on family size, published by the U.S. Bureau of the Census; adjusted annually for changes in the Consumer Price Index; and adjusted by the Secretary for use in all health professions programs. The Secretary periodically publishes these income levels at [http://aspe.hhs.gov/poverty/index.shtml](http://aspe.hhs.gov/poverty/index.shtml).

2. Individuals who come from an educational environment such as that found in certain rural or inner-city environments that has demonstrably and directly inhibited the individual from obtaining the knowledge, skills, and abilities necessary to develop and participate in a research career.
MARC U-STAR Awards

• Two-year training program for research-oriented junior and senior honors students
  • Academic enhancement, professional skills
  • Research training and guided discovery
  • Requires one summer at research institution

• MARC trainees receive stipend, fees, and tuition remission; trainee related expenses are paid to the institution

• Requires one summer research training experience at a Research-Intensive Institution
Eligible Organizations

- Public/State Controlled Institutions of Higher Education
- Private Institutions of Higher Education
- Hispanic-serving Institutions
- Historically Black Colleges and Universities (HBCUs)
- Tribally Controlled Colleges and Universities (TCCUs)
- Alaska Native and Native Hawaiian Serving Institutions
- Asian American Native American Pacific Islander Serving Institutions (AANAPISIs)

- The sponsoring institution must assur support for the proposed program.
- Appropriate institutional commitment to the program includes the provision of adequate staff, facilities, and educational resources that can contribute to the planned program.
- Only one application per institution (normally identified by having a unique DUNS number or NIH IPF number) is allowed for the MARC U-STAR Program.
- Foreign Institutions or foreign components are not allowed.
ELIGIBILITY

MARC Program Directors/Principal Investigators:

• The PD/PI must have a regular full-time appointment (i.e., not adjunct, part-time, retired, or emeritus) at the applicant institution

• The PD/PI should be an established investigator and capable of providing both administrative and scientific leadership to the development and implementation of the proposed program

• The PD/PI will be responsible for the selection and appointment of trainees to the approved research training program, and for the overall direction, management, administration, and evaluation of the program

• The PD/PI will be expected to monitor and assess the program and submit all documents and reports as required
MARC Mentors:

- Strong records as researchers in the area of the proposed research training program
- Strong record of mentoring students in research and career planning
- Researchers from diverse backgrounds, including racial and ethnic minorities, persons with disabilities, and women are encouraged to participate as mentors
- May be members of faculty at the applicant institution or external faculty who participate in the proposed program
ELIGIBILITY (continued)

MARC Trainees:

• Full-time honors students from UR groups at the applicant institution in science majors relevant to biomedicine

• Must be a citizen or a noncitizen national of the United States or have been lawfully admitted for permanent residence at the time of appointment

• 12-month appointments during the final two years of undergraduate training. On an annual basis, trainee appointments for less than 12 months require prior written approval by NIGMS
MARC U-STAR: Allowable costs

- **STIPEND**: $12,336/yr. for students in junior/senior year
- **TUITION AND FEES**: Equal to 60% of the level requested by the applicant institution, up to $16,000 per yr.
- **SUMMER RESEARCH EXPERIENCE (SRE)**: $3,000/10 weeks for the SRE for up to 50% of the appointed number of MARC U-STAR trainees
- **TRAVEL**: Trainee/faculty travel including attendance at scientific meetings
- **TRAINING RELATED EXPENSES (TRE)**: A maximum cap of $350,000/year
  - TRE (research intensive)- T1: $16,800/ trainee/yr.
  - TRE (non-research intensive)- T1: $25,200/ trainee/yr.
  - TRE (research intensive)- T2: $8,400/ trainee/yr.
  - TRE (non-research intensive)- T2: 12,600/ trainee/yr.

