The Neural and Genetic Bases of Age-Related Hearing Loss
By D. Robert Frisina, Sr., and Robert D. Frisina, Jr.

Age-related hearing loss — presbycusis — is the number one communicative disorder, and one of the top three chronic medical conditions of our aged populace. Until we have the means for prevention or cure, this communication deficit is inevitable in some form or another for everyone as we age. Improved understanding of the neural and genetic bases of presbycusis will allow for the successful development of preventions and biomedical treatments.

Problems in the Ear
The classical clinical sign of presbycusis is a progressive loss of sensitivity to high frequency sounds. Since normal speech perception requires the processing of vowels and consonants, and since consonants have primarily high frequencies, consonant confusions and concomitant declines in speech perception occur as one develops a high-frequency hearing loss. This high frequency hearing loss is due to pathology of hair cells, microvasculature and eighth cranial nerve cells in the high frequency (basal) turn of the cochlea — the portion of the inner ear used for hearing.

In our audiology research laboratories at the International Center for Hearing and Speech Research at NTID, we have conducted experiments during the past decade on over a thousand human listeners, ages 18-98, utilizing a rigorous set of audiology and speech perception tests. Classical tests measure the sensitivity and health of the cochlea, mostly under quiet listening conditions. In contrast, state-of-the-art paradigms measure the capabilities of the ear (peripheral auditory system) and the brain (central auditory nervous system) under both quiet and more realistic background noise listening situations (e.g., Tadros et al., 2005).

Otoacoustic emissions are a novel neurophysiological means of assessing the health of the cochlear outer hair cell system. The cochlea has two systems of hair cells. The inner hair cells convert sound into the code of the nervous system, and are the major source of sound information that travels along the auditory division of the eighth cranial nerve to the brain. The outer hair cells provide electromechanical amplification for the inner hair cells so that one can perceive low level sounds (for example, whispers) under quiet conditions. If tones are put into the ears with tiny speakers, sounds will emanate from the ears a very short time later (less than a second). These sounds coming out of the ears, or echoes, are a physiological index of the health and function of the cochlear outer hair cell system. We have discovered a correspondence between age-related declines in the outer hair cell system of human listeners and our experimental mice, using otoacoustic emissions. This is part of the age-related hearing loss that occurs in the ear.

Brain Deficits
More sophisticated audiological and speech perception tests allow us to understand changes that take place in the ear versus those that have a central (brain) component in presbycusis. For instance, the Hearing-in-Noise-Test (HINT) assesses how speech perception in background

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Notes of Note continued on page 3
With this installment of the Bulletin we celebrate the 175th anniversary of our parent institution, the Rochester Institute of Technology (RIT), and welcome some new and not-so-new faces to these pages. RIT has been home to the National Technical Institute for the Deaf (NTID) for 37 years. In those years the faculty and staff have worked hard to provide a cultural and academic home to deaf and hard-of-hearing students pursuing careers in social work and the arts, but more often in what we now call STEM (science, technology, engineering, and mathematics). However, our work extends beyond the students currently enrolled at RIT. We are also charged with discovery and with providing new information and strategies to colleagues in the US and around the world. The authors in this anniversary edition of the Bulletin represent well this dual vision of a technical college for the deaf on the campus of a large technical university in upstate New York.

Best practices surface as a result of research and experience. Student experience is the foundation of the article by the team of RIT students — Annmarie Ross, Erin Vlahos, Stephanie Shubert, Jill Smink, and Dan Short — brought together to work on Project Access by Sue Foster and Gary Long and support from the US Department of Education. Together with interpreters and professors from RIT’s College of Science, the team has documented strategies that improve students’ access to information in science classrooms.

While we know a good deal about the etiology of hearing loss in infants and small children, we know relatively little about age-related hearing loss. The article by the Frisinas (Directors of the NIH-supported International Center for Hearing and Speech Research) gives us a glimpse of the results of their groundbreaking research: how aging affects the auditory system and what gene arrays will tell us about aging and hearing loss.

As Julie White and Jerry Berent note in their article on the NTID Institutional Review Board, there has been a dramatic upsurge in research activity at RIT in recent years. This in part explains why the university now needs a dedicated professional to guide faculty in procedures that assure protection of students who become subjects and collaborators in our research. Happily, that professional — Julie White — is someone who knows both rights issues and grant-getting. Her co-author, Jerry Berent, is current chair of the NTID IRB and a member of the Department of Research.

