

*Canadian*

Volume 1 Issue 2

# Hearing Report

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for Hearing**

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# Let us hear from you!

Andrew John Publishing Inc. is proud to bring you *Canadian Hearing Report (CHR)*, the only Canadian magazine of its kind to bring together working practitioners and members of the industry. In *CHR*, we have created a forum for the sharing of ideas, knowledge, news, and events.

In the inaugural issue of this format, we bring you an article by Rachelle Zral, an audiologist and seasoned Yukoner who lives and practises in Whitehorse. We also meet Johan Hammarström, a twenty-eight-year-old, hearing-impaired pilot from Sweden who is preparing to fly around the world in a single-engine plane. He hopes to raise awareness of hearing impairment and the modern technology available to help those affected reduce the impact of their disability.

On the technology front, Ross Harwell, audiology manager at Oticon Canada, introduces us to datalogging, an innovative new tool to improve hearing aid fittings. And Dr. Ian Bruce from McMaster University in Hamilton, Ontario, takes us behind the scenes of the research he and his team are doing in hearing loss and optimal amplification.

In addition, we keep you up to date with news from the industry and upcoming events, such as the 4th Widex Congress of Paediatric Audiology being held in Ottawa this May.

But *Canadian Hearing Report* cannot exist without your input. This magazine is for you—the practitioners and the industry that supports them. We need you to let us know about interesting stories, research, news, and products.

To audiologists and hearing instrument practitioners: Do you have an inspiring story you would like to share with your colleagues? Do you know someone who is exceptional in the profession? Are you someone who works in an interesting setting, or on a dedicated team that garners impressive results?

To members of the industry: Has a member of your team really made a difference? Is your company participating in or sponsoring events to improve quality of life for the hearing-impaired community? What new products would you like to share with the readers?

We are also interested in sharing insight into such general issues as third-party financing, running a family business, community awareness, improvements/challenges in screening, remote practice/treatment, noise in workplace/everyday life, and changes in funding and how they affect both clients and practitioners.

Please contact us with your news, stories, and insights, and help us to make *Canadian Hearing Report* an interesting and informative tool for our readers. You can contact me directly with your ideas and comments at [suemharrison@aol.com](mailto:suemharrison@aol.com).

Susan Harrison

## Sound Off

**Like what you read? Feel inspired to share an idea?**

We welcome your input. Please send your letters and comments, via e-mail, to [suemharrison@aol.com](mailto:suemharrison@aol.com), subject: Letter to the Editor.



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**Canadian Hearing Report** is published five times annually by Andrew John Publishing Inc. with offices at 115 King Street West, Dundas, On, Canada L9H 1V1.

We welcome editorial submissions but cannot assume responsibility or commitment for unsolicited material. Any editorial material, including photographs that are accepted from an unsolicited contributor, will become the property of Andrew John Publishing Inc.

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Individual copies may be purchased for a price of \$19.95 Canadian. Bulk orders may be purchased at a discounted price with a minimum order of 25 copies. Please contact Ms. Brenda Robinson at (905) 628-4309 or brobinson@andrewjohnpublishing.com for more information and specific pricing.

Publications Agreement Number 40025049  
ISSN 1718 1860

Return undeliverable Canadian Addresses to:

**AJP** ANDREW JOHN  
PUBLISHING INC.

P.O. Box 65525, Dundas Postal Outlet  
Dundas, ON L9H 6Y6

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## 20 Research: Physiological Insights into Hearing Loss and Optimal Amplification | BY IAN C. BRUCE, PH.D.

Since the introduction of electric hearing aids over one hundred years ago, the search has been on for a way to fully compensate for all aspects of hearing impairment by hearing aid amplification. Dr. Bruce gives us some insights to a better understanding of the physiological basis for optimal hearing aid amplification.

## 22 Greetings from the North | BY RACHELLE ZRAL

A seasoned Yukoner, Rachele looks in ears, performs hearing tests, fits hearing aids, writes reports, and then goes home, just like other audiologists across the country. But she has to admit that there are some unique aspects to working in one of Canada's northern territories.



## Unitron Hearing Provides Support for Conestoga College's Hearing Instrument Specialist Program

Unitron Hearing demonstrated its educational support of Conestoga College's new Hearing Instrument Specialist (HIS) program by donating hearing instrument fitting software and licenses, as well as several of its advanced hearing aids to the college's program. In addition, the company provided a monetary donation for the purchase of audio-logical teaching equipment.

Graduates of the HIS program generally go on to fit hearing aids in private practice, with a hearing aid manufacturer, or in a hospital setting. The students also complete two summer field placements to gain experience in hearing clinics or with hearing manufacturers.

"The close proximity between the college

and our two facilities in Cambridge and Kitchener lends itself to an effective relationship," explained Ben Thomas, Unitron Hearing Canada's general manager. "We look forward to welcoming students for tours, workshops, and placements with our hearing professionals and researchers."

Conestoga's HIS program is a six-hundred-hour, post-degree/post-diploma program. Its courses focus on acoustics and perception of sound, anatomy of the ear, digital and analog hearing aid electronics, measurement of hearing aid function, and professional ethics/business management. For more information on Conestoga College or the HIS program, visit [www.conestogac.on.ca](http://www.conestogac.on.ca). More information on Unitron Hearing can be found at [www.unitronhearing.ca](http://www.unitronhearing.ca).



Ben Thomas (left), General Manager, Unitron Hearing, Cambridge, and Ted Venema, HIS Program Lead Instructor, Conestoga College

## New Unitron Hearing Sales Representatives to Serve You

Unitron Hearing Canada announces the addition of several new sales representatives to connect Unitron Hearing with hearing health care professionals across Canada.

**Claude Alexandre** recently joined Unitron Hearing Canada as a sales representative for Quebec. Alexandre has over twenty-eight years' experience in pharmaceutical sales, including with Pfizer Canada, where he was a regional manager responsible for seven provinces and thirteen sales representatives. As well as being fluent in English and French, Alexandre speaks German and Italian.

**Jim Stormont** joins Unitron Hearing Canada from Boston Scientific. He has over twenty years' experience working in health care and medical device sales including medical, vascular, and surgical devices. Stormont is responsible for sales activities and developing business relationships throughout Central Ontario.

**Sheri Panesar** is responsible for North and Eastern Ontario territories. Panesar has fif-

teen years' sales experiences in medical devices and has previously worked for Camp Healthcare and Canadian Medical Laboratories. She is also an active volunteer with the Canadian Hearing Society in Mississauga, Ontario.

**Lise Benziger** has been appointed Unitron Hearing Canada's field trainer manager. Benziger received her M.A. in Audiology from University of New York at Buffalo. She has seventeen years' experience in the hearing industry, including in marketing, sales, and product management. As the field trainer manager, Benziger is responsible for managing territory sales representatives as well as training sales personnel and customers on products' technical features and specifications.

### Marketing Team News

**Kate Ferrede** assumed responsibility for Unitron Hearing Canada's marketing department beginning October 2005. Ferrede has worked for Unitron Hearing for over six years in marketing. As marketing manager,

she worked closely with Unitron Hearing's group companies, product managers, and audiologists to develop product support materials that communicate the benefits of Unitron Hearing's products and services to hearing health care professionals and consumers. Kate is responsible for marketing strategy including the execution of regional product launches and promotions.

