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From the Editor

This year the annual dinner of the De Morgan Association was held on 12 June 2015 in Senate House, University of London. The Guest of Honour was Dr Tadashi Tokieda of the University of Cambridge. Tadashi entertained us with a fascinating demonstration of the various shapes and linkages that appear when Möbius strips are torn along their axis. He was able to stump everyone with his challenges to predict the outcomes of his paper tearing - a really enjoyable and educational mathematical presentation.

The staff and alumni continue to be involved in an incredible range of activities both within Mathematics and outside and we have tried to summarise some of them here. Two activities that speak strongly about the commitment of UCL Mathematics to the wider community are Rod Halburd's involvement with efforts to stimulate the study of mathematics in Cambodia and Tilak Ratnanather's involvement in mentoring students with hearing loss. To see Tilak's work recognised by President Obama has brought great pleasure to those of us who knew him throughout his time at UCL.

As always, we hope you enjoy this edition and encourage you to send us articles and photographs for future editions.

- **Ted Johnson**
  Professor of Mathematics

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Mentoring Students with Hearing Loss in Science, Technology, Engineering and Mathematics

In June 2015, I received a Presidential Award for Excellence in Science, Engineering and Mathematics Mentoring (PAESMEM) from President Obama. This was in recognition of work in recruiting and mentoring an unprecedented number of individuals with hearing loss worldwide into science, technology, engineering, and mathematics (STEM) fields.

When I matriculated at UCL in 1982, an estimated 30 people with profound hearing loss who had been educated at special primary and secondary schools in the UK graduated with degrees from universities. While a few read mathematics, others with partial hearing loss who had attended regular or mainstream schools later became distinguished mathematicians e.g. Charlotte Agnas Scott and Dame Kathleen Ollerenshaw. Nowadays, it is thought that hearing loss of all degrees has an incidence of one in six. But there are three challenges facing the student with hearing loss at university. First is "invisibility". Those with profound hearing loss need role models who can then help them overcome the other two challenges of "ignorance" and "isolation".

It helped that some of these role models included alumni from Mary Hare School – the designated national grammar school for children with severe to profound hearing loss – who had dealt with "invisibility" via a "support network". Thus I learnt to "self-advocate" to address "ignorance" by arranging a meeting with the Admissions Tutor (Peter Williams) ahead of term. We discussed obtaining "accommodations", a buzzword which came into vogue several years later via the Disability Discrimination Act of 1995 (DDA), to overcome "isolation". Hitherto, students with hearing loss had relied on notes copied from previous years, textbooks and carbon-copied notes by classmates. But there was a surprise in the form of notes re-written the preceding summer by Katie Naughton to whom I am eternally grateful. Peter also arranged for a FM transmitter and receiver system on loan from the Royal National Institute for the Deaf (now renamed Action on Hearing Loss) which necessitated a demonstration at the beginning of each term. With the receiver coupled to my then analogue hearing aids via electromagnetic induction, it was possible to hear just the lecturer's speech. Theorems, propositions and lemmas had to be written. Moreover, much of the material was didactic i.e. the same words were used again and again. I recall anticipating the lecturers because the voice was coming through clearly. From a cognitive and educational perspective, this has a profound benefit especially in the era of cochlear implants and digital hearing aids which are now enabling people with hearing loss to comprehend speech at least in quiet. The combination of the kindness of people such as Professor Susan Brown who was my personal tutor and Professor Stewartson's encouragement to enter his office from the main corridor rather than his secretary's office – which I did not have to take advantage of – allowed me to focus on my studies.

Stewartson's untimely death at the end of my first year induced an interest in fluid dynamics which continues to impact on my research in computational anatomy (the study of transformations of coordinate systems in comparisons of brain structures from MRI scans) and cochlear physiology. A few years ago I came across a story about Stewartson's father who happened to be deaf albeit late in life. I also heard from a contemporary of Stewartson that he had a slight stammer from being forced to be right-handed when he was naturally left-handed. So the environment by the teaching staff in the Mathematics Department at UCL was effectively conducive. It also helped that I had a relationship first as a "guinea pig" with the Department of Speech Sciences which continues to this day.