As always, we invite your comment on these articles and research conducted at NTID (watch these pages for a new research agenda). You may send us our ideas and comments by visiting our website (go to www.rit.edu/ntidresearch and click on “Comments on NTID Research Agenda”) or by contacting me through the NTID Research Bulletin (address below).

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noise changes as the spatial locations of speech and background noise vary in a free-field listening situation. Since integration of information to locate the source of sounds in space from the two ears takes place in the brain, deficits on this task indicate problems in auditory portions of the brain.

Another physiological test involving otoacoustic emissions allows us to measure the health of the auditory feedback system (efferent system). Here otoacoustic emissions are measured in one ear, with and without background noise being presented at the other ear. If the brainstem auditory feedback system is working properly, the strength of the otoacoustic emissions will decline in the presence of the contralateral noise.

We have discovered that problems with the parts of the brain used for hearing start to decline in middle age, for both human listeners and experimental animals (mice). Specifically, even in cases where the ear has normal sensitivity to sound (high frequency hearing in the normal, young adult age range), problems can arise for binaural processing (comparing information from the two ears for successful sound source localization), speech perception in background noise (Frisina and Frisina, 1997), temporal processing (Frisina et al., 2001), and operation of the auditory efferent system (Kim et al., 2002).

Follow-up neuroscientific investigations of these auditory processing changes starting in middle age have revealed some underlying structural, chemical and molecular changes in the parts of the brainstem used for hearing (Frisina, 2001a,b). For example, neuropathological recordings from single nerve cells of the auditory midbrain (inferior colliculus) reveal that their abilities to code timing aspects of complex sounds and speech decline with age (Walton et al., 1998). In addition, neural pathways from the lower brainstem providing inputs to these regions become diminished with age. In the area of chemical changes, calcium-binding proteins that regulate the amount of intracellular calcium in nerve cells change with age in the auditory midbrain. Potassium channels that allow nerve cells in some portions of the brain used for hearing also decline with age, affecting complex sound processing and the effectiveness of the auditory feedback system from the brain to the ear.

**Technological Advancement: Gene Microarrays**

Knowledge of how changes in gene expression may manifest themselves in age-related hearing loss, and play possible causative roles, will likely lead to more effective preventative measures or biomedical curative interventions. The most comprehensive way to assess gene expression in the ear or brain employs a relatively new technological procedure involving gene microarrays, a so-called high-throughput technique. This approach involves attaching many probes for thousands of different genes onto tiny spots on a small glass slide. This slide is then washed in a solution prepared from the tissue of interest (inner ear, or portion of the brain used for hearing) containing fluorescently-labeled DNA. Using digital imaging, the tiny spots that light up on the gene microarray slide are recorded and analyzed. Genes corresponding to spots that light up indicate a significant amount of gene expression in the original

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Other Languages (TESOL) in San Antonio, TX. Other NTID presenters included English professors Sybil Ishman, "Language sensitivity and deaf L2 writers," and Susan Keenan, "What deaf students learn from writing classes." The concerns of teaching English to deaf students (TESD) are represented through TESOL’s Bilingual Education interest section. Berent encourages teachers and researchers to join TESOL (www.tesol.org) and to submit TEDS-related proposals for next year’s TESOL Convention, March 15-19, 2006.

Ronald R. Kelly, Gerald P. Berent, Gary Blatto-Vallee, and Jeffrey Porter are conducting mathematics related research on deaf and hearing students’ abilities to use English language quantifiers and spatial relationships in word problems as part of their 18-month NSF Catalyst Project titled Science of Learning Center on Mathematics and Deaf Learners. In addition to NTID/RIT, this collaborative grant involves Martha G. Gaustad at Bowling Green State University.
tissue; conversely, spots with little fluorescence indicate a small amount of gene expression for the gene corresponding to that spot. Comparing fluorescence levels in control animals, young adults with normal hearing in our presbycusis experiments, to those in older animals with age-related hearing loss allows for quantitative determination of expression changes with age for cochlear and brain tissue samples.

Our initial findings suggest that there are significant changes in neurotransmitter (proteins by which nerve cells communicate) and gap junction (potassium regulation) gene expression as a function of age in the ear. Neurotransmitters that either excite (e.g., glutamate) or inhibit (e.g., GABA) neighboring nerve cells exhibit gene expression changes in portions of the brainstem used for hearing, i.e., the auditory midbrain. In cases where there are significant gene expression changes with age, we also tend to find strong relations or correlations with an animal’s hearing ability across mice of different ages and hearing abilities.