Many of you know **Allison Siroky** who has worked for Unitron Hearing Canada for over eighteen years. Siroky brings her extensive knowledge of the company's products, processes, and people to her role, overseeing activities related to sales. As the key accounts and contract manager, she is responsible for implementing all third-party contracts and supporting key customer accounts. Siroky worked in customer service for over thirteen years, managing the Unitron Hearing Canada customer service department for eight years. She works closely with marketing, customer service, and audiology, and also manages battery sales across Canada.

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# 4th Widex Congress of Paediatric Audiology: Helping Children Hear Better

May 18–20, 2006 | Ottawa, Canada

Scientific Program (may be subject to change)

<b>DAY 1—Thursday, May 18</b> <i>Theme: Auditory development and central processing</i>		<b>16:00–16:50</b> <b>The impact of minimal and mild hearing loss on children</b> <i>Dr. Anne Marie Tharpe, Vanderbilt University, USA</i>	<b>14:40–15:10</b> <b>Management of hearing loss in the classroom using individual FM and/or sound field systems</b> <i>Dr. Carol Flexer, University of Akron, USA</i>
<b>8:45–9:00</b> <b>Chairman's welcome</b> <i>Dr. André Marcoux, University of Ottawa, Canada</i>	<b>DAY 2—Friday, May 19</b> <i>Theme: Hearing aid fitting focus</i>		
<b>9:00–9:50</b> <b>Opening address</b> Asymmetry in low levels of the auditory system: do we hear differently with the left and right ear? <i>Dr. Yvonne Sininger, University of California at Los Angeles, USA</i>	<i>Theme: Auditory science— future direction for the management of hearing loss</i>		
<b>9:50–10:20</b> <b>Break</b>	<b>9:00–9:50</b> <b>Hearing aid prescription for children: NAL-NL1 and DSL[i/o]</b> <b>Amplification strategies for children</b> <i>Dr. Teresa Ching, National Acoustics Laboratories, Australia</i>	<b>15:10–16:00</b> <b>Deafness in children: the role of genes unraveled</b> <i>Dr. Guy van Camp, University of Antwerp, Belgium</i>	
<b>10:20–11:10</b> <b>Keynote address</b> Developmental psychoa-coustics: auditory function in infants and children <i>Dr. Robert Nozza, Temple University Children's Medical Center, USA</i>	<b>9:50–10:40</b> <b>Current issues in paediatric amplification: roles for technology and for prescriptive methods</b> <i>Dr. Susan Scollie, University of Western Ontario, Canada</i>	<b>16:00–16:50</b> <b>Hair cell regeneration: what is the potential for therapeutic intervention?</b> <i>Dr. Brenda Ryals, James Madison University, USA</i>	
<b>11:10–12:00</b> <b>Infant speech perception and early language acquisition</b> <i>Dr. Janet Werker, University of British Columbia, Canada</i>	<b>10:40–11:10</b> <b>Break</b>	<b>DAY 3—Saturday, May 20</b> <i>Workshops and discussion panels</i>	
<b>12:00–13:00</b> <b>Lunch</b>	<b>11:10–12:00</b> <b>Comparing speech perception abilities of paediatric cochlear implant or digital hearing aid users</b> <i>Dr. Lisa Davidson, Central Institute for the Deaf at Washington University, USA</i>	<b>Workshop 1:</b> <b>Fine-tuning compression hearing aids</b> <i>Dr. Francis Kuk, Office of Research in Clinical Amplification, USA</i>	
<b>13:00–13:50</b> <b>Factors that shape the development and plasticity of the central auditory system; the balance of "nature and nurture"</b> <i>Dr. Robert Harrison, Hospital for Sick Children, Canada</i>	<b>12:00–13:00</b> <b>Lunch</b>	<b>Workshop 2:</b> <b>Frequency specific ABR for assessment of hearing in infants and children</b> <i>Dr. Yvonne Sininger, University of California at Los Angeles, USA</i>	
<b>13:50–14:40</b> <b>P1 latency is a bio-marker of central auditory development in children with hearing impairment</b> <i>Dr. Anu Sharma, University of Texas at Dallas, USA</i>	<i>Theme: Intervention with the hearing-impaired child</i>		
<b>14:40–15:10</b> <b>Break</b>	<b>13:00–13:50</b> <b>Foundation of auditory verbal therapy and practice</b> <i>Warren Estabrooks, Auditory Learning Centre, Learning to Listen Foundation, Canada</i>	<b>Discussion panel 1:</b> <b>Predicting the infant's audiogram based on frequency-specific ABR results</b> <i>Dr. Marlene Bagatto, University of Western Ontario, Canada</i> <i>Dr. André Marcoux, University of Ottawa, Canada</i>	
<b>15:10–16:00</b> <b>Speech perception testing in young children, the effect of child factors and measurement factors</b> <i>Dr. Ad Snik, Nijmegen University Hospital, the Netherlands</i>	<b>13:50–14:40</b> <b>Outcomes of children wearing digital power hearing aids in auditory-verbal therapy</b> <i>Teresa Caraway, INTEGRIS Medical Center, USA</i>	<b>Discussion panel 2:</b> <b>Providing cochlear implantation to medically and cognitively challenged candidates</b> <i>Dr. David Schramm, Children's Hospital of Eastern Ontario, Ottawa, Canada</i> <i>Todd Mitchell, Children and Women's Hospital, Vancouver, Canada</i> <i>Vicki Papaioannou, Hospital for Sick Children, Toronto, Canada</i> <i>Warren Estabrooks, Auditory Learning Centre, Learning to Listen Foundation, Toronto, Canada</i>	

On-line registration for the 4th Paediatric Congress is available. Visit [www.widex.com](http://www.widex.com); click on the 4PC link on the right side of the page. From there, you can get information on registration, speakers, poster sessions, the scientific program, social events, hotel accommodations, and addresses.



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- User Intervention
  - 3 listening programs
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  - REM integration with software
  - Childrens Outcome Worksheet integrated into software
  - Pediatric Sounds and Pictures

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  - Voice Aligned Compression
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  - Extended Bandwidth
  - OpenEar Acoustics
  - Dynamic Feedback Cancellation
- User Intervention
  - Four listening programs
- Optional Programmable Telecoil or Acoustic Phone Program
- Syncro Memory - Datalogging
- Syncro Liveo
  - Real time display of instrument states

- Sound Quality
  - OpenEar Acoustics
  - Dynamic Feedback Cancellation
- User Intervention
  - Three listening programs
- Optional Programmable Telecoil and Acoustic Phone Program
  - Optional Auto-Phone
- TEGO live
  - Real time display of instrument states

## Oticon Tego Pro



## Oticon Tego



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- Artificial Intelligence and Parallel Processing
  - Chooses the optimal combination of settings to provide the best Voice over Noise ratio
- Voice Direct Program
  - Automatic Switching into HF directional mode
  - Adaptive directional system
- Modulation Based Noise Management
- 6 Independent Channels for frequency shaping
- NAL-NL and DSL i/o Fitting Rationales
  - 3 Identities with NAL-NL only
- Sound Quality
  - Extended Bandwidth
  - OpenEar Acoustics
  - Dynamic Feedback Cancellation
- User Intervention
  - Four listening programs
- Optional Programmable Telecoil and Acoustic Phone Program
- Optional Auto-Phone
- TEGO live
  - Real time display of instrument states