T1: New applications, T2: Renewals
MARC U-STAR: Allowable costs (continued)

• TRE FUNDS CAN BE USED FOR:
  o PD/PI/Co-I support: 3.0 person months/yr. or 25% on a 12-month basis (total)
  o Administrative personnel: 6.0 person months (i.e., 50% on a 12-month basis) depending on the size and scope of the program.
  o Seminar speakers; equipment and research supplies for a research classroom course(s), if proposed; program website design and maintenance; faculty/staff travel directly related to the program; faculty training in pedagogical skills development; student academic skills development workshops (e.g., problem-solving, critical thinking, effective communication and time management).
  o PROGRAM EVALUATION: $3,000/ 5 year grant period

• FACILITIES AND ADMINISTRATION COSTS: Indirect costs are reimbursed at 8% of modified total direct costs (exclusive of tuition and fees, consortium costs in excess of $25,000, and expenditures for equipment), rather than on the basis of a negotiated rate agreement.
MARC GRANT APPLICATION-Training program plan

Include information on:

• Background
• Program Administration
• Program Faculty
• Proposed Training
  o Research Training
  o Academic Enrichment and Skills Development
• Mentoring and Advising
• Trainee Candidates
• Program Evaluation
Background

• Describe the need for the proposed academic and research training program as well as the feasibility of success in the context of the institutional setting

• Include the information on enrollment of underrepresented students as well as the unique environment and strengths of the institution. Institution type according to the Carnegie Basic Classification system and describe their distinctive educational research environment.

• Complete the institutional self-assessment to include:
  - Baseline data regarding the student population
  - Graduation rates (subsequent completion of Ph.D. or combined M.D.-Ph.D. degrees for all students and for underrepresented student)
  - Relevant science programs
  - Use NIGMS suggested Tables A-C to provide the data to support the institutional self-assessment narrative

• Include the design of the MARC U-STAR program by showing the institutional baseline data as a starting metric, applicants should state the MARC U-STAR Program goals with respect to graduation rates, matriculation into biomedical Ph.D. graduate programs, and earned higher degrees, particularly doctoral degrees
Program Administration:

• Describe the acknowledged strengths, leadership and administrative skills, training experience, scientific expertise, and active research of the PD/PI

• Describe the planned strategy and administrative structure to be used to oversee and monitor the program. If there are multiple PDs/PIs, then the plan for Program Administration is expected to synergize with the “Multiple PD/PI Leadership Plan” section of the application

• Applicants must also describe the administrative structure and leadership succession plan for critical positions (e.g. PD/PI) in the administrative structure

• If a program coordinator or administrator position is planned, a description of the person’s administrative capabilities

Program faculty:

• Include information about the program faculty who will be available to serve as mentors to MARC trainees

• Provide information on their experience in research and training
MARC GRANT APPLICATION-Training program plan (continued)

Proposed training:

• Provide a structured training program to prepare UR STEM students for doctoral study
• Provide list of activities planned for research training and skill development

Mentoring and advising activities (examples):

• Providing guidance regarding what is necessary to succeed as independent scientists
• Discussion of milestones, achievements and activities that promote success as independent scientists
• Providing opportunities to improve and/or complement the mentorship provided by research faculty (preceptors) and other mentors
• Offering formal educational activities or events that inform students of the variety of research-related career opportunities for which Ph.D. training would be beneficial
MARC GRANT APPLICATION-Training program plan (continued)

Trainees:

- Include student selection criteria
- Description of the size and qualifications of the potential pool of trainees
- Specific plans for selecting the trainees

Program evaluation plan:

- Plan for self assessment of the stated goals in context of the baseline data
- Plan to measure outcome metrics
- Plan to obtain feedback on program from current and former trainees
- The measurable goals and specific objectives are set by the applicant institution
Institutional Environment and Commitment to the Program

• Explain what distinguishes the proposed MARC U-STAR program from the related programs at your institute and how the programs will synergize with one another

• Include a statement from the applicant institution describing the commitment to the planned program. The institution must confirm that sufficient time will be allowed for the PD(s)/PI(s), other faculty, staff and participating students to contribute to the proposed program

• A signed letter, on institutional letterhead, that describes the applicant institution’s commitment to the planned program is required
Advisory Committee Plan

• A plan must be provided for the appointment of an Advisory Committee to monitor program and trainee progress. Composition, member expertise, responsibilities, frequency of meetings, and other relevant information should be included.