Implications for Treatment Strategies

As we continue to unravel the mysteries of the neural, genetic and molecular bases of age-related sensory disorders such as presbycusis through basic research, we move closer to more effective preventative and curative biomedical interventions. As gene therapies and stem cell research involving therapeutic cloning of stem cells become more developed, possibilities for avoiding or reversing gene expression changes in the cochlea or brain become realizable. There are still many research and clinical trials steps to be taken before these possibilities will reach otolaryngology and audiology clinical settings; however, the accelerated rate of recent progress bodes well for the future.

References


Implications of NTID Research 2005 will be published in Fall 2005. To reserve a free copy, please email Gail Hyde at GLH9638@RIT.EDU, including the information requested below, or complete this form and return it to Gail Hyde c/o Educational Design Resources, National Technical Institute for the Deaf, 52 Lomb Memorial Drive, Rochester, NY 14623-5604.

Name

Address
The NTID Institutional Review Board: Procedures, Guidelines, and Resources
By Julie White and Gerald P. Berent

History of the NTID Institutional Review Board
The National Technical Institute for the Deaf Institutional Review Board (NTID IRB) has an auspicious history, having been established by NTID in 1978 in response to its extensive research activity involving deaf and hard-of-hearing subjects. The NTID IRB was one of the first IRBs in the country, and many of its policies and procedures informed those of the RIT IRB, which was established in 1985.

The NTID IRB and the RIT IRB are actually two branches of one RIT Institutional Review Board, whose goal is to ensure the protection of human subjects in research. Universities often have separate IRB branches in order to focus on research activity within individual colleges, within specific disciplines, within groupings of disciplines across colleges, or by the need for specialized attention to specific subject populations. At present, the NTID IRB branch reviews human subjects research focusing on deaf and hard-of-hearing individuals. The RIT IRB branch reviews all other human subjects research at RIT. As research activity at RIT increases, there may be a need for additional IRB branches.

Human Subjects Research
All research initiated or conducted at RIT must be approved by the IRB if the research involves human subjects. The IRB is an administrative body established to protect the rights and welfare of human research subjects recruited to participate in research activities conducted under the auspices of the university.

The review of research involving human subjects at RIT is in compliance with Part 46 of Title 45 of the Code of Federal Regulations and in accordance with the RIT Federal-Wide Assurance for Protection of Human Research Participants. The Federal-Wide Assurance certifies that RIT will comply with the Department of Health and Human Services regulations for the protection of human research subjects.

In Fall 2004, RIT Sponsored Research Services made a change to further ensure compliance with human subjects research regulations, naming Julie White as RIT’s first designated director of the Office of Human Subjects Research (OHSR). This change allows for greater consistency and coordination in IRB procedures, an essential task due to the 300% increase in projects reviewed by both IRB branches since 2001.

The IRB Review Process
In order to determine which projects require IRB review, investigators must answer two questions: “When is a project research” and “When is it human subjects research?” Federal regulations define research as “a systematic investigation, including research, development, testing and evaluation, designed to develop or contribute to generalizable knowledge. Activities which meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program which is considered research for other purposes.”

As defined by the federal regulations, human subject means a living individual about whom an investigator (faculty, staff, or student) conducting research obtains (1) data through intervention or interaction with the individual or (2) identifiable private information.

Once an investigator has determined that the proposed activity constitutes research with human subjects, the research protocol must be reviewed by the appropriate IRB. The process begins by the investigator answering all questions in the request document known as Form A, available at www.research.rit.edu, and submitting Form A to OHSR. A complete, clearly written request containing all the required information facilitates the IRB review process.

Risks to human subjects. When it reviews a request, the IRB’s responsibility is to ensure (1) that risks to human subjects are minimized and/or the benefits outweigh the risks, (2) that the rights and welfare of any subject will be adequately protected, and (3) that informed consent when required will be obtained appropriately. The IRB categorizes the project as either “Exempt” from IRB review...
(see www.research.rit.edu for the categories of exemption) or as one of the following types:

- **Type I** — No risk of injury to human subjects. No informed consent necessary. Eligible for expedited review.

- **Type II** — Presents no more than minimal risk of injury to subjects as a result of the activity. Informed consent is required. Eligible for expedited review.

- **Type III** — Potential exists for harming subjects or violating their rights. Informed consent and assurance of minimization of risk are both required. The RIT Provost must approve.

- **Type IV** — Significant possibility of injury to subjects. The risk must be outweighed by potential benefit. Informed consent and assurance of minimization of risk are both required. The RIT Provost must approve.