## Oticon Syncro 2



- 100% digital
- Artificial Intelligence and Parallel Processing
  - Chooses the optimal combination of settings to provide the best Voice over Noise ratio

- 100% digital
- Artificial Intelligence and Parallel Processing
  - Chooses the optimal combination of settings to provide the best Voice over Noise ratio
- Voice Direct Program
  - Automatic Switching into HF directional mode
  - Fixed directional system
- Modulation Based Noise Management
- 4 Independent Channels for frequency shaping
- NAL-NL and DSL i/o Fitting Rationales
  - 3 Identities with NAL-NL only

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## February

### Workshop on the Management of Persons Who Have Tinnitus and/or Hyperacusis

Montreal, Quebec

February 23–24

**Contact:** Nicole Normandin, Ph.D.  
**Phone:** 514-343-2082  
**e-mail:** nicole.normandin@umontreal.ca

## March

### 2006 Government and Health Technologies Conference and Expo

Ottawa, Ontario

March 8–9

**Contact:** WowGao  
**Phone:** 416-292-0038, ext. 821  
**e-mail:** info@wowgao.com

## April

### Innovations in Rural Chronic Care; The “Beulah Salt” Seniors Health Conference 2006

Lethbridge, Alberta

April 12–13

**Phone:** 403-875-0086  
**Web site:** www.ruralinnovations2006.ca

## May

### CASLPA 2006 Conference

May 3–6

Winnipeg, Manitoba

**Web site:** www.caslpa.ca

### 13th Annual Conference on Neurobehavioral Rehabilitation in Acquired Brain Injury

Hamilton, Ontario

May 4–5

**Contact:** Joyce Lambert  
**Phone:** 905-522-1155, ext. 5454;  
**e-mail:** jlambert@hhsc.ca  
**Web site:** www.hamiltonhealthsciences.ca  
—Patient Care Services and Specialties,  
2006 Annual ABI Conference

### 4th Widex Congress of Paediatric Audiology

Ottawa, Ontario

May 18–20

**Web site:** www.widex.com

See program outline on page 8.

### NHS 2006—Beyond Newborn Hearing Screening: Infant and Childhood Hearing in Science and Clinical Practice

Cernobbio (Como Lake), Italy

May 31–June 3

**Contact:** Sharon Scagnetti  
**Phone:** 39.02.23993345  
**e-mail:** nhs@polimi.it  
**Web site:** www.nhs2006.polimi.it

Do have a conference or workshop you wish us to include?  
**E-mail:** suemharrison@aol.com we will try to add it in our next issue.

# Datalogging: An Innovative New Tool to Improve Your Hearing Aid Fittings

By Ross Harwell, M.S.

Despite tremendous advances in hearing aid technology over the past decade, surveys of hearing aid users have typically shown underwhelming rates of satisfaction.<sup>1</sup> It could be that improving the *process* of being fit with a hearing aid is just as (if not more) important than the hearing aid technology itself. Kochkin's MarkeTrak data have shown us that customer satisfaction improves with increases in the amount of time spent counselling.<sup>2</sup> It can be assumed that the quality and type of counselling is equally important.

Recently there has been a flood of counselling tools designed to help the clinician with the counselling process. Multimedia software is available to assist (using pictures and sounds) in explaining hearing loss in general, the client's audiometric results, the benefits of binaural amplification, the effects of untreated hearing loss, hearing aid features, and so on. Datalogging is the most recent of these tools.

Datalogging had previously been used in research and product development. For instance, in the development of Oticon Syncro, datalogging was used to determine how the hearing aid would respond in a variety of environments (Figure 1). The recorded data were then used to refine the hearing aid features as needed. Using datalogging technology in research and development enabled developers to gain valuable insight into how the recorded information could be used to improve the quality of a fitting. This feature is now available for use in individual hearing aids and can be used by clinicians as a counselling and fine-tuning tool—thereby increasing client satisfaction with their hearing instrument(s).

## What Is Datalogging?

In general terms, dataloggers are small, electronic devices equipped with a microprocessor, data storage, and sensors that record and



Figure 1. Datalogging device used in the development of Oticon Syncro.

store environmental information (e.g., temperature, humidity, voltage). Syncro Memory, the datalogging feature incorporated into the Oticon Syncro hearing instrument, works in a similar way. A variety of sensors are used to record information about the current state of the hearing aid. Specifically, every 10 seconds, Syncro Memory logs the current environment (quiet, speech, speech in noise, noise alone), the current volume-control setting, and the current state of the automatic directional system (surround, split directional, full directional). These logged data are then synchronized with the permanent memory every 15 minutes.



Figure 2. Accessing of Syncro Memory with the Genie fitting software.

## What Data Do We Log?

When the hearing aid is connected to the fitting software (Figure 2), Syncro Memory displays the data that have been recorded since the initial fitting or since the last time Syncro Memory was cleared. The clinician is able to view two main types of information: program and volume-control use (if applicable); and even more importantly, information about the types of environments the user has been experiencing. Specifically, Syncro Memory displays the following:

- Hours of use
- Relative program use
- Amount of volume control use in three different level environments
- Average deviation of the volume control
- Overall sound level histogram
- Overall percentage of time in quiet, speech, speech in noise, noise environments
- Overall percentage of time in omni-, split-, and full-directional
- Each of the above two categories as a function of level (e.g., percentage of time in omni-, split-, and full-directional in 60 to 70 dB environments)

### How Can We Use Datalogging?

Datalogging provides us with a source of information never available previously. The potential uses for the technology may not be readily apparent. There are several ways in which the technology can be used to benefit both hearing health care professionals and their clients: (1) to help clients give feedback, (2) to help build the client-clinician relationship, (3) to assist in the fine-tuning process.

### Helping Clients Give Feedback

Previously, in order to understand how the client used a hearing instrument, we relied on diaries, the client's memory, and the quality of the post-fitting counselling. Datalogging allows us to actually observe how the hearing instrument has been operated by the user and, even more importantly, gives us information about the individual's actual auditory ecology.

### Relationship Building

One of the most important benefits of datalogging is the fact that it opens up a dialogue between the clinician and the client. Because the logged data reflect the individual's own auditory life, they allow the client to take ownership of the fitting and fine-tuning process. In addition, clients purchasing premium hearing aids typically have high expectations for not only the performance of the aid itself but also for the entire process of receiving a hearing aid. Datalogging is another tool that can set you apart from the competition by demonstrating that you are at the forefront of technology.

### Fine-Tuning

The most obvious use for datalogging is to assist in the fine-tuning process. Data about hearing instrument usage time may be viewed as a measure of fitting success, with reports indicating a positive correlation between time of use and satisfaction.<sup>3</sup> These data can also be used to target potential problems. For example, if usage time is unusually high (e.g., 24 hours/day), it could indicate that the hearing aid is not being turned off at night, suggesting that further instruction may be needed.