• Describe how the Advisory Committee will function in providing oversight of the development, implementation, and evaluation of recruitment strategies, the recruitment and retention of participants, and the evaluation of the overall effectiveness of the program.

• A plan for Advisory Committee selection and approval of MARC U-STAR participants should be included.
Recruitment Plan to Enhance Diversity

- Describe steps to be taken during the proposed award period regarding the identification and recruitment of research-oriented honors students from underrepresented groups.

- Describe the specific efforts to be undertaken by the training program and how these might relate to the recruitment efforts of the institution.
Plan for Instruction in the Responsible conduct of Research

• Describe in detail the plans for teaching responsible conduct of research (RCR)
• The instruction in RCR is mandatory for all trainees
• Please refer to NIH policy [https://grants.nih.gov/grants/guide/notice-files/NOT-OD-10-019.html](https://grants.nih.gov/grants/guide/notice-files/NOT-OD-10-019.html) for more information
Peer Review: Review Criteria

• Listed in the FOA, Section V

• Read the review criteria while preparing your application to make sure all of the required information is included

• Review panel will assess your application against the review criteria
Important dates

• **Application Due date(s):** May 25, 2017; May 25, 2018 by 5:00 PM local time of applicant organization

• Plan to submit early to allow adequate time to make any corrections to errors found in the application during the submission process by the due date

• **Peer Review:** October - November 2017, 2018

• **Advisory Council Review:** January 2018, 2019

• **Earliest Start Date:** June 1, 2017
THE FIRST STEP IN PREPARING FOR A COMPETITIVE MARC U-STAR APPLICATION

READ ALL OF THE INSTRUCTIONS in the FOA CAREFULLY
Additional information

- FAQs about MARC U-STAR FOA: https://www.nigms.nih.gov/Training/MARC/Pages/FAQs.aspx
MARC Program Data
MARC U-STAR Awardee Institutions (1986-2013)

• Number of Schools awarded: 114
  • Mean Award: 15 years
• Total trainees appointed: >9,000
• Mean trainee support: 19 months
• NIGMS supported 53 MARC U-STAR programs
• 553 MARC trainees
• Program budget: ~ $18M
MARC participating institutions (June 2016)

https://www.nigms.nih.gov/training/MARC/pages/PartInstUSTAR.aspx
MARC Undergraduate Schools Over Time

Research Classification

- Doctoral Research Universities (at least 20 doctoral degrees)
  Research: Very High, High; or Doctoral
- Master’s (at least 50 Masters, fewer than 20 doctoral degrees)
- Baccalaureate (fewer than 50 Masters or 20 doctoral degrees)

Trend to more Research Universities
MARC Undergraduate Schools Over Time

Student Enrollment

- Eligibility defined by student-, not institution-type

Historically Black College & University (HBCU), Predominantly Black Institutions (PBI);
Hispanic Serving Institutions (HSI);
Asian American Native American Pacific Island-Serving Institutions (AANAPISI);
American Indian Alaska Native Serving Institutions (AIANSI)
MARC U-STAR Alumni Demographics

~85% from underrepresented racial/ethnic groups
## MARC Graduate Degree Attainment

