

Proposed Title (tentative): *LABRats* – A National Organization to Teach Science, Build Self-Esteem, and Instill the Virtues of Community Service

Submitting Institution: *Society for Amateur Scientists*

Principal Investigator: Shawn Carlson, Ph.D.
Executive Director, *Society for Amateur Scientists*
scarlson@sas.org 401-823-7800

Impact:

LABRats will be a community-based youth program that will unite teenage science enthusiasts with volunteer adult mentors to connect the teaching of science, technology, engineering, and mathematics (STEM) with development of the “great virtues,” including self-respect, leadership, and a strong commitment to community service. *LABRats* will build local and national communities that empower young people with both the knowledge and the skills they need to make their own scientific discoveries. The program will also include what we call “college-bound” and other career-path activities, which will be designed to create the expectation in the participants’ minds that they can be successful in college or other technical careers. Young people will be attracted to the program for STEM as well as the contributions they will make in a community of like-minded people. Many parents, seeing that *LABRats* will prepare their kids both for the future and to live rewarding lives, will urge their children to get involved. The *LABRats* motto will be, “Do the experiment.” The program will include hands-on, inquiry-based instructional activities, as well as independent open-ended research supported by adult volunteer STEM experts who will be recruited from nearby communities.

The need for a program like *LABRats* has never been greater. Despite the development of many new inquiry-based curricular materials, student comprehension of key concepts is not improving significantly, and the United States is falling behind other countries, most likely for systemic reasons. The most critical strategic impact of *LABRats* will be the creation of a new informal STEM education engine that will employ the most effective STEM education techniques known. What’s more, the program will mobilize a powerful resource, namely passionate adult mentors. We outline here a four-year project to develop *LABRats* into a program that can then be both self-sustaining and readily replicated across the country.

The target audience for *LABRats* is 6th through 12th graders who are interested in STEM. *LABRats* will actively recruit and serve currently underrepresented groups, such as girls, minorities, and underserved urban and rural populations. During the proposed four-year development phase *LABRats* will reach about 800 young people. Included in this group will be a full range of potential *LABRats* participants so we can learn how to adapt the program to those populations that have traditionally been the most difficult to serve. In the five years following the NSF-funded period, *LABRats* will enroll more than 20,000 young people. We hope to grow the program exponentially thereafter, until it one day serves every corner of America.

We will recruit participants by linking with existing programs aimed at grades K-9, advertising through key partners and schools, advertising at science fairs, and other longer-term strategies, such as television interstitials and live demonstration shows.

In a nationwide front-end survey of almost two hundred 6th through 12th graders, the vast majority of respondents said that they wanted to learn how to make their own discoveries and would consider joining a group like *LABRats*. Furthermore, less than half of all respondents were currently participating in STEM programming outside of school, highlighting the need for additional programming.

LABRats intends to impact its participants in three primary ways: develop STEM-related skills, such as empirical reasoning and other “habits of mind;” develop leadership, citizenship,

and a commitment to community service; and improve comprehension of key STEM concepts. The Institute for Learning Innovation will lead efforts to measure these impacts through both qualitative and quantitative means.

Collaboration:

LABRats will be built through collaboration. A national office, housed at the *Society for Amateur Scientists* (SAS) in East Greenwich, Rhode Island, will support a paid staff that will be distributed in science-technology centers (and related institutions) around the country. These experienced professionals will receive additional training and will be responsible for all activities necessary to ensure that local *LABRats* groups run their programs successfully. Local groups may meet at the coordinating science center or at local community-based organizations, such as the Boys and Girls Clubs, YMCA/YWCA, and 4-H locations. Each local group will be led by two to three adult volunteers to coordinate logistics and will have access to a pool of adult volunteer STEM mentors that will serve the entire region.

This new infrastructure will benefit all partners and provide new opportunities for outreach that were not previously possible. SAS will be able to offer its adult members new ways to share their passion for STEM by inspiring and developing the next generation of scientists and engineers through mentorship. *LABRats* will help science-technology centers to expand their reach with only a modest investment. Likewise, community-based organizations will benefit by receiving trained adult volunteers to deliver *LABRats*.

