DEVELOPING AN INCLUSIVE ENVIRONMENT FOR DEAF AND HARD-OF-HEARING STUDENTS IN UNDERGRADUATE RESEARCH PROGRAMS

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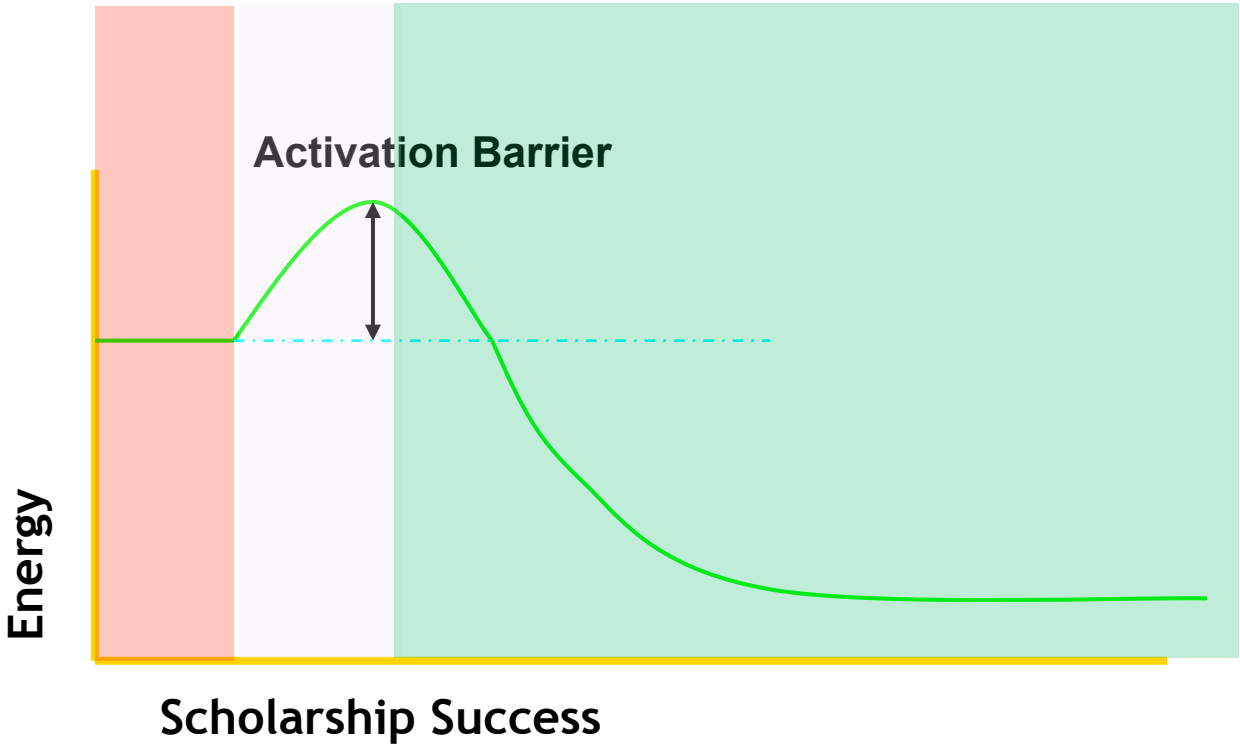
National Technical Institute for the Deaf
Laboratory Science Technology Program

R·I·T
National Technical Institute for the Deaf

R·I·T
College of Science

Rochester Institute of Technology (RIT)	***National Technical Institute for the Deaf (NTID)***	***Laboratory Science Technology Program (LST)***
■Located in Rochester, New York (Western Part of the State). ■Enrollment of over 17,000 students. ■Offers degrees from Associate to Doctorate level.	■One of the nine colleges of RIT. ■The first and largest technical college for deaf and hard-of-hearing students. ■Enrollment of over 1,500 students. ■Primarily offers Associate level degrees. ■ Students cross-register in the other colleges of RIT.	■Chemical Technology-like program. ■**Developed primarily from an industry perspective.** ■**Prepares students for employment as laboratory technicians.** ■Students learn the proper analysis of chemical, biological, biotechnical, environmental, and food samples. ■ "LST + 2" program allows students to complete the LST A.A.S. at NTID degree and then continue for two more years at RIT for a B.S. degree in Applied Science Technology. ■Recognized by the ACS's Chemical Technology Program Approval Service (CTPAS).