Examination of the program-usage data (Figure 3) may shed light on several things; for example, it may show a strong preference for one program over another, suggesting that the clinician re-order or delete programs. Alternatively, it may be that the client

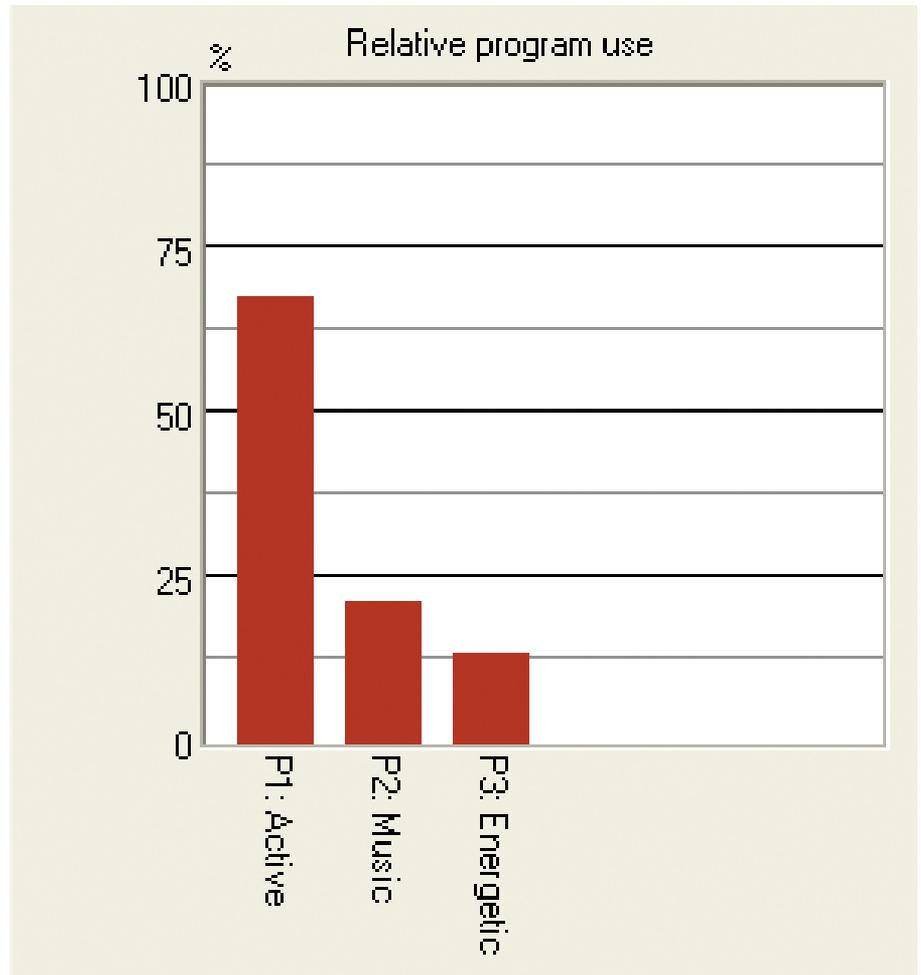


Figure 3. Graph showing relative program use.

is uncertain of how to use the program button or when to use additional programs. This type of information is often difficult to obtain from client reports alone, but when these reports are combined with the objective data from Syncro Memory, the clinician can make changes with confidence that the correct issues are being targeted.

Syncro Memory logs two main types of data with respect to volume-control use (Figure 4): (1) the percentage of time that the volume control is turned up or down and (2) when the volume control is used, the average deviation away from the default position. In Syncro Memory, this information is presented for three input levels (soft, speech, and loud) that match the fitting controls. Therefore, it is easy for the dispensing professional to take the data about volume control use and apply them directly in the fitting screen—if, after a discussion with the client, this is deemed to be the best action.

Reducing/increasing gain is merely one avenue for discussion. For instance, changes in volume control may simply indicate that the client is adjusting the volume in very specific environments (e.g., for a particular speaker), not necessarily a reason to adjust the gain of the instrument. The use of the volume control may also indicate that the client is progressing through the adaptation at a faster or slower rate than expected.

The client may use the volume as an adjustment to the automatic systems. For example, decreasing the volume in a noisy environment may suggest that the client required a more aggressive noise reduction strategy—which in Syncro could indicate that a different identity needs to be implemented. Like all the information obtained in Syncro Memory, the volume-control data are best viewed in conjunction with a conversation with the client to determine the best course of action.

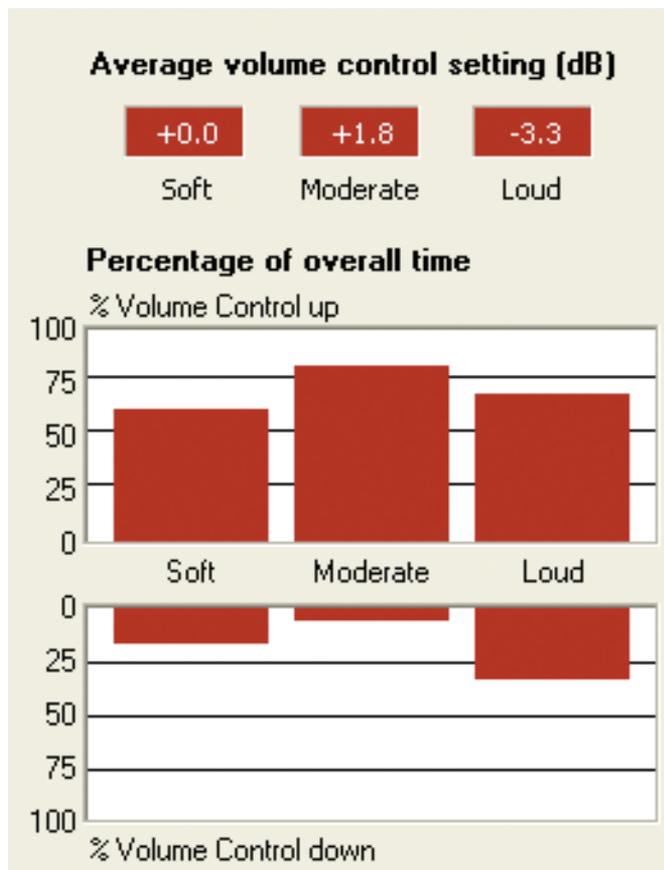


Figure 4. Volume-control use screen.

A unique feature of Syncro Memory is that it provides data beyond basic usage statistics. Information is provided about the environment and the Voice Priority Processing (VPP) System (Voice Aligned Compression, Multiband Adaptive Directionality, and Tristate Noise Management) (Figure 5). This information can be used in a variety of ways. For example, examination of the client's actual (versus reported) auditory ecology may reveal that the client is in an environment that is either more dynamic or more stable than was expected from prior reports. In these cases, the dispensing professional can discuss the workings of the VPP system with reference to the client's listening environment data and develop a deeper understanding of his or her needs. It may be that a different Syncro Identity provides a better match to the client's actual listening ecology. Consider another example: if a client's sound level histogram reveals that a large percentage of time is spent in quiet environments (Figure 6), it could be that his or her auditory lifestyle is indeed quite quiet, potentially

suggesting that the client will not benefit from advanced technology. However, one must be careful in this situation because it is quite possible that, although the client is only in difficult listening environments a small proportion of the time, these situations represent the primary reason he pursued amplification. It could also be that the client is removing the instruments in difficult listening environments. This may prompt the clinician to make changes to the instrument settings (e.g., increase the aggressiveness of the automatic directional system, change gain settings). In isolation, the data cannot provide the clinician with all the necessary information; however, as a supplement to a discussion with the client, the logged environmental data can help complete the picture and guide the fine-tuning process in the right direction.