Senior Staff

- Shawn Carlson, Ph.D., Principal Investigator, MacArthur Fellow, and Founder and Executive Director of the *Society for Amateur Scientists*. Dr. Carlson holds a Ph.D. in nuclear physics, and is a well-known science writer and educator. He designed the *LABRats* program.
- Heather Smith, Director of Program Development. Dedicated full-time to program development and implementation. She has a Masters degree in Genetics from Harvard University and extensive strategic planning and project management experience.
- *LABRats* Coordinators. These people will be full-time professionals dedicated to coordinating *LABRats* delivery through regional centers. To be identified.

Advisory Committees

General Advisory Committee – These people will advise all aspects of program development.

- Earnestine Baker, Executive Director, Meyerhoff Scholarship Program, UMBC
- Richard Hudson, Ph.D., Executive Producer, Dragonfly TV, Twin Cities Public Television
- Steve Jacobs, Director, Discovery Channel Young Scientists Challenge; Chair, NSTA Committee on Informal Science; Apprentice to Mr. Wizard
- Dale McCreedy, Ph.D., Director, Gender and Family Learning Programs, Franklin Institute
- Claudia Morrell, Director, Center for Women & Information Technology, UMBC
- Carl Pennypacker, Ph.D., Principal Investigator, Hands-On Universe
- Laura Watkins, Ph.D., Executive Director, Patriot's Trail Girl Scouts Council

Program Content Committee – These people will advise development of STEM education elements

- Cary Sneider, Ph.D., Committee Chair, VP Educator Programs, Museum of Science, Boston
- Paul Hickman, Director of CESAME, Assoc. Professor of Education, Northeastern University
- Pamela Pelletier, Science Assessment Specialist, Boston Public Schools
- Philip Sadler, Ph.D., Director, Science Education Department, Harvard-Smithsonian Center for Astrophysics
- Judah Schwartz, Ph.D., Visiting Professor of Education and Research Professor of Physics & Astronomy, Tufts University

- Carol Smith, Ph.D., Associate Professor of Psychology, University of Massachusetts, Boston
- Robert Tinker, Ph.D., President, Concord Consortium
- Christos Zahopoulos, Ph.D., Director, SEED and RE-SEED, Northeastern University

Consultants

STEM Content Review Committees – two well-respected and credentialed content experts from each of the seven major STEM disciplines: physical, earth, life, space, technology, engineering, and mathematics. To be identified.

Contractors

Web site and online community – Michael Douma, Executive Director IDEA and Nugzar Kachukhashvili, database architect

Television interstitial and live demonstration development – team to be developed with the advice of Steve Jacobs and Richard Hudson.

College-bound program – Regina Thomas, Founder, College Coaching Pros

Evaluation – Institute for Learning Innovation; team led by Kirstin Ellenbogen, Ph.D. and Cheryl Kessler.

Organizational Partners

Regional Centers – all will participate in program development; two East Coast centers will serve as pilot regional centers during Years 2 and 3; others are expansion candidates

- Mystic Aquarium, Mystic, CT – contact is Stephen Coan, Ph.D., VP of Education
- SEE Science Center, Manchester, NH – contact is Douglas Heuser, President
- Discovery Museum and Planetarium, Bridgeport, CT – contact is Linda Malkin, VP
- California Academy of Sciences, San Francisco, CA – contact is Carol Tang, Ph.D., Chair of Educational Programs

TERC – program/curriculum development; contact is Dan Barstow

ROOTS and RIMES projects – exemplary ongoing research projects used for education; contact is Bruce Jackson, Ph.D., Principal Investigator, Boston University Medical School

Community-Based Organizations

- Boys and Girls Club of Cumberland-Lincoln, RI – contact is Rachel Kowalski
- Additional organizations to be added in regional center locations

Innovation:

The social structure of the *LABRats* program is based on tried-and-true elements first perfected by scouting organizations. The program will be delivered through four main vehicles: weekly evening meetings, monthly field trips, a merit badge program, and a mentor program.