KINETICS OF SCHOLARSHIP SUCCESS: A NOTE TO FACULTY



- You've got a research program/agenda/ideas
- *Overcoming the Activation Barrier
- With success comes more success

GOALS OF UNDERGRADUATE RESEARCH

Goals of most Undergraduate Research Programs:

- work on projects that are logistically prohibitive in the traditional classroom
- learn first-hand about how research works and ethical conduct in the research setting
- be involved in experiential learning activities, develop lifelong learning skills, and apply learned course knowledge to practical projects
- be a valued member of a team as well as cultivate relationships with faculty
- gain insights into future careers and prepare for the next level of education
- **increase recruitment and retention of students into the Chemical Sciences**

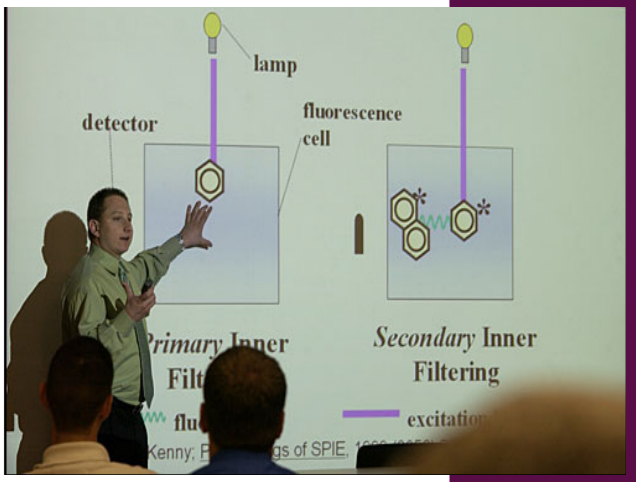
UNDERGRADUATE RESEARCH PROGRAM AT NTID

NTID research programs *may* have a couple unique goals:

1. **to involve 1st & 2nd year and/or Associate degree level students**
   - Issues with rapid student turnover and academic preparation

2. **to involve Deaf and Hard-of-Hearing (D/HH) students**

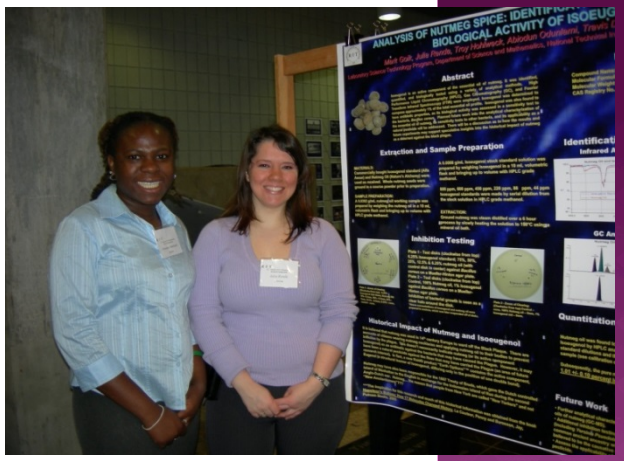
SUCCESS IN WORKING WITH D/HH & EARLY UNDERGRADS



- ***Breaking the research into "digestible" projects***
  - Projects are carefully chosen to fit students' abilities, while still contributing to the larger group research initiative that is providing the scholarly contributions to the field.
  - Projects should include direct and measurable outcomes with continuous feedback.
  - Research team meetings can be used for advisors to demonstrate how the smaller projects relate and students can present to each other in order to provide an understanding of the laboratory's overall research initiatives.

SUCCESS IN WORKING WITH D/HH & EARLY UNDERGRADS

- *Requires talented and dedicated faculty*
- *Providing individualized attention to researchers*
- *Providing positive feedback*
  - I believe that the data that has been collected by my students at NTID is of the highest quality that has ever been produced under my direction. It is paramount to <u>share these accolades with students often</u>.



SUCCESS STORIES FROM AAS RESEARCH STUDENTS

- **Gloria Wink**
  - A.A.S. Laboratory Science Technology, RIT/NTID. B.S. Environmental Science, RIT. M.S. Environmental Science, RIT. Ph.D. Toxicology, U. of Rochester???...enrolled in NIH Bridges to the Doctorate program.
  - Research on Dissolved Organic Carbon Research and Electronic Cigarettes.