As defined by the federal regulations, *minimal risk* means that “the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.”

**Full Board review and expedited review.** Reviews of submitted requests are generally handled at regularly scheduled meetings of the IRB. In the event that full Board review is not possible in a timely fashion, a research request that is clearly proposed as Type I or Type II may be reviewed in an expedited process. In an expedited review, the IRB chair (or the chair’s designee) or the OHSR director has the authority to expedite the process by assigning a Type I or II to the project. Generally, Board review takes one to three weeks. Investigators who anticipate the need for a quicker response are urged to communicate that need to the OHSR director. Investigators receive written notification of IRB action within one week of review, including any modifications or clarifications required as a condition for IRB approval. When substantive clarifications or modifications are required, IRB approval will be deferred, pending subsequent review of the requested material. When the IRB stipulates revisions requiring simple concurrence by the investigator, the revised research protocol may be approved through expedited review.

**Student-initiated research.** RIT faculty members supervising undergraduate or graduate students who are conducting research with human subjects are responsible for informing students of elements of the RIT policy that are relevant to the students’ research. Faculty supervisors who have filed a certificate of training with the OHSR have the authority to determine whether a student’s project is either Excluded (not research or not research with human subjects) or Exempt from IRB oversight. Authorized faculty members who make such a determination inform their student of the determination in writing and tell the student to proceed with the project. Within 20 days of providing written approval to the student, the faculty member must inform the IRB of this Excluded or Exempt student research.

If the supervising faculty member determines that the student research is not Excluded or Exempt, the faculty member should assist the student in understanding the IRB approval process and in developing and submitting a Form A and associated documentation for IRB review.

**Follow-up review.** Research that continues for more than one year must be reviewed again by the IRB. For continuing review of a protocol, the investigator must provide a protocol summary and status report on the progress of the research (see Form F at www.research.rit.edu). If the original project has been modified, the investigator must provide new relevant information, including new risks associated with the research, a copy of the current informed consent document, and any newly proposed consent document.

**RIT-initiated research at another institution.** RIT investigators seeking the cooperation of another institution in RIT-initiated research involving human subjects must submit their
requests to the RIT IRB for approval regardless of approval by the other institution. While compliance of other participating institutions with applicable regulations is the responsibility of those institutions, research sponsored wholly or in part by RIT must comply with RIT’s policy.

Outside investigators conducting research at RIT. RIT entertains inquiries from outside institutions and investigators who wish to conduct research and collect data at RIT. Regardless of whether a project has been reviewed and approved by another institution’s IRB, it must also be reviewed and approved by RIT’s IRB before data are collected at RIT. If the applicant is affiliated with another institution with an IRB, that Board must first review the proposed research, and a copy of its findings and documentation must be forwarded to the RIT IRB. RIT’s Board may add conditions to the proposed research or disapprove the participation of RIT.

Proposed Policy Revisions
Over the past year, the RIT IRB branches have reviewed RIT’s Policy for the Protection of Human Subjects in Research. Their recommended revisions are designed to ensure that RIT’s policy is in accord with federal regulations and guidance. Two major changes include (1) a requirement that investigators file a certificate of training with the OHSR prior to receiving IRB approval of a research project and (2) new procedures for student-initiated research. Regarding certificates of training, Sponsored Research Services offers PI Institutes throughout the year which fulfill the training requirement; in addition, on-line training is available. Acceptable on-line and on-campus workshop training options are listed on the OHSR website: www.rit.edu/research/compliance.

Suggestions for Keeping the Process Simple
1. Participate in available on-line and on-campus training to receive certification. These are simple and convenient activities.

2. Study the categories of risks to human subjects (Types I-IV) and especially the Exempt categories. Under specified conditions, research on classroom practices and educational strategies and the use of educational tests, surveys, interviews, and existing data in research are exempt from IRB review.

3. When you develop an IRB request for review (Form A), be thorough and clear and provide all requested information. It facilitates Board review of your request if you type your own information into the Form A file using a font that is distinct from the font used in Form A questions and guidelines.

4. Familiarize all students whose research you supervise with the relevant IRB information on policies, guidelines, and procedures. Assist students in their preparation of requests for IRB review, and communicate IRB decisions, including Board conditions for approval, to them.