**Subset: MARC Alumni 2001-2005 Look-Ups Through 2015**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>504</td>
<td>29.2%</td>
</tr>
<tr>
<td>MD/PhD</td>
<td>25</td>
<td>29.2%</td>
</tr>
<tr>
<td>Doctorate (Other)</td>
<td>17</td>
<td>5.2%</td>
</tr>
<tr>
<td>DDS / DMD /DVM</td>
<td>35</td>
<td>5.2%</td>
</tr>
<tr>
<td>PharmD</td>
<td>42</td>
<td>22.6%</td>
</tr>
<tr>
<td>MD / DO</td>
<td>212</td>
<td>11.7%</td>
</tr>
<tr>
<td>JD</td>
<td>11</td>
<td>0.6%</td>
</tr>
<tr>
<td>MA / MS</td>
<td>202</td>
<td>14.4%</td>
</tr>
<tr>
<td>Master (Other)</td>
<td>59</td>
<td>3.8%</td>
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<tr>
<td>Baccalaureate</td>
<td>632</td>
<td>34.9%</td>
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<tr>
<td>Grad Student</td>
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<td></td>
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<tr>
<td>Workforce</td>
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<td></td>
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<tr>
<td>Unknown</td>
<td>287</td>
<td></td>
</tr>
<tr>
<td>Term/Dec/Short</td>
<td>71</td>
<td>3.9%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1810</td>
<td>99.9%</td>
</tr>
</tbody>
</table>

- Enrolled or Degree in Science or Health 69%
Other Training Programs-NIGMS

- Bridges to the Baccalaureate Program (R25)
- Postbaccalaureate Research Education Program (PREP) (R25)
- Research Initiative for Scientific Enhancement (RISE) Program (R25)
- Initiative for Maximizing Student Development (IMSD) Program (R25)
- Building Infrastructure Leading to Diversity (BUILD) Initiative

NIGMS TWD Website: https://www.nigms.nih.gov/Training/Pages/default.aspx
Contact:

Sailaja Koduri: sailaja.koduri@nih.gov

Alison Gammie: alison.gammie@nih.gov

Richard Okita: richard.okita@nih.gov

Shiva Singh: shiva.singh@nih.gov
Questions?
Maximizing Access to Research Careers at Fort Lewis College 2010-2016

August 31, 2016

Les Sommerville
Professor of Chemistry
In 1911 the federal government transferred 6,200 acres of land to the State of Colorado “to be maintained as an institution of learning to which Indian students will be admitted free of tuition and on an equality with white students” in perpetuity (Act of 61st Congress, 1911).
FLC Students

In Fall 2015

- 3,679 students enrolled
- 1,166 Native American Students (34%)
- 395 Hispanic students (11%)
- At least 45% of students enrolled at FLC are Native American or Hispanic
FLC is designated as a Native American-Serving, Non-Tribal College by the U.S. Department of Education.

Ranked 3rd in the nation in the percent of Native American students enrolled at a non-tribal college or university (American Indian Science & Engineering Society, 2015-2016 Special College Issue).
Native American STEM Degrees

- FLC awards more STEM degrees and more baccalaureate degrees to Native American students than any other baccalaureate institution in the nation

(NSF WebCaspr, 2015)
The 2010 – 2015 MARC Students

- 12 MARC Scholars
- 7 Native American/Alaska Native, 4 Hispanic, 1 African-American
- 10 women, 2 men (2, 2, 3, 1, 4)
- Average GPA 3.51 (low 3.02/High 3.92)
- By 2016 12 of 12 graduated (2016 – 4 students supported on MARC interim funding)
1. many from low income and 1st generation families
2. 1/3 single moms with family and child responsibilities
3. non-linear tracks to degree and graduate school
4. personal and cultural challenges
5. Made 55 presentations
6. 8 publications
Baseline:
- 2004-2008 4 URM students went to graduate school out of 152 URM STEM graduates (about 1 in 38).
- 2009-2013, 8 URM students went to graduate school out of 215 UR STEM graduates (about 1 in 27)

MARC Results:
- By 2014 1/6 MARC graduates in graduate school
- By 2016 3/11 MARC graduates in graduate school
- By 2017 7/12 expected to be in graduate school (NIH has a 3-year window for MARC scholars to start graduate school)
- By 2017 3 completed Masters, 1 completed DVM, 1 is applying to M.D./Ph.D. programs
2010 – 2015
High Impact Activities