- **Nelsy Carcamo**
  - A.A.S. Laboratory Science Technology, RIT/NTID. B.S. Environmental Science, RIT. M.S, Environmental Science, RIT.
  - Research on deposition of carcinogens in the lungs (won the best poster presentation at the Undergraduate Research Symposium with over 90 presentations).

- **Melody Frink**
  - A.A.S. Laboratory Science Technology, RIT/NTID. B.S. Biochemistry, RIT. Working on Ph.D. in Chemistry, The Ohio State University.
  - Received one of the prestigious RIT Outstanding Undergraduate Scholar Award.
    - Given to those with a GPA of 3.85 after 125 quarter credits of study.
    - The first LST graduate to do so.

BENEFITS TO FACULTY

- **UG research should also be mutually beneficial to faculty. Through small group or individualized interactions, faculty are able to:**
  - advance their scholarly research
  - provide substantial student learning opportunities while teaching beyond the limitations of a typical course
  - integrate teaching and research efforts
  - cultivate relationships with students and improve student recruitment/ retention

MECHANISM FOR SUCCESS

- ***Institutional support***
  - Could include:
    - financial assistance for student travel
    - in-house start-up funds/grants
    - securing necessary equipment
    - cultivating media outlets to share stories about research success
    - **recognition** that the intense effort required to lead this type of research can become a valued portion of the faculty member's plan-of-work
  - RIT provides a vibrant atmosphere for UG research by having weekly seminars for sharing student research, a summer research program, and a large annual UG research symposium.

MECHANISM FOR SUCCESS

- *Opportunities for the dissemination of results*
  - An outcome of projects should be the communication of results (publications, conference presentations, presentations to department faculty/peers, etc.).
  - Establishing local opportunities for students to report technical findings is important too
    - student presentations to advisory groups, the Board of Trustees, or writing articles for local newsletters is extremely valuable.
  - Conferences are great opportunities to demonstrate the sophistication of the technical communication of research initiatives to professional audiences.
    - For our D/HH students, attendees are always impressed, not only with students' abilities to convey the importance and results of their research, but also with their aptitude for finding effective solutions to communication barriers.

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Multidimensional fluorescence studies of the phenolic content of dissolved organic carbon in humic substances†

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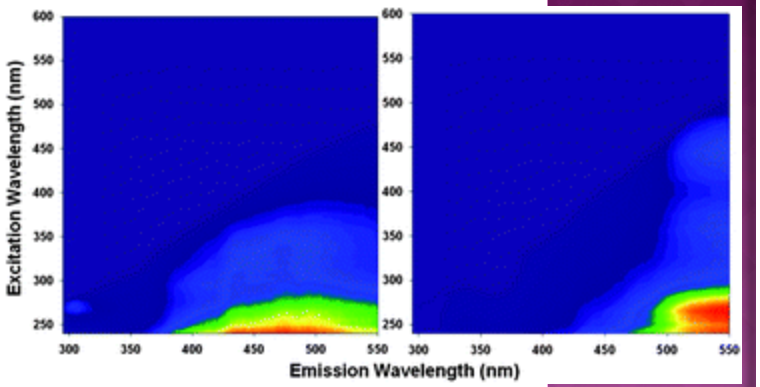
Indicators suggest that the amount of dissolved organic carbon (DOC) in natural waters may be increasing. Climate change has been proposed as a potential contributor to the trend, and under such a mechanism, the phenolic content of DOC may also be increasing. This study explores the assessment of the phenolic character of DOC using multidimensional fluorescence spectroscopy as a more convenient alternative to traditional wet chemistry methods. Parallel factor analysis (PARAFAC) is applied to fluorescence excitation emission matrices (EEMs) of humic samples to analyze inherent phenolic content. The PARAFAC results are correlated with phenol concentrations derived from the Folin-Ciocalteau reagent-based method. The reagent-based method reveals that the phenolic content of five International Humic Substance Society (IHSS) samples varies from approximately 5.2 to 22 ppm Tannic Acid Equivalents (TAE). A four-component PARAFAC fit is applied to the EEMs of the IHSS sample dataset and it is determined by PARAFAC score correlations with phenol concentrations from the reagent-based method that components C2, C3, and C4 have the highest probability of containing phenolic groups. The results show the potential for PARAFAC analysis of multidimensional fluorescence data for monitoring the phenolic content of DOC.