5. Use your last name as part of all file names that you submit to OHSR electronically.

6. Prepare and submit requests for IRB review as early as possible to provide sufficient time for Board review.

7. Ask the OHSR Director or an IRB chair to clarify policies, guidelines, or procedures that are not clear to you.

Although instructors in mainstream postsecondary institutions often want to include their deaf and hard-of-hearing (deaf/hh) students fully in classroom teaching and learning activities, they may lack the necessary awareness, skills, and knowledge to do so. Project Access,2 a federally-funded program at NTID/RIT directed by Susan Foster and co-directed by Gary Long, is designed to facilitate instructors’ awareness of barriers experienced by deaf/hh students in mainstream classes and to provide strategies they can use to increase access. We are deaf RIT students who have worked with Project Access for three years. In this article, we share two Project Access products—Students’ Top Ten List for Teachers and Deaf, Deaf Campus.3

The Top Ten List for Teachers presents the most important classroom teaching behaviors from the perspective of deaf/hh students in RIT classes. Deaf Deaf Campus is an experiential, student-led, deafness emersion activity designed to create awareness and sensitivity on the part of hearing instructors and student peers. Following are brief descriptions of each.

1. Don’t use words like “this” and “that” as referents in the class or lab.

For example, in the lab don’t use sentences such as “Move these things over there.” Instead use proper names—including technical terminology—when referencing items in this fashion. For example: “Move the small beaker to the table by the window.” Allow time for students (and an interpreter or captionist if present) to reference the item or location so that the proper association is made. When you are more specific it helps all students, hearing or deaf, to understand.

2. Have PowerPoint and lecture notes available to the students before class.

Providing these materials ahead of the class makes it easier for deaf and hard-of-hearing students to prepare for class and, importantly, provides a context for class discussions. Make sure that support service providers (interpreter, notetaker, tutor, and/or captionist) are provided with access to the material, too—either through a hard copy provided in advance of the class if possible, or through some other source like email or web distribution.

3. Treat all students equally.

When students register for your class, they are all there to learn, although each has different skills and understanding. Keep in mind that although deaf and hard-of-hearing students have special needs, they are basically the same as hearing students. Treat them equally. You set the tone—perhaps without realizing it—for the entire class; make sure it is one in which all students are treated equally.

4. Have a positive/flexible attitude.

A positive and flexible attitude helps everyone’s day. You are a model for your students. We encourage you to be open in your interactions with deaf and hard-of-hearing students in your classes.

Voices from the Mainstream continued on page 10

1. The five students who authored this article are enrolled in the College of Science at Rochester Institute of Technology.

2. Project Access is funded through two Department of Education grants—Demonstration Projects to Ensure Students with Disabilities Receive a Higher Education, and Fund for the Improvement of Postsecondary Education.

3. This workshop is adapted from the Deaf Deaf World developed at NTID by Barbara Ray Holcomb and Mary Lou Basile. We appreciate their letting us use their workshop as our model and are especially grateful to Ms. Holcomb, who provided guidance and mentorship to us throughout the process of developing and offering the workshop.

Voices From the Mainstream

By Annemarie Ross (Biochemistry), Erin Vlahos (Math), Stephanie Shubert (Imaging Science), Jill Smink (Biology), and Dan Short (Math)

Student authors include (l. to r.) Dan Short, Stephanie Shubert, Annemarie Ross, and Erin Vlahos. Missing from this photo is Jill Shank.
5. Interpreters are not always an accurate reflection of students when voicing for them.

Be patient when an interpreter voices for students. Deaf and hard-of-hearing students use diverse communications skills. If you do not understand the student’s question or statement, ask for it to be repeated, and consider that the interpreter may not be voicing accurately and/or may need time to clarify unclear information with the student.

6. Be aware of “process time,” which is the time required to process information into another language. Slow down!

It maybe beneficial to take a small break. Recognize that there is a processing time of 5-10 seconds between what you say and the time that an interpreter signs the material to students. This has significant implications, particularly in an interactive classroom. If you ask for class participation (to answer questions, state opinions, give examples, etc.), allow the necessary time for your statement to be interpreted before calling on a student. This will provide an equal opportunity for deaf and hard-of-hearing students to participate. Slow down. We know it’s tough, but this list indicates that the rapid pace of instruction is one of the top areas of classroom concern by deaf, hard-of-hearing, and hearing students.

7. While using PowerPoint slides, overheads, or other similar material, give students time to read it before moving on.

This will allow students to absorb information before you begin to explain the content, and will minimize later confusion. Allow ample time for deaf and hard-of-hearing students to read presented media before you begin to speak.