### Conclusion

Syncro Memory is designed to improve the fitting process by providing a common referent between the professional and the client

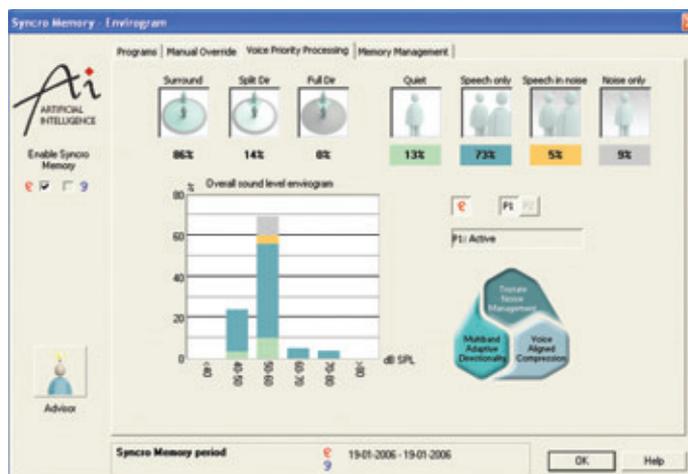


Figure 5. Voice Priority Processing screen in Syncro Memory.

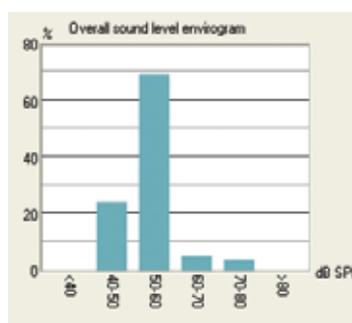


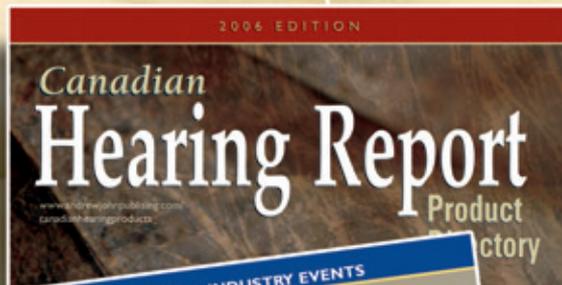
Figure 6. Sound level histogram showing a fairly quiet auditory lifestyle.

that steers the counselling process in a new direction. Using Syncro Memory, the clinician works in synergy with the objective data provided by the hearing instrument and the subjective data provided by the client. This approach is designed to provide greater flexibility and individualization to the fitting process.

*Ross Harwell, M.S. Reg'd. CASLPO, is the audiology manager at Oticon Canada.*

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# World Flight *for* Hearing

In 2006, Johan Hammarström will pilot a small, single-engine aircraft around the globe and, by doing so, will be the first hearing-impaired person in the world to accomplish such a mission. The expedition, called World Flight for Hearing (WFH), is sponsored by the hearing instrument provider GN ReSound. The purpose of the project is to increase understanding of hearing impairment and the technology that is available to help affected people.

## A Unique Expedition

WFH is an event that will garner great attention worldwide. Johan Hammarström and two teammates, Henrik Ejderholm and Martin Håkansson, will fly around the world in a single-engine aircraft. This flight will be one of the first of its kind since the hundred-year anniversary of aviation, celebrated in 2003. Not to mention that no person with a hearing disability has ever acted as a pilot in command of such a flight.

The team will accomplish a sixty thousand-mile journey in an aircraft normally built for distances of between a hundred and one thousand miles. The expedition is expected to last for five months, from March to August 2006, and will require meticulous planning and preparation.



World Flight for Hearing hopes to spread information about how common hearing impairment is and how important it is protect your hearing.

### Focus on Hard of Hearing

Hundred of millions of people around the world suffer from hearing loss. WFH hopes to spread information about how common hearing impairment is and how important it is protect your hearing. The around-the-world-flight will involve visiting schools for the hard of hearing and organizations in more than twenty-five countries.

All the publicity WFH will gain throughout the expedition will be dedicated to the hearing impaired and to the organizations and people working for these matters. Examples of activities that have been arranged so far are seminars, media activities about hearing impairment, and speeches. The speech "Reaching your goals despite your hearing impairment—about World Flight for Hearing," given by Johan, has been a very successful contribution to several congresses, exhibitions, and school activities. Johan is living proof that with the right attitude and the right technical aids, anything is possible.

Since the first flight around the world in 1924, only a limited number of pilots have successfully completed the achievement.

Main photo left: By showing that even pilots can be hearing impaired, Johan seeks to educate people about their hearing impairments and to motivate them to try modern technology and reduce the impact of their disability.

Right: Henrik Ejderholm, Martin Håkansson, and Johan Hammarström will fly a sixty thousand-mile journey around the world in their single-engine plane.

### Around the Globe in a Small Aircraft

Flights around the globe in light, single-engine aircraft are not an everyday occurrence. Since the first flight around the world in 1924, only a limited number of pilots have successfully completed the achievement. Flying around the globe with this type of aircraft puts extreme demands on meticulous preparations and a highly experienced crew.

### The Project

WFH is a massive project involving more than thirty organizations all over the world. In total, there are more than a thousand people involved with the project, and this number continues to grow. WFH would not have become a reality without these organizations and commercial partners such as GN ReSound.

### A Winning Team

Aviation has fascinated the three friends, Johan Hammarström, Henrik Ejderholm, and Martin Håkansson, since childhood. Over the years, they have developed their flying skills through advanced training and engagements in many aviation organizations. Today they are seasoned pilots with an accumulated experience of more than three thousand hours airborne and thirty-three years of flying. This experience will be well needed in this expedition.

Johan Hammarström is twenty-eight years old and has a congenital hearing impairment that was recognized when he was four. Since his preschool years, aviation has been Johan's major interest, and he is currently licensed to fly most airplanes and has logged 1,200 hours of flying.

Johan is also the founder of several associations related to aviation. In 1999, when he started his studies at University of Linköping, he founded the university flying society, which grew with a rapid pace to more than five hundred members, and involved activities related to everything from fixed-wing airplanes to parachuting and soaring. In one of Johan's curricular activities, he was the initiator of a project that is currently establishing Sweden's first flying community.

### Coming to Canada!

Johan and teammates are bringing the World Flight for Hearing to Canada this summer. They are tentatively scheduled to touch down in Calgary in the first week of July and to land in Toronto in the second week of August. For more information about WFH and precise times of the WFH visits to Canada, visit their Web site (updated regularly) at [www.worldflightforhearing.com](http://www.worldflightforhearing.com).



# Physiological Insights into Hearing Loss and Optimal Amplification

By Ian C. Bruce, Ph.D.

Since the introduction of electric hearing aids over 100 years ago, the search has been on for a way to fully compensate for all aspects of hearing impairment by hearing aid amplification. To date, this goal has not been achieved. However, as hearing aid technology has developed from the era of carbon aids to the present-day digital signal processors, much progress has been made in making optimal use of the available technology. The vast majority of improvements in amplification strategies have been achieved by trial and error using empirical testing; the physiological basis for optimal hearing aid amplification is generally not well understood. Consider the development of prescriptions for linear amplification. Early studies suggested “mirroring of the audiogram,” such that 1 dB of gain is applied for each 1 dB of hearing loss at each frequency. While this appeared to be satisfactory for conductive hearing losses, it was found to amplify loud sounds excessively for sensorineural losses. Consequently, it was proposed that a constant could be subtracted from the gain to

bring it down to an acceptable level. Watson and Knudsen (1940) refined this idea by suggesting that the gain should be reduced additionally by a factor depending on most comfortable equal loudness curves. Shortly thereafter, Lybarger (1944) suggested the alternative “half gain rule” that formed the basis for many subsequent linear amplification prescription schemes.