SAFETY IN THE LABORATORY

- Understandably, individuals are often first concerned with safety issues when considering taking on a deaf/hard-of-hearing student in the lab.
  - We have found the safety barriers to be minimal
    - Attitudinal barriers might be the largest to overcome.

OUR STUDENTS…

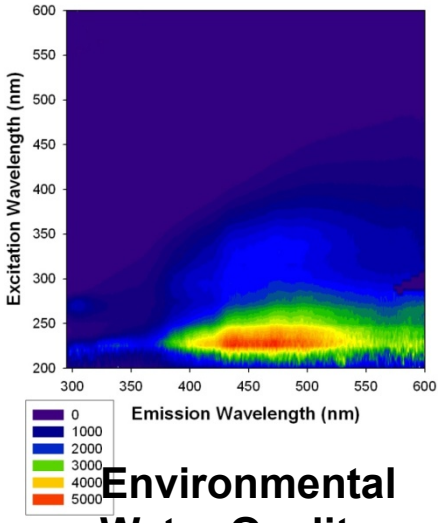
We believe that our students:

- Are very knowledgeable in applied information
- Have excellent bench skills
- Are often able to enter a new laboratory facility and contribute from the start

Some Evidence of our student success:

- Several of our students have received the American Chemical Society's Chemical Technology Student Recognition Award.
- The employers that have worked with our students on cooperative work experiences in the past have given high recommendations.
  - Some of the organizations with which we have placed LST students in the past include: Tufts University, Stanford's CPIMA_SURE, Paradigm Environmental Services, Monroe County Medical Examiner's Office, RJ Lee Group, Strong Memorial Hospitals Research Laboratories, General Mills, FDA, and NOAA.
- Several of our students have presented their research at local and national symposia.