1. Year-round research

2. Summer Research Experience at an R-1 university

3. Dissemination of research results – presentations at regional and national meetings

4. MARC dinner and poster presentations – Invited UR FLC alumni Ph.D.

5. Departmental seminar series – representatives from graduate programs
2010 – 2015
High Impact Activities – con’t

6. Coordinated seminar with student AISES and SACNAS chapters at FLC – (presentation by prominent UR scientist)

7. FLC undergraduate research symposium

8. MARC Meet and Greet

9. RCR training

10. Laboratory Safety Training
2010 – 2015
High Impact Activities—con’t

11. Power Up! Training in Critical Thinking and Communication (GRE Prep)

12. Professional Skills Development

13. Going Green! Financial Literacy

14. pre-MARC program

15. Graduation potluck and celebration
It Takes a Campus!

1. MARC Scholars
2. pre-MARC students
3. MARC Mentors
4. pre-MARC mentors
5. Steering Committee
6. Advisory Council
7. Support programs
8. Department colleagues
9. Administration
10. Evaluator
11. PC
12. PI

The PI cannot do this alone!
What is working?

• opportunities students would never have experienced without the MARC program. “I got to do the research I love” and “...it was a great range of research experiences.”

• attending conferences, introduction to the scientific community the chance to do research at “an important university”

• funding is major benefit. “I could never have done that much research if I had to work to support myself”

• confidence they gained by working on high-level research and realizing they could work at that level.

• they never realized “Research” was a possible career until the exposure they gained through MARC.
Assess and Improve!

- More GRE support and preparation
- More assistance with the application process for graduate school
- More opportunities for MARC students to meet jointly
- Identifying pre-MARC students who will be successful in MARC and who will pursue PhDs.
- Implementing more formalized assessments of stakeholder satisfaction and student satisfaction with grant activities.
- Alleviate time pressure on the mentors
Create Community!

Have fun, support your students and colleagues!

Thank you
MARC AT THE UNIVERSITY OF THE VIRGIN ISLANDS

Teresa Turner, tturner@uvi.edu
August 2016
HBCU founded in 1962, enrollment of 2350
Located 1100 miles southeast of Miami
Only university in the US Virgin Islands, has a big impact on the Territory
Open admissions
Affordable tuition, $4,631 per year
Higher levels of poverty than any state, students 69% African-American, 7% Hispanic, 94% US citizen or permanent residents
MARC began at UVI in 1992

Dr. Gwen-Marie Mooleenar had been the MARC Program Director at Howard University

Dr. Mooleenar wrote first MARC grants

In 1999 Dr. Mooleenar became Provost, Dr. Teresa Turner became MARC Program Director, mentorship of PI is key

Started with 4 slots, in 2000 increased to 6, in 2016 increased to 8
Last 6 years 82% of UVI MARC graduates have gone on to PhD Programs.

MARC graduates who were not admitted to PhD programs are in masters programs or the NIGMS-funded PREP program.

UVI MARC graduates are in PhD programs at: the University of Michigan, Michigan State University, Boston University, University of North Carolina at Chapel Hill, University of Iowa, Vanderbilt University, Howard University, Washington University, University of Arkansas for Medical Science, University of Alabama at Birmingham, Old Dominion, Duke, Penn State.

Over 80% of the students who enroll in PhD programs complete their degrees.
2011-2015 biology and chemistry majors 20.6% of graduates have gone on to PhD programs (13.4% was the 2010 baseline)

2011-2015 mathematics and applied mathematics majors 14.2% have gone on to PhD programs

2011-2015 computer science majors 10.2% have gone on to PhD programs

Number of Science and Math undergrads went from 287 in 2001 to 460 in fall 2015, over 60% increase
Dr. Carlos Gutierrez at Cal State LA mailed us a copy of the Cal State LA MARC proposal in 2000.

It is possible to ask people for copies of their proposals and they will often send them.

Also possible to obtain proposals using the Freedom of Information act.

