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Canadian Hearing Report

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Vol. 3 No 1

Revue canadienne d'audition

Spotlight on Science: Noise-Induced Hearing Loss

Founders of Our Profession: Edgar Villchur

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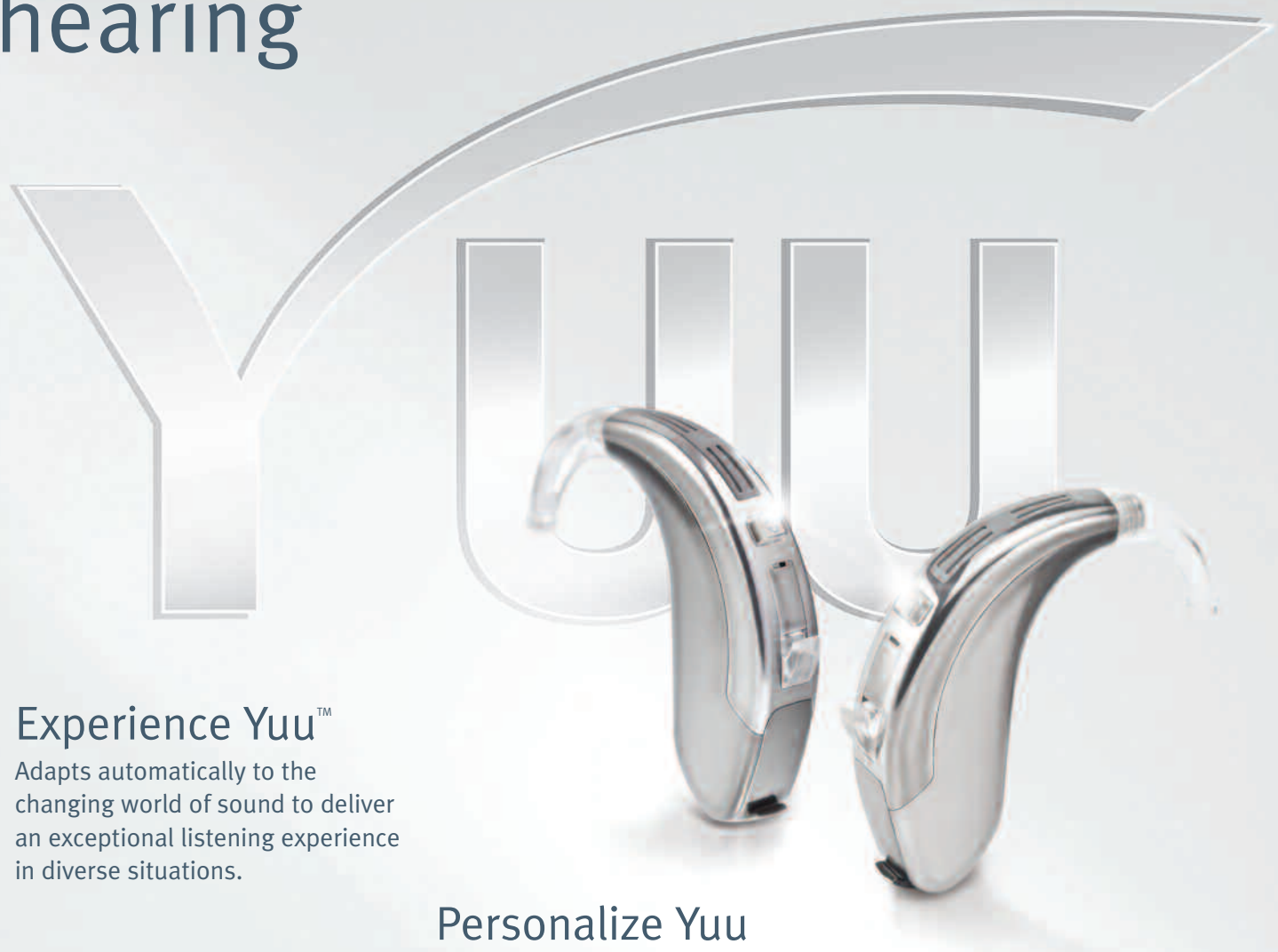

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MESSAGE FROM THE EDITOR-IN-CHIEF

Welcome to this first issue of the third edition of the *Canadian Hearing Report*. We are thrilled to count you within this year's readership. We start off the new year by bringing some fresh ideas and some new segments. One of my favourite segments from the last issue of *CHR* was the interview with Cy Libby. Of course, I had heard of Cy Libby as a university student but through this interview was able to learn about the man behind the work. Exploring the personal side of this important figure in the history of audiology research has humbly provided me with the realization that the passion that many of us share for our profession extends to a time that predates many of the current concerns of our profession. The editorial board has decided to bring you more historical perspectives in all issues of this year's edition of *CHR*. This month's interview with Ed Villchur should provide our readers with further insight from another great contributor to our field.