BE OPEN TO COLLABORATION

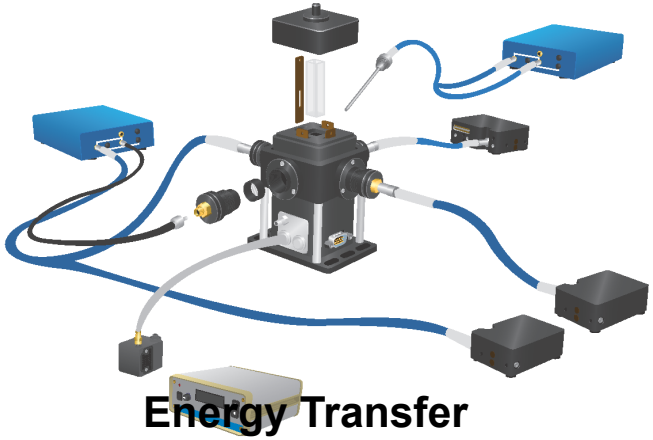


Environmental Water Quality

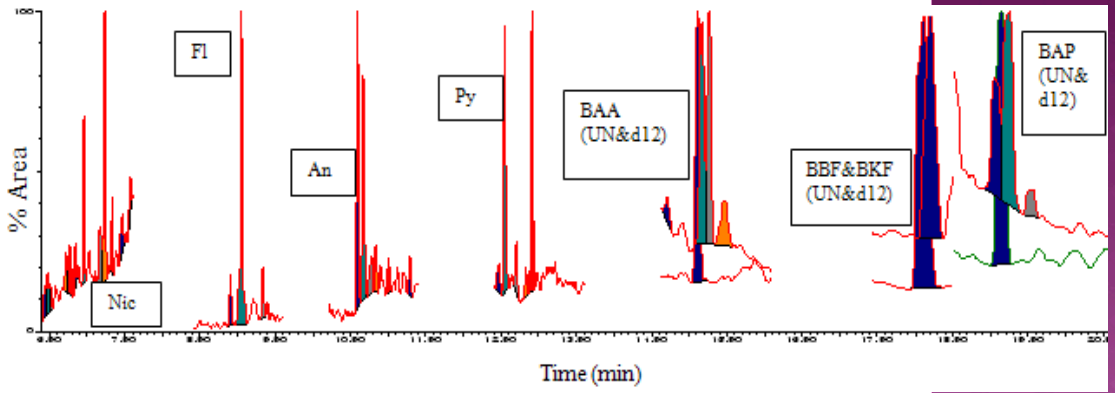
Chemistry of Viticulture & Enology

Pedagogy

Nutrition in Migratory Birds



Energy Transfer



Carcinogen Deposition in Cigarette Smoke

OVERCOMING THE ACTIVATION BARRIER: MAKE A PLAN

- Develop a research question/activity (your interests, institutional needs/initiatives, etc.)
- Find a research peer-mentor?
- Collaborate (interdisciplinary, cross-campus, external to RIT)?
- Get funding (start small & build on success)
- Disseminate (journal articles lead to more funding… more funding to more articles published…and so on…)

MY ORIGINAL PLANS/GOALS

- Short Term:
  - get a few students hands-on experiences in the lab (without funding, limited to projects that utilize institute resources)
  - publish a peer-reviewed article from the work (to establish credibility)
- Intermediate Term:
  - secure funding (start with small grants and get bigger)
  - publish more
  - establish a research group (larger number of students and collaborators)
- Long Term:
  - create a vibrant/sustainable research program (with success comes more success)

MECHANISM FOR SUCCESS

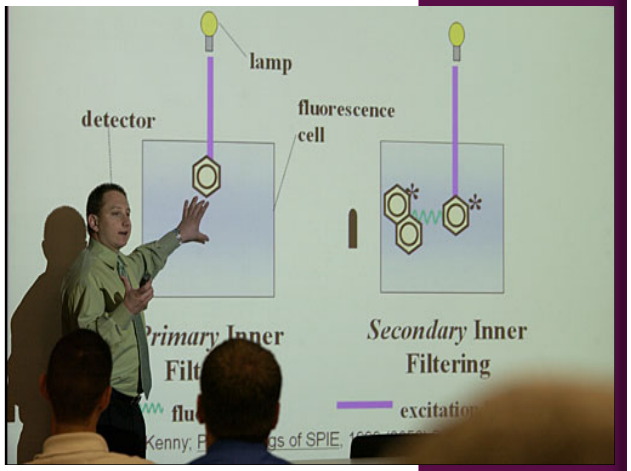
We have found that a successful UG research program should have:

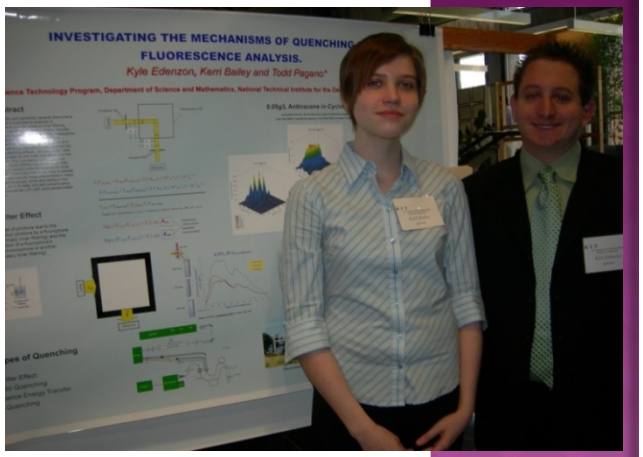
- ***Direct student involvement***
  - Students should be directly involved in every aspect of the research.
  - For me, it can be like having a dozen extra hands in the laboratory performing the research, with astounding productivity.