TWD at NIGMS holds program directors meetings, extremely helpful.
READ THE LITERATURE ON MENTORING, UNDERGRADUATE RESEARCH

- Cite literature in the grant proposal to explain why your program has the design that it does.
- Understanding Interventions conference is a good conference to learn about the research in this field.
UVI interprets “biomedical” broadly and MARC students have included biology majors, chemistry majors, math majors, computer science majors, psychology majors, and marine biology majors.

UVI relies on summer research experiences on the mainland, UVI MARC students go off-island two summers.

UVI has two campuses, St. Thomas and St. Croix, we plan pre-MARC activities on St. Croix.
Work in synergy with other programs at the institution, we meet every two weeks for a planning meeting of MARC, RISE, HBCU-UP, Cybersecurity, NASA programs.

Other programs help prepare students to be successful as MARC students, they help create a critical mass of high achieving serious students.

Example of joint activity: Fall Research Symposium in September, students in all programs and all majors present posters on their research, younger students, parents, administrators attend; visiting scientists, faculty, high school teachers act as judges.

MARC visiting scientists seminars are open to all students.
UVI uses the application process to build interest in research careers

- One electronic application to all student development programs
- Application deadline Feb 28 of each year
- Spring 2016 92 applicants
- Applicants are required to apply to off-island summer programs
- All applicants are interviewed and advised about research careers
- Students not accepted into MARC have gone to PREP, earned PhDs
UVI HAS WORKSHOPS ON APPLICATIONS OPEN TO ALL STUDENTS

- Fall semester workshops on “How to Find Summer Programs”
- Day long workshop on November 1 (local holiday) on “How to Write a Statement of Purpose”
- MARC seniors present a workshop on “How and Why to Apply to Summer Programs”
UVI USES FRESHMAN DEVELOPMENT SEMINAR CLASS TO BUILD INTEREST IN RESEARCH CAREERS

- Dr. Turner, MARC Program Director, volunteered to teach this class on St. Thomas, Dr. Baumann, MARC Coordinator on St. Croix, teaches the class on St. Croix

- Students start off as pre-med or engineering, they are not aware of the PhD degree and the possible careers; they are unaware of tuition waivers and stipends in graduate school

- Students don’t understand the terms used in the summer programs’ fliers, e.g., bioinformatics, translational research, nanotechnology
Annual Biomedical Research Conference for Minority Students is the highlight of the students’ year, very inspired, much more aware of possibilities

Winning a best poster or best oral presentation award is an important affirmation for students

Encourage faculty to apply to serve as judges at ABRCMS, they learn about programs at other institutions, they become better mentors for MARC students
BUILD RELATIONSHIPS WITH PROGRAMS

- T32 program directors can write letters of support for MARC programs. MARC program directors can write letters of support for T32 programs.
- Trust can be established, program directors know about the quality of UVI students and its undergraduate curriculum; UVI knows which programs can best support our students.
- More than one UVI graduate at the same PhD program can support each other.
- Invite program directors to speak on campus, they can interview students.
UVI submitted a MARC supplement to develop its curriculum, developed a concentration in computational biology available to majors in mathematics, computer science, or biology.
MARC funding alone is not enough to make a program successful, e.g., flights to summer research experiences for UVI students are often more than the maximum that the NIH budgets

UVI has the Emerging Caribbean Scientists fund made from donations that supplements the training grants if needed
Develop strong support for the program across the university

- UVI President, Provost, and Deans all serve on the MARC Advisory Committee
- Large group of faculty across departments needs to be involved in planning the program
- Some MARC program activities have been institutionalized
Recent alumni are great visiting scientist speakers

Alumni in PREP and masters programs still need with in PhD applications, fellowship applications

MARC grant proposals require good data on alumni
Think in terms of developing potential rather than simply identifying talent

Train faculty to mentor students

In selecting students think beyond standardized tests: Data demonstrate that GRE scores do not predict number of publications in graduate school or probability of completing graduate school

DON’T SELL THE STUDENTS SHORT