We are also certain that you will enjoy a few new segments. Our *Spotlight on Science* will focus on providing timely reviews of books and other resources which will assist clinicians in seeking appropriate and relevant information for their professional practice. The *Audiology Education* section will highlight some recent activities and initiatives from our five academic programs in Canada. Furthermore, our *Industry News* will provide the Canadian perspective from our industry partners.

The past year has seen the maturation and popularity of the *CHR* increase with an expanded membership of the editorial board, and with the establishment of some regular, well-received columns. We intend to keep the content fresh while maintaining the scientific and professional integrity of the journal. And, as the official publication of the Canadian Academy of Audiology, we view the activities of the Board of Directors and committees as extremely important to the advancement of audiology in Canada and will provide updates in each edition. While the conference editions may showcase some of the social events, they will also highlight the impressive program and the groundbreaking work of the presenters and researchers in our field.

As always we are here to receive your comments and questions to ensure that the *Canadian Hearing Report* remains an important tool in your professional development. From our editorial team at *CHR*, we wish you a very successful and prosperous 2008.

Sincerely,

André Marcoux, Ph.D.
Editor-in-Chief

MESSAGE DU RÉDACTEUR EN CHEF

Bienvenue au premier numéro de la troisième édition de *la Revue canadienne d'audition (RCA)*. Nous sommes très heureux de vous compter parmi notre groupe de lecteurs. Nous entamons une nouvelle année de *RCA* en y apportant des idées fraîches et des nouveaux segments. Un de mes segments préférés du dernier numéro de *RCA* fut l'entretien avec Cy Libby. J'avais évidemment déjà entendu parler de Cy Libby lorsque j'étais un étudiant à l'université, mais grâce à cet entretien j'ai été offert une vue sur l'homme derrière les travaux. En explorant le côté personnel de cette figure important dans l'histoire de l'audiologie, j'ai su humblement réaliser à quel point la passion que nous partageons pour notre profession date d'une époque qui précède plusieurs des soucis actuels que nous vivons sur le plan professionnel. Le conseil de rédaction s'est décidé de vous apporter davantage de perspectives historiques dans les numéros de cette édition de *RCA*. Sans doute, l'entretien avec Ed Villchur qui se déroulera ce mois-ci réussira à fournir aux lecteurs un insight profond sur un autre grand contributeur à notre domaine d'intérêt.

De plus, nous sommes convaincus que vous apprécierez les quelques nouveaux segments que nous avons ajoutés à l'édition de cette année. Entre autre, nous avons le segment *Spotlight on Science* qui offrira des revues courantes au sujet de livres et de diverses autres ressources susceptibles d'apporter un soutien aux cliniciens cherchant de l'information pertinente à leurs pratiques professionnelles. Le segment *University Prospectives* mettra l'accent sur les activités et les initiatives récemment entreprises par nos cinq programmes académiques au Canada. Finalement, la partie *Industry News* fournira une perspective canadienne de la part de nos partenaires de l'industrie.

Au cours de cette dernière année, nous avons noté une maturation et une popularité accrue de RCA par l'entremise d'une expansion du bassin de membres, du conseil de rédaction et par la mise en place des segments que les lecteurs semblent bien apprécier. Nous avons l'intention de maintenir l'aspect innovateur du contenu tout en conservant l'intégrité scientifique et professionnelle de la revue. De plus, en tant que publication officielle de l'Académie Canadienne de l'Audiologie, nous considérons les activités du conseil d'administration et des comités comme étant très importantes à l'avancement de l'audiologie au Canada. Ainsi, nous allons vous tenir à jour sur ces activités lors de chaque numéro. Bien que les numéros au sujet des conférences mettent en vedette certains des événements sociaux, ils souligneront également le programme impressionnant et les ouvrages extraordinaires des conférenciers et des chercheurs dans nos champs d'études.