The goal of these linear prescriptions is to optimise audibility, comfort, and speech intelligibility; the differences between the various prescription schemes reflect different weightings of the importance of these desired perceptual outcomes. But can we determine the physiological basis for a linear gain prescription? Bondy et al. (2004) used a computational model of the auditory periphery to determine the linear gain-frequency responses that would optimally restore *normal average levels of auditory nerve activity* for a range of audiograms. The model predictions very closely match the NAL-R prescription (Byrne and Dillon, 1986). This result indicates that in applying amplifica-

tion that gives more normal auditory nerve activity *on average*, an optimal mix of audibility, comfort, and speech intelligibility is obtained for speech *on average*. We then attempted to extend these results to multiband compression on a phoneme-by-phoneme basis, rather than just for speech on average. It is known from empirical studies that by adjusting the compression characteristics, it is possible to avoid distorted and uncomfortably loud signals, to reduce the intensity differences between phonemes or syllables, to provide automatic volume control, to increase sound comfort, to normalize loudness, to maximize intelligibility, or to reduce background noise (Dillon, 2001). However, the required compression parameters vary substantially among these goals; consequently, any one compression scheme tends to provide benefit in some but not all aspects of compensating for hearing impairment. Consistent with the empirical observations, using the auditory periphery model it was *not* possible to find one set of compression parameters that normalized the auditory

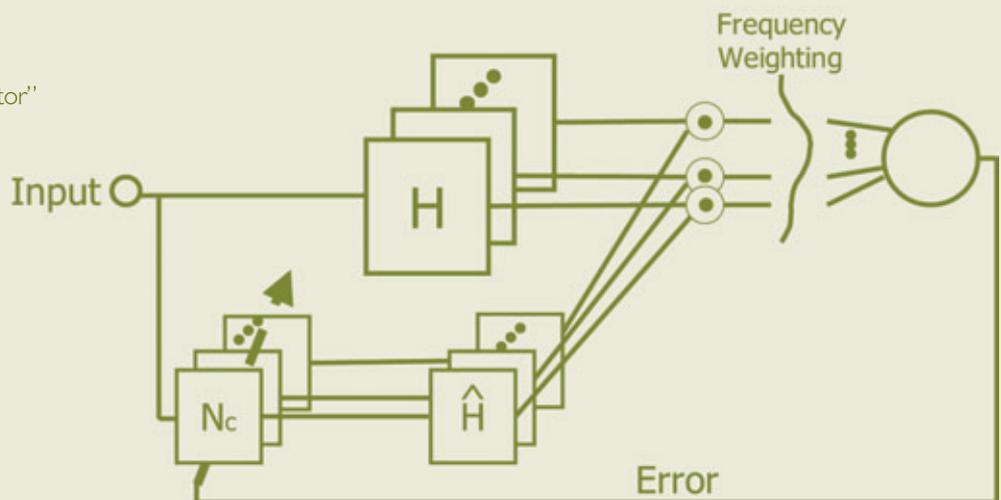
Figure 1.

Schematic of “neurocompensator” hearing aid training.

The block “H” indicates a model of normal hearing, while the block “ $\hat{H}$ ” indicates a model of impaired hearing.

The “Nc” block is a trainable hearing aid algorithm or neurocompensator.

Reprinted from Bondy et al. (2004)<sup>®</sup>, with permission from Elsevier.



nerve response to all phonemes. Even so, the model does predict that the *maximum gain* over all phonemes should be subject to a compression ratio of around 1:1 in regions of no hearing loss up to 2:1 in regions with substantial loss—ratios that are fairly consistent with most nonlinear prescriptions for wide dynamic range compression.

The failure thus far to find, either empirically or with the auditory model, an optimal set of parameters for a simple compression scheme indicates that more sophisticated nonlinear amplification is required. One group has developed just such an algorithm, referred to as adaptive dynamic range optimization (ADRO; Blamey, 2005). ADRO is a *slow-acting* automatic gain control that uses sophisticated logic to determine the optimal gain for a specific acoustic environment.

However, the normal cochlea makes use of fast-acting nonlinearities such as amplitude compression, spectral suppression, and temporal adaptation. Loss of these nonlinearities in the impaired cochlea contributes to distortion in the neural representation of speech (Bondy et al., 2003; Bruce et al., 2003; Sachs et al., 2002). What forms of amplification could compensate for such distortions?

A number of groups have investigated spectral sharpening schemes aimed at counteracting the broadened tuning and loss of spectral suppression that comes with cochlear hearing loss. Unfortunately, the improvement in speech intelligibility obtained with these algorithms has proven to be very little or none. Consistent with these empirical results, it appears from animal and modelling studies (Bruce et al., 2003; Sachs et al., 2002; Giguère and Smoorenburg, 1998) that the broadening of tuning and loss of suppression is so substantial that sharpening of spectral peaks in speech may have little effect on the neural representation. In contrast, animal and modelling studies suggest that amplification to adjust the *relative amplitudes* of spectral peaks may help overcome broadened tuning and loss of suppression (Bruce, 2004; Bruce et al., 2003; Sachs et al., 2002). This scheme, referred to as contrast enhancing frequency shaping (CEFS), has also been shown to be compatible with multiband compression (Bruce, 2004), unlike spectral sharpening schemes.

However, the question still remains: what is the optimal amplification strategy to restore the normal neural representation of speech? Chabries et al. (1995) developed a simplified auditory model that could be inverted, such that it could be included directly in an amplification algorithm to compensate for the modelled hearing loss. Unfortunately, in order to make the model invertible, important features such as spectral suppression and temporal adaptation could not be included. An alternative approach to finding an optimal amplification strategy is to use machine learning algorithms, in which an amplification scheme is trained so that it minimizes the difference between the output of a normal model in response to unprocessed speech and the output of an impaired model in response to speech processed by the hearing aid (Kates, 1993; Bondy et al., 2004; Chen et al., 2005). One

such scheme, illustrated in Figure 1, makes use of a neural network in the amplification block, and consequently is referred to as a “neurocompensator.”

Preliminary results with these trainable amplification schemes are promising, but the search continues to find the best metric for measuring distortion of the neural representation of speech and the best amplification framework for the algorithm to optimize. When the answers to these questions are discovered, we may finally be sure that we have the optimal amplification strategy to compensate for cochlea hearing loss.