- ***Available interesting/desirable research projects***

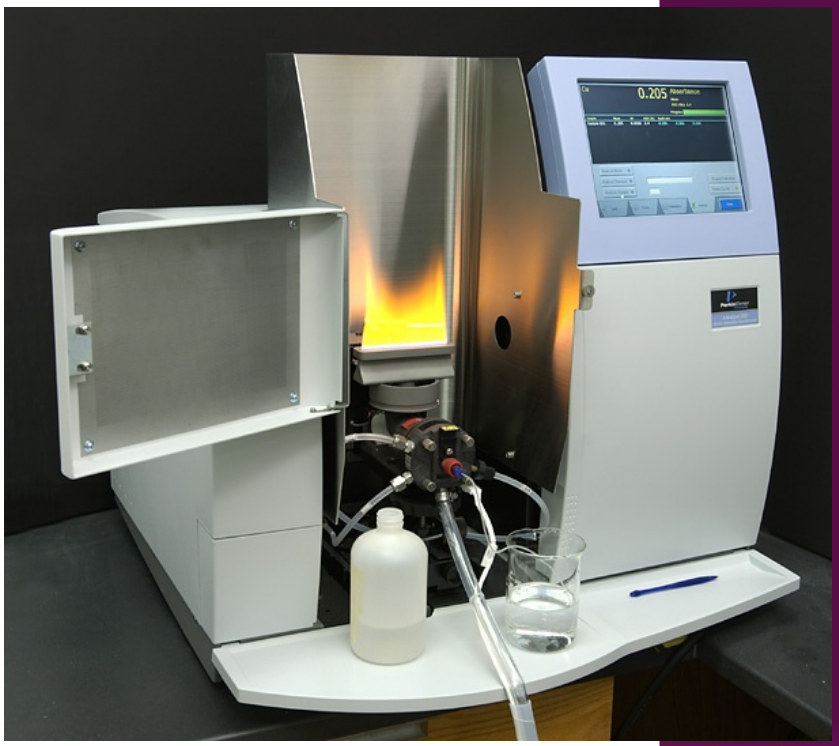
GOALS OF OUR UG RESEARCH PROGRAM

- The current momentum of UG research is exciting. Ours strives to provide students with valuable opportunities to:
  - learn discipline-specific information while performing cutting-edge research
  - contribute in innovative ways to the scholarship of their field
  - communicate findings/ advancements/ technical information with peers and professionals in their field





FEATURES



- Emphasis on:
  - technical & applied content
  - multiple hands-on opportunities
  - workplace skills
  - important “soft” topics
  - Courses
    - Chemistry (General, Analytical, Organic)
    - Instrumental Analysis
    - Laboratory Mathematics
    - Cell Biology, Molecular Biology and Microbiology
    - Chemical Technology and Biotechnology
    - A unique six part Laboratory Applications series
- State-of-the art instrumentation laboratory
- Required Cooperative Work Experience (Co-op)

COOPERATIVE WORK EXPERIENCES (CO-OP)

Why are co-ops important:

- Provides valuable work experience.
- Opens the potential for permanent employment.
- Provides networking opportunities.
- Provides insight as to whether that position/field/company is right for you.
- Highlights your strengths and weaknesses.
- Provides practice on how to deal with communication issues.

Where do they occur:

Academic:

- Tufts University, James Madison University, Stanford University, others.

Industry:

- Dow Chemical, Novartis Pharmaceutical, Eli Lilly, Kodak, others.

Government:

- NOAA, Medical Examineers Office, FDA, others.

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

National Science Foundation
WHERE DISCOVERIES BEGIN

EMPLOYER FEEDBACK

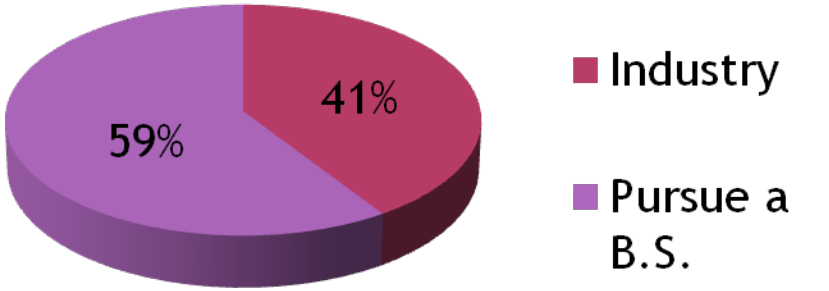
- The first question always on a potential co-op supervisor's mind is student safety
  - They ensure the students receive safety training and accommodations are provided to make sure the information is clearly communicated.
- After a student completes the co-op, they want to try to hire them back
- 4.8/5 Supervisor Satisfactory Evaluation Rating