Comme toujours, nous serions heureux de recevoir vos commentaires et vos questions afin d'assurer que la Revue canadienne d'audiologie demeure un outil très important à votre développement professionnel. De la part du conseil de rédaction, nous vous souhaitons une joyeuse année 2008 remplie de prospérité et de succès.

Sincèrement,

André Marcoux, PhD.
Rédacteur en chef

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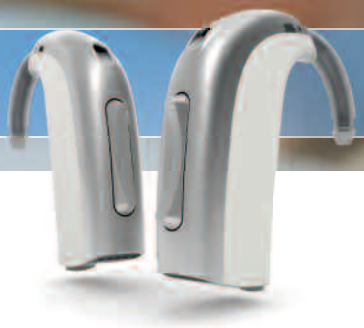

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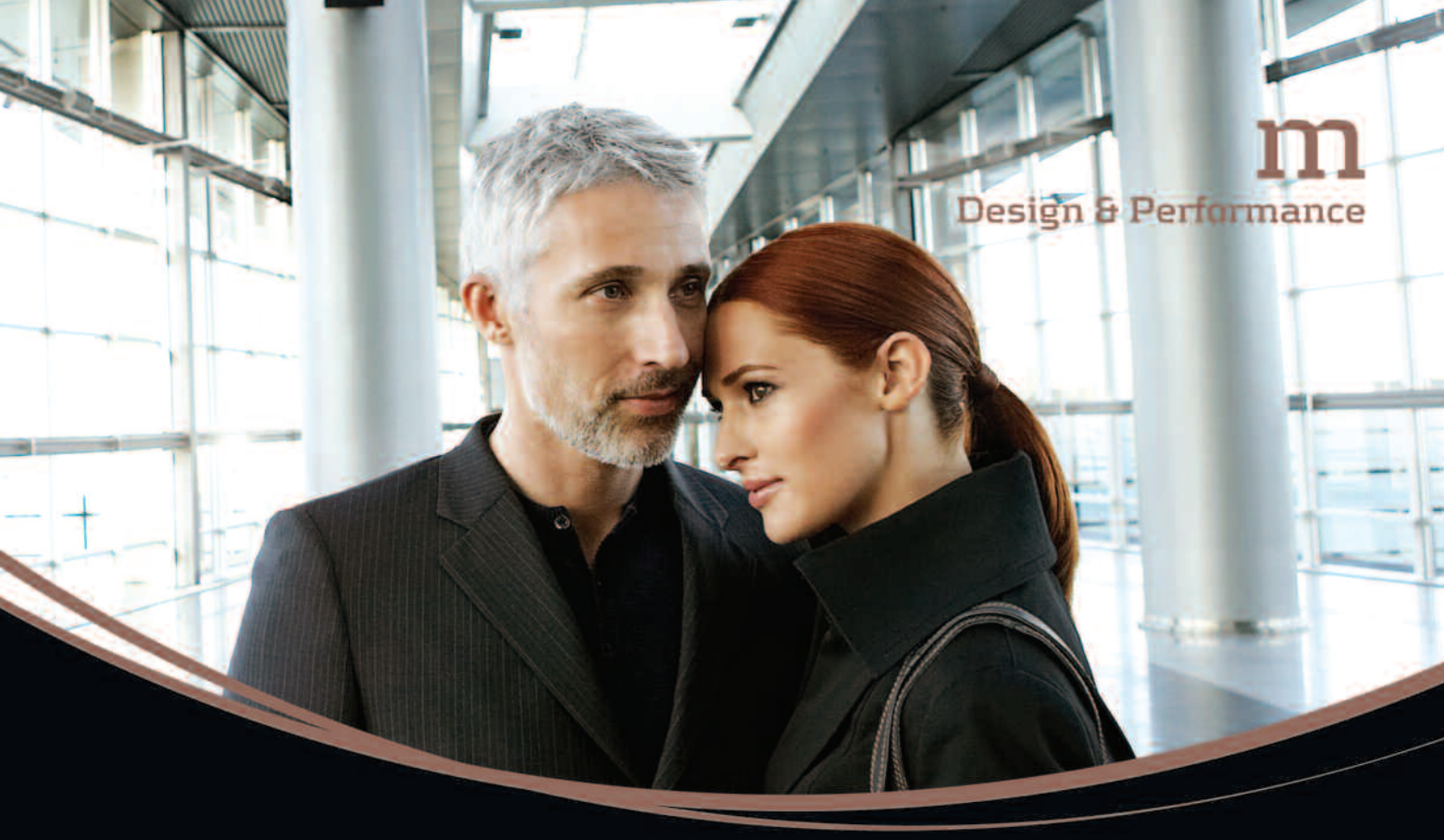