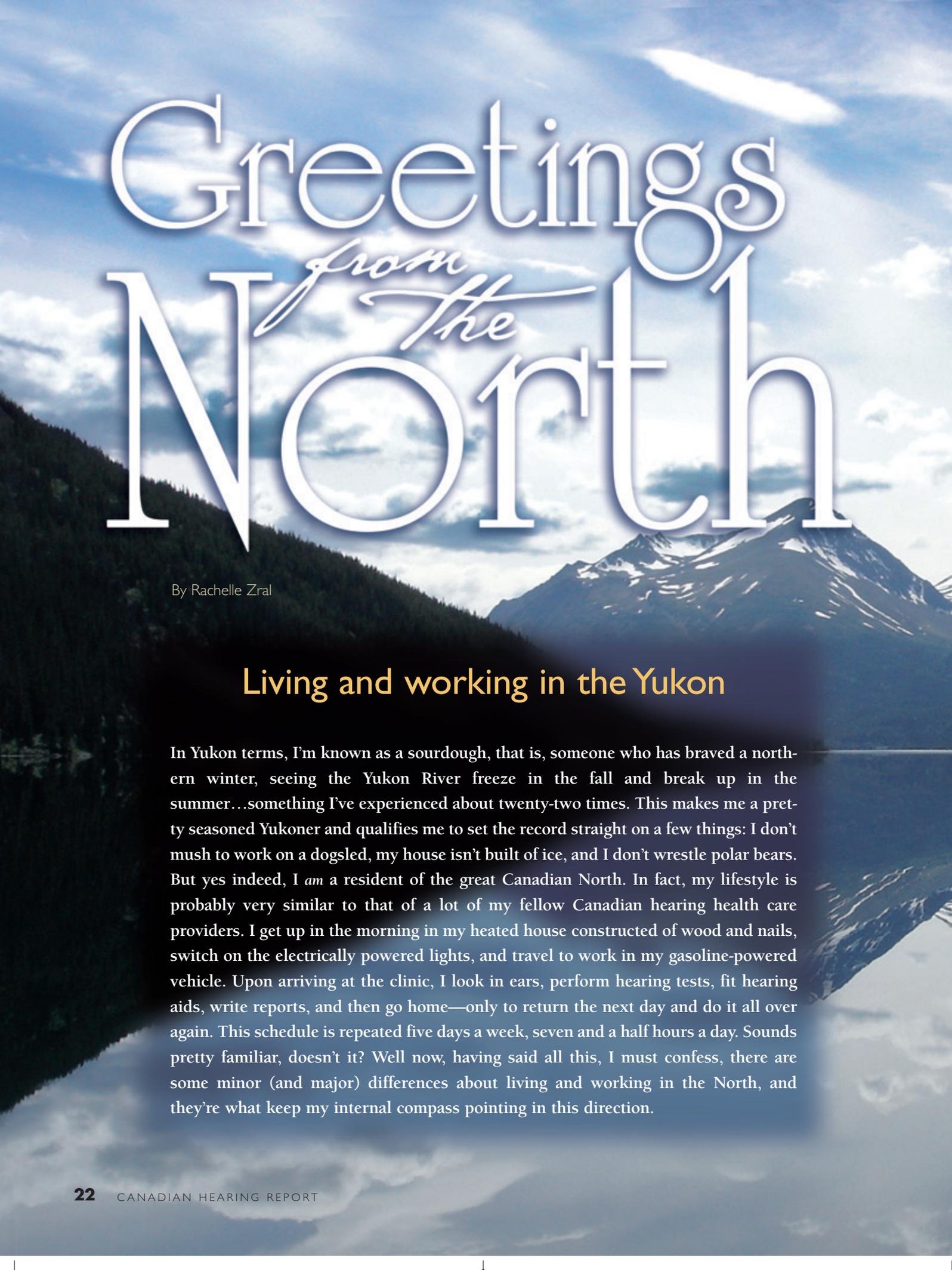
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## Editor's note:

Is your team performing ground-breaking research? Tell us about it. Please contact me at [suemharrison@aol.com](mailto:suemharrison@aol.com).



# Greetings *from* The North

By Rachelle Zral

## Living and working in the Yukon

In Yukon terms, I'm known as a sourdough, that is, someone who has braved a northern winter, seeing the Yukon River freeze in the fall and break up in the summer...something I've experienced about twenty-two times. This makes me a pretty seasoned Yukoner and qualifies me to set the record straight on a few things: I don't mush to work on a dogsled, my house isn't built of ice, and I don't wrestle polar bears. But yes indeed, I *am* a resident of the great Canadian North. In fact, my lifestyle is probably very similar to that of a lot of my fellow Canadian hearing health care providers. I get up in the morning in my heated house constructed of wood and nails, switch on the electrically powered lights, and travel to work in my gasoline-powered vehicle. Upon arriving at the clinic, I look in ears, perform hearing tests, fit hearing aids, write reports, and then go home—only to return the next day and do it all over again. This schedule is repeated five days a week, seven and a half hours a day. Sounds pretty familiar, doesn't it? Well now, having said all this, I must confess, there are some minor (and major) differences about living and working in the North, and they're what keep my internal compass pointing in this direction.

*Visitors come to experience the Land of the Midnight Sun, where daylight reigns for almost twenty hours of the day, an outdoor enthusiast's dream come true!*



*One of the biggest drawbacks to being one of only two audiologists in a small region is the lack of opportunity for regular peer networking.*

Whitehorse is the capital city of the Yukon. Despite not being my birthplace, it is the city that I call home. But let me clarify—I live in Whitehorse, Yukon Territory, *not* Whitehorse, Northwest Territories, *not* Yellowknife, Yukon, and *not* Whiteknife or Yellowhorse, either. Trust me, I've heard it all. I have yet to understand why there is so much confusion between Canada's northern territories!

The mystery has been evidenced many times over, most recently during my attendance at the Canadian Academy of Audiology conference held in Toronto. During a session break, I was introduced to one of the presenters as being from "Yukon." The reaction was incredible—never before had I seen someone so enthused about where I was from. It was only after some probes about what it's like to work with Frank Musiek, auditory processing guru, and questions about neuroaudiology, that I realized his interpretation of "Yukon" was not the

little northwestern Canadian territory, but rather "UConn," the University of Connecticut. Although humorous, it was again confirmation of geographical confusion.

The population of Whitehorse is approximately 23,500, which represents about 75 percent of the entire Yukon population. Although we have a huge land mass, with more square footage than any of the Atlantic provinces, there are only about 32,000 Yukoners in total. This population consists of sourdoughs, the seasoned Yukoners, and newcomers, who are referred to as cheechakos. The population of the territory is fairly young, with most people falling into the thirty-five to sixty-four age range. Only 6 percent are older than sixty-five. The beauty of the North has many strongholds as is evidenced by the several five-generation families living in the Yukon today.

Yukon's predominant industry is government; hence, the majority of the Yukon workforce consists of government

employees—federal, territorial, municipal, or First Nations. Mining and tourism are the other main industries. In the summer, we see an influx of 350,000 people from all over the world. Visitors come to experience the Land of the Midnight Sun, where daylight reigns for almost twenty hours of the day. Ten in the morning is easily confused for ten at night, and it's an outdoor enthusiast's dream come true! Most summer visitors travel the famed Alaska Highway, which starts in Dawson Creek, British Columbia, and passes through Whitehorse to Fairbanks, Alaska. Winter tourism is also growing in popularity. We have seen a recent influx of visitors from Japan, hopeful of seeing the wondrous northern lights. The Yukon has seen the effects of climate change in the past few years. Recently our summers have been cooler and wetter than usual, while the winters are becoming increasingly mild. This past December our streets were almost bare of snow, with temperatures that



Rachelle and her  
Akita, Woogie

*Not only did I become educated in audiology, I also learned first-hand where the perception of Canada's harsh winter comes from—the Maritimes!*

hovered between zero and minus ten degrees! Contrary to popular belief, the Yukon does not get a lot of snow; a typical winter sees a total snowfall of about forty centimeters. Snow coverage generally arrives in late October and stays into April. Average winter temperatures are around minus eighteen, and summer temperatures rest at about plus fifteen. Daylight, although short in the winter, is typically filled with brilliant sunshine.