LABRats is about relationships—between younger and older members, adult volunteer leaders, and adult volunteer mentors. We are not aware of any other programs that strive to build communities around these types of relationships the way that *LABRats* will to teach both STEM and good citizenship. *LABRats* will also incorporate the latest techniques that have been shown to be the most effective in STEM teaching, such as focusing on a small number of key concepts, requiring predictions to be made prior to inquiry-based activities, allowing for repeated iterations until an activity works, and meaning-making discussions after experiments.

Program deliverables will include: manuals and training programs for adult volunteer leaders, adult volunteer STEM mentors, and participants; a collection of weekly meeting activities; a comprehensive merit badge program consisting of four badge levels in each of the seven main STEM disciplines; a college-bound and other technical career-path program; and a website for communication, sharing, and planning. We will also develop a handbook for new regional centers, including a *LABRats* coordinator training program, sample budgets and

timelines, and best demonstrated practices for recruitment, training, fundraising, and developing community relationships.

Despite the large difference in ages, all members of a *LABRats* group will come together at the same weekly evening meetings. Like scouts, we will use an interactive community approach, in which older members will take responsibility for helping less advanced members grow in the program. Local groups will be gender-segregated based on research supporting this strategy to increase STEM learning and promote personal growth.

Monthly field trips will cater to the interests of each group and will take advantage of STEM-related opportunities near to home. Examples may include special activities at local science museums, a field trip to make nature observations, or taking environmental data as part of a monitoring program.

The merit badge and mentor programs will be tightly linked and will increase in complexity, culminating with extended individual research projects. Both the merit badge program and the weekly meeting activities will cover key concepts that the Program Content Committee will select from various national STEM education standards.

A brief description of our development plans by year is given below. To supplement NSF funds, SAS is also carrying out a major fundraising campaign in the corporate, private, and foundation sectors. We have already raised almost \$400,000 for *LABRats* in cash and pledges to date.

Year 1 – Program Development and Testing – develop and test enough program materials to begin running pilot programs. We will also recruit and train adult volunteer leaders and STEM mentors for the pilot phase. To minimize development costs, we will draw from existing materials, such as Hands-On Universe, GEMS, SEED, and GLOBE. We will also use materials developed by NASA, DOE, NIH, and other government agencies making modifications necessary to integrate them into our program. Our goal is to enhance and extend rather than duplicate the instructional materials used in the schools. Content review committees will review all materials for accuracy. Formative evaluation will inform program design and development.

Christos Zahopoulos, Ph.D. will advise mentor recruitment and training based on his extensive experience with the RE-SEED program. All mentors will be extensively screened and will agree to appropriate background checks.

Years 2 and 3 – Pilot Programs, Testing, Refinement – run pilot programs from two regional centers simultaneously to learn how best to transplant the program into new communities. In Year 2, each regional center will support two groups of twenty participants. In Year 3, the original groups will continue and each regional center will add two additional groups, for a total of eight groups. Formative evaluation will inform program refinements; summative evaluation will begin in Year 3.

Year 4 – Initial Expansion – add four to six regional centers in key locations across the country. We will target larger, well-known members of the Association of Science-Technology Centers (ASTC). These centers will position us for a national rollout. Summative evaluation will be completed at the end of Year 4.

Transition to Self-Sustainability – We realize that creating the full *LABRats* social structure will take several years beyond the NSF-funded period. SAS will take proactive responsibility for continuing to support and disseminate the *LABRats* program indefinitely. The national office will ensure that *LABRats* staff at all participating science and technology centers are properly trained and supported. Our plan is to develop revenue sources in every community that *LABRats* reaches, so that eventually each regional center will become self-sustaining. National fundraising efforts will be ongoing.