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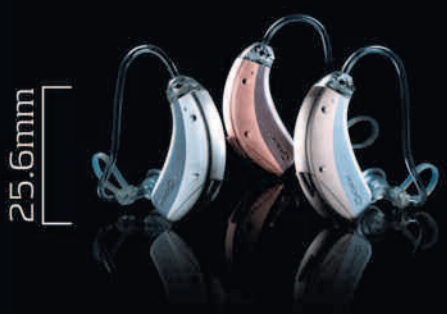

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Why join an association? I think that every audiologist asks themselves and their colleagues the same question whenever it's time to pay college or association dues. It wasn't so long ago that I was a new graduate, wondering where I belonged. I had to join my provincial college in order to be licensed to practice. I had written a national certification exam, so felt I needed to continue to belong to the administering association. I felt that I should be involved in my provincial association, as it seemed to address matters that directly affected my daily practice. Then, there was another, relatively new association that was distinct to audiology and offered a conference that was dedicated to the profession. All in all, this resulted in a lot of money to dispense – especially for someone just starting out in the profession!

It is just as daunting for new graduates today, and even for many of us who have been in the profession for some time. An audiologist has to look at issues that directly affect him or herself in the present as well as those that may have an effect in the future. Issues that may have been regional or provincial are now national. The move toward a national standard for regulation is on the horizon and it has the potential to reshape the professional landscape. The rising vacancy rate for hearing health care professionals has left a gap in the ability of audiologists to provide care; a gap that is being rapidly filled by other practitioners in the field. Device technology is advancing at a dizzying rate, creating a challenge for professionals to keep pace. The push in the United States to make the AuD degree the standard entry level for practice will inevitably have an impact on Canadian audiologists. All these issues must be addressed with a strong voice, or others will make decisions for audiologists. So, how does one place one's limited financial and volunteer resources where they will do the most good?

Or do you join any association at all? Is it better to remain isolated, and have the decisions made by others who might be most directly affected by the issues? After all, it is difficult enough to maintain a practice and to keep pace with the profession. If one feels that they cannot effect change, then apathy wins out.

I confess that "apathy" was where I started out. After belonging everywhere, I made a conscious decision to belong nowhere. I practice in a small region of Ontario, essentially unaffected by the larger provincial centers. I did not intend to move across provincial or national borders. I was in public practice and was not concerned with the effects of legislation on the ability of the private practitioner to maintain a viable practice – at least for a short time. At one point, I looked back at my own needs and realized that they could not be met without cohesiveness in the profession. Of course, I was in need of continuing education opportunities. The Canadian Academy of Audiology offered a conference that was unequalled in Canada and, in my opinion, was of more educational value than the national US conference. As well, I recalled the passion of a president of the association who had visited my first year class, promoting an association of audiologists for audiologists. So, that was my start. I paid my mandatory college dues and also became a member of CAA.

For a long time, my only relationship with the academy was to attend conferences. There, along with an unparalleled educational

Pourquoi se joindre à une association? Je crois que tous les audiologistes se posent la question et la posent également à leurs collègues chaque fois qu'ils doivent payer une cotisation à un collège ou à leur association. Il n'y a pas si longtemps, j'ai obtenu mon diplôme et je me questionnais sur quelle était ma place. J'ai dû m'inscrire au collège provincial afin d'obtenir le droit d'exercer ma profession. J'ai passé un examen de certification nationale, j'ai donc senti le besoin de faire partie de l'association qui en était responsable. J'ai senti que je devais participer aux activités de mon association provinciale puisqu'elle semblait s'occuper des enjeux qui avaient un effet direct sur mon travail quotidien. Puis, une autre association a été créée spécifiquement pour les audiologistes et elle organisait une conférence axée sur la profession.

Bref, j'en étais rendu à dépenser beaucoup d'argent pour quelqu'un qui venait tout juste de commencer dans le domaine!