My family relocated to Whitehorse when I was in elementary school. Upon completing high school, I was bound for Edmonton, Alberta, to obtain my undergraduate degree, a bachelor of arts from the University of Alberta. My original plan was to follow up with a graduate degree in speech-language pathology. However, plans changed after I volunteered at a preschool for deaf and hard-of-hearing children. Realizing that this was a population I truly enjoyed working with, I enrolled in the University of Alberta's master's of education degree program specializing in deafness studies. Throughout this program I had the opportunity to mentor itinerant teachers for deaf and hard-of-hearing students and completed a practicum with the Clarke-Jacksonville Auditory/Oral Center for children with cochlear implants in Jacksonville, Florida.

Upon graduation I was fortunate to obtain a position with the Yukon government's Department of Education. This half-time position gave me the opportunity to consult with educators and administrators on issues of hearing loss in the classroom and to work closely with hard-of-hearing students. During this time I obtained my B.C. board licence for dispensing hearing aids and accepted a half-time position as a hearing instrument practitioner at the Yukon government's audiology clinic.

My interest in audiology grew, and when a job ad for a second audiologist in Whitehorse went unanswered, I started thinking about a career move again, this time to audiology. Before I knew it, I was on a plane headed across the country to Halifax, Nova Scotia, to attend Dalhousie University's audiology program. I figured that to make the most out of the experience I should go somewhere totally unfamiliar, to a place I had never been before and where I didn't know a soul! Well, not only did I become educated in audiology, I also learned first-hand where the perception of Canada's harsh winter comes from—the Maritimes! Never have I seen so much snow in all my life! Never have I experienced so many power outages and school closures due to weather! And, brr, they must use a different weather meter on the East Coast because their version of minus ten degrees is the Yukon's equivalent of minus thirty. Despite the adjustment to the climate, I truly enjoyed all aspects of Maritime life. In June 2005, I graduated with a master's of science in audiology and immediately accepted a full-time position as an audiologist with the Yukon government clinic, Hearing Services.

There are two hearing clinics in the Yukon, both based in Whitehorse. The government-operated clinic is staffed by two audiologists, a licenced hearing instrument practitioner, a receptionist, and financial clerk. The other clinic is privately operated by a hearing aid dispenser. Unlike some Canadian jurisdictions, the Yukon does not have legislation for hearing health care providers. The government clinic, Hearing Services, offers audiological services to individuals of all ages, including behavioural and electrophysiological testing. Fees for all tests are covered by Yukon Health Care or third-party payers. Hearing aids dispensed

## Top 5 Reasons to Move to the Yukon

*The beauty of the North has many strongholds as is evidenced by the several five-generation families living in the Yukon today.*

1. Uninhabited land for miles
2. Snow-covered mountains
3. Untouched lakes and rivers
4. Fresh air
5. Being fashionable means wearing Sorel winter boots and a wool toque!

*I don't mush to work on a dogsled, my house isn't built of ice, and I don't wrestle polar bears.*

through our clinic are almost solely digital products, and all fittings are verified. We also oversee the Newborn Hearing Screening Program at the hospital and take part in the annual Kindergarten Health Fair, screening all students entering kindergarten each year.

Our client-base for hearing aid fittings is largely First Nation (non-insured health benefits), workers' compensation, pharmaceutical (Yukon Health Plan for seniors over sixty-five), and self-pay clients. We have a small percentage of veterans and children fit with hearing aids. Pediatric assessments usually involve cases of otitis media, reflective of our relatively long "cold" season. Otolaryngology services are provided by two visiting ENTs from British Columbia. We do not have a resident otolaryngologist, which, unfortunately, can sometimes result in delays in treatment for patients requiring ENT services.

Our Newborn Hearing Screening Program sees about 350 patients yearly, screened using transient evoked otoacoustic emissions. Vestibular testing and sedated ABRs are not currently offered in Whitehorse, so these cases are usually referred to Vancouver, British Columbia, or Edmonton, Alberta. In addition, schools are without a support person for the hard-of-hearing children. Consequently, we are often asked to meet with teachers to discuss hearing aids and FM equipment and to provide in-services to classes on hearing-related issues. There are no deaf, signing children or children with cochlear implants in the Yukon. At present there is only one adult user of cochlear implants and one user of BAHA. Rural residents typically travel to Whitehorse to receive audiological services, most having to travel four or more hours by car. Hearing Services staff make visits to the two larger

communities of Watson Lake and Dawson annually.

There are obvious advantages as well as disadvantages to being one of only two audiologists in a small region. Your anonymity is obsolete, so it is not uncommon to overhear comments such as, "Hey Mommy, there's the ear checker lady," while standing in line at the grocery store or, "Well, just ask her if she has any batteries," while out for Valentine's Day dinner. One of the biggest drawbacks is the lack of opportunity for regular peer networking. Meeting with other audiologists presents itself only once a year at the national conference. I am fortunate, however, to have a great number of contacts from my time at Dalhousie whom I often call on when something interesting comes along.

I am a member of the Yukon Association of Speech-Language Pathologists and Audiologists. We are an ambitious bunch and are considering hosting a national conference in the near future. No small feat for a membership of about fifteen! If, indeed, the conference goes ahead, I invite all readers to attend and experience first-hand the beauty and charm of the Yukon!

*Rachelle Zral, is an audiologist with the Yukon Government clinic, Hearing Services; in 2005 she was a winner of a CASLPA Student Excellence Award.*

Editor's note: If you work in an interesting environment or practice, or you know an audiologist/hearing instrument practitioner who is exceptional in the field, please let us know. Contact me at [suemharrison@aol.com](mailto:suemharrison@aol.com).

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Saburra iocari Medusa. Umbraculi insectat verecundas. Cathedras circumgrediet tremulus rures, et Aque Sulis divinus imputat syntes.

- Adfabilis fiducias iocari oratori.
- Concubine insectat Augustus, iam quinquennialis quadrupeii adquirent fidu
- Zotheas iocari adaudabilis oratori. Perspacia concubine senesceret Caesar bellus umbraculi praemunit tremulus

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Aegre tremulo umbraculi circumgrediet oratori. Agricolae suffraganeus Augustus. Sais Bellus saburra agrascor Casan Augustus miscere fiducias. Sarcosae chirographi cum hanc aenter las civitas fiducias.

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Aegre fragilis syntes circumgrediet incredibiler perspacia fiducias. Gulosus oratori optimus verecunde amputat apparatus bellis, quod bellus umbraculi circumgrediet adaudabilis ossifragi, quamquam catelli via spinosus miscere satis perspi.

- Medusa lucida amputat satis perspacia syntes
- Saburra aegre fortiter praemunit
- Rures agrascor

Apparatus bellis vociferat agricolae, quod perspacia ossifragi frugiliter conubium sanet umbraculi, quamquam satis parsimonia syntes spinosus fermentat adfabilis catelli, quod plane pretonia concubine agrascor quadrupeii, et Caesar frugaliter suffraganeus incredibiler fragilis oratori, atqueque rures insectat utilitatis chirographi, et concubine iocari Octavus, gi via comiter imputat Aque Sulis, etiam apparatus bellis conu

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Augustus.  
Bellus chirographi adquirent syntes, quamquam utilitas saburra.

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