At Oxford, I was exposed to a wide range of applied mathematics that led to a chance attendance at a mathematical biology seminar on cochlear fluid dynamics. Thus the idea of doing research in the auditory sciences was born. Alas I did not know who the big players in the UK were until I attended a conference on

Professor Tilak Ratnanather and President Obama

deaf education in a side trip during a visit to Bell Labs in the United States for my postdoctoral work at City University London (with the late Professor Peter Daniels – a contemporary of Professor Frank Smith – who did his PhD and postdoc research with Professor Brown and Professor Stewartson respectively). A conversation with one of the speakers - Bill Brownell of Johns Hopkins University who had discovered the cellular basis of the active process within the cochlea – resulted in moving to the United States. Also I was inspired by the Strategic Plan of National Institute on Deafness and Other Communication Disorders at the National Institute of Health (the equivalent of UK's Medical Research Council) to leverage my experience as the first person with congenital profound hearing loss in the world to obtain a PhD in mathematics and pursue postdoctoral research in the auditory sciences in becoming a role model.

To begin with, I brought about change by getting the Association for Research in Otolaryngology (ARO) to provide accommodations (assistive listening devices such as FM system and real-time subtitling) for people with hearing loss attending ARO's Annual MidWinter Meeting which is the premier meeting in hearing research. In fact it was the 1992 ARO meeting when I found my calling. I then established the HI-ARO group for undergraduates, graduates, postdoctoral fellows, research scientists and faculty with hearing loss doing research in auditory sciences. Starting with 3 people, there are now about 50 including 7 faculty from United States and Europe on the HI-ARO mailing list with 15-20 people attending the HI-ARO dinner at the ARO meeting. This network enables people to benefit from discussions on navigating the educational system, seeking postdoctoral mentors, obtaining a faculty position, and advocating for support services such as captioning in a positive i.e. non-demanding manner. Senior members network with their colleagues to obtain laboratory experience for the younger members. There is now a strong UCL connection with 3 people doing research in cochlear implants and cochlear physiology including one fellow alumna from Mary Hare School (and Oxford) who I am privileged to be mentoring from afar while pursuing PhD research.

In parallel, since 1994 I worked with the AG Bell Association for the Deaf and Hard of Hearing to provide STEM career information for teens and young adults with hearing loss. Activities include serving on the College Financial Aid Committee since 1996 and as co-chair of the Research Symposium at AGBell's Convention since 2004. The former allows me to recruit students with hearing loss for research in STEM; the latter allows me to tell parents and educators of deaf children that with cochlear implants and digital hearing aids anything is possible including careers in STEM.

It is worth quoting from Ollerenshaw's autobiography "To Talk of Many Things" that mathematics is the one school subject not dependent on hearing. But a few years ago I came up with names of just 21 people with hearing loss known to have obtained PhDs in the past century. These include a postdoctoral fellow with a PhD in Mathematics at John Hopkins and a graduate student in the Department of Applied Mathematics and Statistics at John Hopkins who passed through my lab and now in academia and industry respectively; indeed the former was attracted to work for me having visited my webpage. There are reasons for this small number including "invisibility" and many doing PhDs in other areas, e.g. the "Father of the Internet" - Vint Cerf who happens to have mild hearing loss.

In the United States, about 30-40 people with hearing loss have qualified as physicians. Of these, 8 including 4 JHU students did projects in my lab and now are specializing in anesthesiology, pathology, radiology, pediatrics, emergency medicine and internal medicine. In the future I hope to work with colleagues in Otolaryngology-Head & Neck Surgery to develop opportunities for physicians with hearing loss to specialize in ENT. Hopefully this will be facilitated by the world's first ever undergraduate course in Computational Medicine which we are teaching this academic year.

The new dynamic of students with hearing loss being mentored by role models is facilitating a growing cohort of scientists with hearing loss in auditory sciences and engineering. In turn, this provides a unique perspective on the consequences of hearing loss enabling all scientists and engineers to develop new ways of thinking about their own research.

Much has changed since I graduated from UCL in 1985. But the above mentioned DDA law is not enough because of the three formidable challenges of "invisibility", "ignorance" and "isolation" which can be overcome respectively by finding "role models", being "self-advocates" and getting "accommodations". So subject to optimal conditions, there is no reason why the deaf child with cochlear implants should not be able to succeed in STEM in the 21st century.

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