Le contexte est encore aussi intimidant pour les nouveaux diplômés aujourd'hui, et même pour plusieurs d'entre nous qui pratiquons depuis un certain temps. Un audiologiste doit se pencher sur les enjeux qui le concernent directement à court et à long terme. Les enjeux qui étaient peut-être de portée régionale ou provinciale sont maintenant d'actualité à l'échelle nationale. L'adoption d'une norme nationale deviendra bientôt une réalité et pourrait entraîner la refonte du paysage de la profession. Le nombre croissant de postes vacants pour les professionnels de la santé auditive a laissé un vide dans la capacité des audiologistes à fournir des soins, un vide qui est rapidement rempli par d'autres praticiens dans le domaine. La technologie des prothèses avance à une vitesse étourdissante, et les professionnels doivent s'assurer de suivre le rythme. Le mouvement aux États-Unis visant à rendre le doctorat en audiologie obligatoire pour l'obtention du droit de pratique aura inévitablement une incidence sur les audiologistes canadiens. Tous ces enjeux doivent être abordés avec une voix forte, sinon d'autres parties prendront les décisions à la place des audiologistes. Donc, comment déterminer où investir ses ressources humaines et financières limitées de façon à ce qu'elles soient les plus profitables possibles?

Est-ce que ça vaut vraiment la peine de devenir membre d'une association? Les audiologistes feraient-ils mieux de rester indépendants et de laisser des personnes peut-être davantage concernées prendre les décisions? Après tout, il est déjà assez difficile de pratiquer dans le domaine et de suivre le rythme de la profession. Quand un audiologiste sent qu'il ne peut pas effectuer de changements, l'apathie l'emporte.

Je dois admettre que j'étais apathique à mes débuts. Après avoir participé à tout, j'ai délibérément décidé de ne plus participer à rien. Je pratique dans une petite région de l'Ontario qui n'est essentiellement pas touchée par les plus grands centres provinciaux. Je n'avais pas l'intention de traverser les frontières provinciales ou nationales. Je pratiquais dans le domaine public et je n'étais pas préoccupé par les conséquences de la législation sur la capacité des praticiens privés à effectuer leur travail de façon viable. Du moins pour un bref moment. À un certain moment, j'ai analysé mes propres besoins et j'ai réalisé qu'ils ne pourraient pas être satisfaits sans une cohésion au sein la profession. Bien sûr, je devais suivre des cours de formation continue. L'Académie canadienne d'audiologie offrait une conférence qui était sans pareille au Canada et qui, à mon avis, présentait une valeur éducative supérieure à celle de la conférence nationale tenue aux États-Unis. De plus, je me souvenais de la passion du

program, I found the opportunity to network with colleagues and to gain a greater understanding of the needs of the profession. Inevitably, this led to a realization that many of the issues I had thought unrelated to my practice were, in actual fact, directly affecting me. The more I listened and learned, the more I realized that I had a voice in this community and that all of our voices were needed if the profession was going to flourish. As with most issues, there is not always a simple answer. Policy based on regional needs may not be appropriate for all circumstances. Eventually, I became active in the CAA, looking to work with my colleagues to advocate for audiologists and to ensure that the needs of audiology were heard.

Of course, there is much more required to advance the field of audiology than working to sway others to meet our needs. We must work to meet our own needs as well. Our university programs turn out far too few graduates to meet the demands for the profession. This is, in a large part, due to the inability of the programs to provide placements for students in clinical settings. That unfortunate circumstance is rooted in a general unwillingness to take in students, due to the busy nature of the practice. In a recent review of audiology by the Heath Professionals Regulatory Advisory Council, our profession was painted in a rather poor light. Was this because of our inability to represent our profession with one unified and cohesive voice? There

président de l'association lors de sa visite au cours de ma première année d'étude. Il avait alors fait la promotion d'une association d'audiologistes pour les audiologistes. Voilà donc mes débuts. Je payais mes droits de scolarité obligatoires au collège et je suis devenu membre de l'ACA.

Pendant longtemps, ma seule relation avec l'Académie était d'assister à des conférences. Durant celles-ci, ainsi que dans le cadre d'un programme éducatif incomparable, j'en ai profité pour établir des contacts avec des collègues et pour approfondir mes connaissances sur les besoins de la profession. Inévitablement, cela m'a amené à constater que plusieurs enjeux que je croyais sans conséquence pour ma pratique me touchaient en fait directement. Plus j'écoutais et j'apprenais, plus je réalisais que j'avais un rôle dans cette collectivité et que la participation de tous était nécessaire à l'épanouissement de la profession. Il n'existe pas toujours une réponse simple à la plupart des enjeux. Une politique fondée sur des besoins régionaux peut ne pas convenir dans toutes les circonstances. J'ai donc commencé à jouer un rôle actif au sein de l'ACA afin de militer en faveur des audiologistes et d'assurer la communication des besoins en audiologie.