OBSERVATIONS OF STUDENT CO-OPS

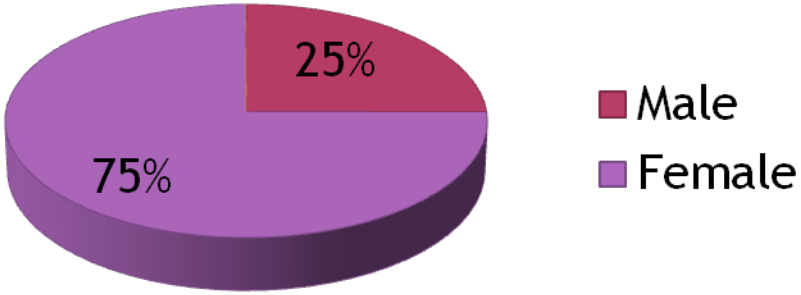
- Students start out the experience very nervous and unsure of themselves because:
  - Accommodations
  - Lack of confidence
- Students end the experience and return to school with a newfound confidence
  - They find out their co-op supervisors are already experienced or know how to be sure students are accommodated
- They return wanting another co-op experience the following summer
  - Easier to find a second one because employers like to the past experience.

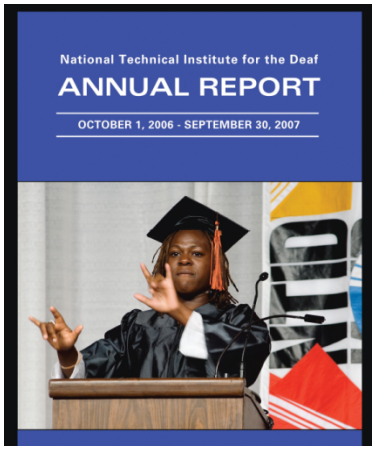
LST GRADUATES

Where do LST Graduates go?



LST Graduates who Pursue B.S. Degrees

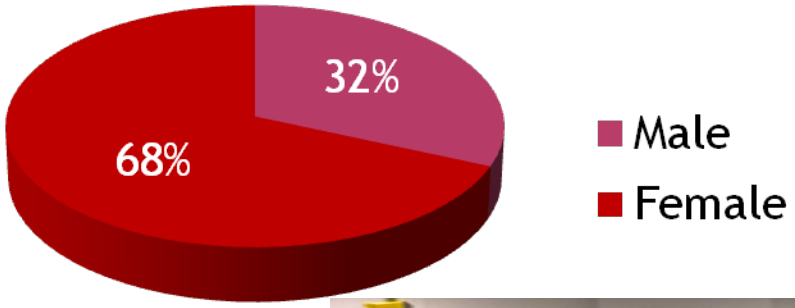




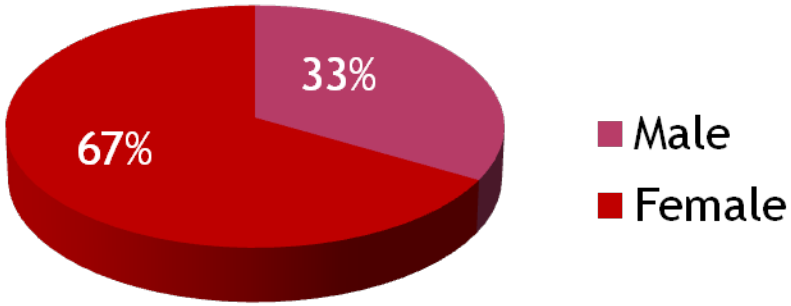
http://www.ntid.rit.edu/sites/default/files/annual_report2007.pdf

PROGRAM MAKE-UP

Students Currently in LST Program



LST Graduates



OBSERVATIONS ON HOW WE ARE RECRUITING RETAINING DEAF AND HARD-OF-HEARING FEMALE STUDENTS

- Intensive Summer Vestibule Program for Freshmen
  - The students first arrive to “sample” two programs of their choice, which allows us to have more one-on-one interaction with the students.
- Female Deaf and Hard-of-Hearing Faculty and Staff
  - The students admire having Deaf and Hard-of-Hearing female professionals who have proven they can be successful scientists.
- Dr. Todd Pagano as Faculty and LST Director
  - Students look up to Todd and trust his advice.
  - He exemplifies a hearing individual who has embraced the Deaf community.
- Teaching Methodology
  - The program is very hands-on with intensive laboratory experiences.

PROGRAM STATUS

Past	Present	Future
-The LST Program was implemented in 2002	-ACS CTPAS Approved -The LST Program has grown to the maximum student enrollment that current resources allow -The LST Curriculum has been modified to accommodate advances in the field -Fully functional laboratories have been set-up	-Establish/promote industrial partnerships -Increase the options for students to receive an Associate of Science (A.S.) degree with articulation agreements with Baccalaureate programs