8. Allow deaf students to have access to the first few rows in class on the first day.

The principal concern is that all students can see you clearly. Deaf and hard-of-hearing students frequently need to sit at or near the front of the room in order to have a clear view of you, of the interpreter, of the captioning, and of any classroom materials. However, this orientation also means that when hearing students are contributing to the class, the deaf and hard-of-hearing students will not know who is speaking. We encourage you to identify the speaker, have the speaker pause to allow him/her to be identified, and then speak. If smooth communication is not possible, repeat the student statement yourself.

9. Don’t force groups of deaf/hearing students to work together; well before you establish groups, ask students privately for their preferences in group assignments.

Ask the deaf and hard-of-hearing students before class for their preferences regarding group organization, and of their need for an interpreter, captionist, or notetaker. This can be crucial to finding a satisfactory solution for your particular environment and available resources. If you force students to work together, uncomfortable situations may arise.

10. If you are using a laser pointer, allow the pointer to remain on the object for an extended period of time.

By allowing the pointer to remain positioned, deaf and hard-of-hearing students will be able to locate its position, read the content there, and return their attention to you (and an interpreter or captionist if present).

**It’s a Deaf Deaf Campus Experiential Workshop**

The purpose of this activity is to give participants a broad experience of what deaf students encounter every day as they go about their business on a hearing campus. For example, students must find ways to communicate with a range of individuals, including teachers, secretaries, cleaning staff, servers
in dining areas, registrar office employees, advisors, and campus safety personnel. Some people are very willing to try to accommodate deaf students, and will go to great lengths to communicate with them in alternative formats. Others are less flexible. In some cases, deaf students’ grades or even safety depend on whether they can successfully navigate these communication hurdles. As a result, they have often become masters at creative communication with hearing people.

Often important information is relayed via a public announcement on speakers. If there is no interpreter present, the deaf student is left to wonder what is happening and how he or she should respond. Sometimes they student must choose between guessing and following the lead of hearing people.

On campuses where there are a number of deaf students, a club may be formed where deaf students can gather and communicate among themselves in sign language. This club may become a haven for deaf students, but it can also isolate them from the many extra-curricular opportunities available on the campus.

Participants in this workshop have the opportunity to experience for a brief period some of the communication frustrations, anxieties, and successes that deaf students go through every day. As they enter the room, students will hand them the sheet titled: “Welcome to It’s a Deaf Deaf Campus.”

Hearing participants learn that in this setting they may not use their voice to communicate and they have to survive by using alternative forms of communication. When they are able to complete designated tasks without speaking, the person managing the task will award them “points.” Those who do use their voices will be penalized by losing points. The only place they can gather to use their voice without penalty is in the “hearing club,” but by staying there they miss opportunities to gain points via participation in the required activities.

We suggest that you give participants little or no description of the goals of this experience before they enter the room. Just hand them the directions and let them work it out. After about 20-30 minutes (timing will depend on the number of participants), reconvene for discussion either in small groups or a single large group. Some discussion questions are provided, but coordinators may develop others that work better for their groups.

The activity works best when it is designed and run by deaf students, perhaps with a faculty mentor. It helps if students all wear the same color T-shirt, to distinguish them from others in the room. Law Enforcement Officers should wear another color T-shirt, to clarify their role in the activity.

In one simulation, we announced two videotaped emergencies in sign language. (You can easily substitute a “live” student announcing an emergency in sign language, and flash the room lights to get people’s attention.) One emergency announcement stated that there was an imminent flood warning and participants were to go to the Information Booth and collect a red chip to indicate they understood the warning. The other announcement was that there had been an explosion at the power plant—participants were told to collect a blue chip. Later, the Law Enforcement Officers stopped people to see if they had collected the correct chip. Points were awarded to those who had done so, and taken away from those who had failed to collect a chip. Naturally, the hearing people were unable to discern the signed message. In one workshop, a participant decided that it was an evacuation notice and left the room, and many others followed thinking he knew what the message said. This later led to a discussion about how deaf persons respond to voiced information in similar situations.

Conclusion
We have provided a brief overview of each of these Project Access products because, in our experience, teachers are very willing to modify their behaviors when they understand the barriers we face on a “hearing campus” and are provided with clear information about what will help. We invite you to use these materials and let us know how it works out! You can find more information about Project Access by visiting the Class Act website at www.rit.edu/classact.
All research initiated or conducted at RIT must be approved by the Institutional Review Board if the research involves human subjects. This Decision Tree explains the process of review by the IRB. See the article on p. 6 for a discussion of IRB review at NTID/RIT.