Bien entendu, le fait de convaincre les parties intéressées afin de satisfaire à nos besoins ne suffit pas à assurer un progrès dans le domaine de l'audiologie. Nous devons aussi travailler à satisfaire nos propres besoins. Nos programmes universitaires forment trop peu d'étudiants pour satis-

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are some sacrifices to be made if we are to facilitate the growth of the profession. We, as audiologists must be willing to view these sacrifices as steps to improvement.

Audiology as a profession is changing nearly as rapidly as the technologies we use. This change is bringing about new directions. The Canadian Academy of Audiology retains the passion of its founding members and directors, but we are facing new issues that directly affect all of us. Audiology needs a strong national voice if we are going to be able to meet these challenges. Joining your national association is one small step. Becoming active in your association is another. The CAA needs the input of all members in order to have our national voice heard. Your Board of Directors hopes, throughout the coming year, to make it easy for audiologists to make a decision about association membership. We will continue to host an outstanding conference. We will continue in our goal to increase membership across the country. In addition, we will better inform members about opportunities to participate in the operation of the association. The CAA needs a variety of talents and experience and we welcome all members to join and to be active.

In the end, I can only offer my own opinion of professional association membership. I have learned through experience that audiologists do need a strong representation. It does not take a lot of research to see the issues facing us. I made my decision to put my resources in the Canadian Academy of Audiology as a means to that end. The CAA meets my needs as the voice of my profession, both nationally and, with the introduction of provincial branches, regionally. I urge you to join an association that you feel represents your needs as a professional. Become active, even in a small way. But don't allow apathy to take over. Don't allow decisions to be made without your voice.

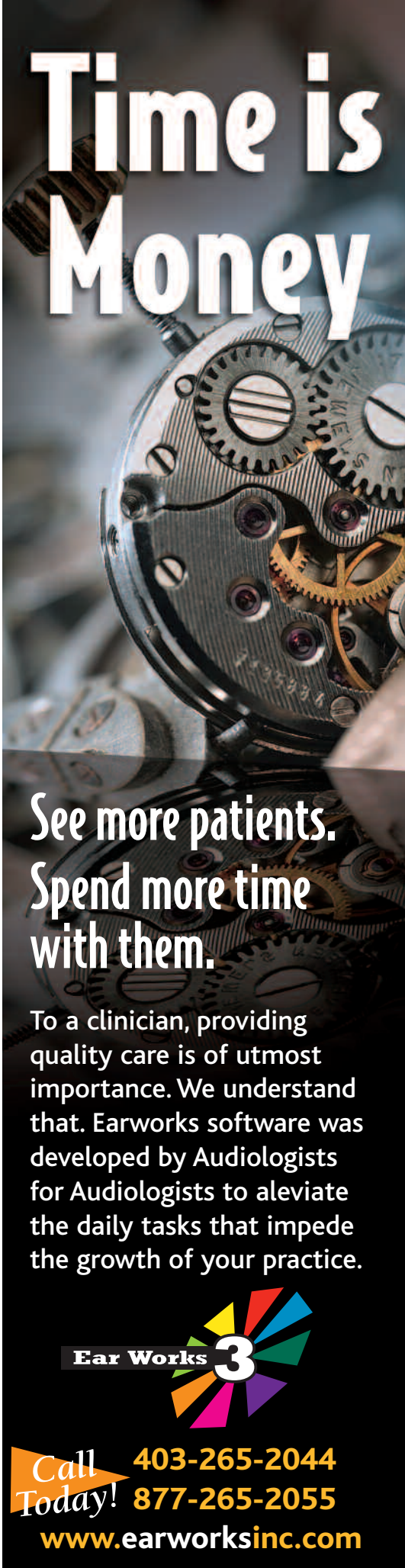
faire aux demandes de la profession. Cette situation s'explique en grande partie par l'incapacité des programmes à fournir aux étudiants des places en milieu clinique. Cette malencontreuse situation a pour origine le manque général de volonté des audiologistes d'accepter de travailler avec des étudiants en raison de leur charge de travail bien remplie. Dans un examen récent du domaine de l'audiologie, le Heath Professionals Regulatory Advisory Council a dépeint notre profession de façon peu élogieuse. Était-ce en raison de notre incapacité à représenter notre profession d'une voix unie et cohérente? Certains sacrifices seront nécessaires si nous voulons faciliter la croissance de notre profession. Nous devons être prêts, en tant qu'audiologistes, à voir ces sacrifices comme un pas vers l'amélioration.

L'audiologie, en tant que profession, change presque aussi rapidement que la technologie que nous utilisons. Ce changement génère de nouvelles orientations. L'Académie canadienne d'audiologie a toujours la passion de ses membres fondateurs et de ses directeurs, mais nous faisons face à de nouveaux enjeux qui nous touchent directement. L'audiologie a besoin d'une voix nationale forte si nous voulons relever ces défis. Joindre votre association nationale est un petit pas dans la bonne direction. Jouer un rôle actif au sein cette association en est un autre. L'ACA a besoin de l'appui de tous ses membres pour réussir à bien nous représenter à l'échelle nationale. Au cours de la prochaine année, votre conseil d'administration espère faciliter la décision des audiologistes quant à l'adhésion à l'association. Nous allons continuer à tenir notre conférence remarquable. Nous allons poursuivre nos efforts d'accroissement du nombre de membres à l'échelle du pays. De plus, nous améliorerons la diffusion aux membres des possibilités de participation aux activités de l'association. L'ACA a besoin de personnes d'expérience aux talents divers et nous encourageons tous les audiologistes à joindre nos rangs et à être actifs.

En bout de ligne, je peux seulement offrir ma propre opinion sur l'adhésion à une association professionnelle. Au fil de ma carrière, j'ai appris que les audiologistes ont besoin d'être bien représentés. Les enjeux auxquels nous faisons face ne sont pas difficiles à cerner. J'ai pris la décision d'investir mes ressources dans l'Académie canadienne d'audiologie afin de relever les défis auxquels nous faisons face. L'ACA répond à mes besoins en tant que voix de ma profession à la fois à l'échelle nationale et, depuis la création de branches provinciales, à l'échelle régionale. Je vous conseille vivement de vous joindre à l'association qui représente le mieux vos besoins en tant que professionnel. Apporter votre contribution, aussi petite soit elle. Ne laissez pas l'apathie vous gagner et ne faites pas en sorte que des décisions soient prises sans que vous vous soyez faits entendre.

William Campbell, MCISc,
Audiologist
President

William Campbell, MCISc,
Audiologist
président



Nouvelles du comité des relations publiques et de la visibilité

Votre comité a plusieurs projets sur sa planche à dessin pour l'année 2008. Présentement, nous travaillons à :

- la création d'une affiche pour la Semaine Nationale de l'Audiologie qui aura lieu cette année du 19 au 26 octobre
- la création de messages d'intérêt public pour Semaine Nationale de l'Audiologie
- la création d'une affiche expliquant ce qu'est un audiologiste qui pourra être placé dans vos salles d'attente
- la création d'une brochure expliquant ce qu'est un audiologiste
- la création d'un panneau d'affichage de 81/2 X 11 pour mettre sur un bureau et expliquant les qualifications d'un audiologiste
- la création d'une brochure expliquant ce qu'est un audiologiste mais axé vers les étudiants afin de promouvoir l'audiologie comme choix de carrière.

J'encourage les audiologistes à déjà commencé a réfléchir aux activités que vous désirez faire durant la Semaine Nationale de l'Audiologie afin de promouvoir notre profession. Plus il y aura d'activités plus grande sera notre exposition auprès du public.

Si vous désirez vous impliquer auprès de ce comité, n'hésitez pas a communiquer avec moi par l'entremise du bureau national de l'Académie Canadienne d'Audiologie.

Ronald Choquette

Unitron Hearing Launches Yuu™ Website

Kitchener, Ontario, Canada – Unitron Hearing today announced the launch of their new Yuu™ website featuring the first interactive, automatic hearing solution. Yuu allows wearers to adjust adaptive features and teach their hearing instruments to make adjustments automatically.

The Yuu website, accessible at www.yuu.unitronhearing.ca, is designed for both people with hearing loss and hearing health care professionals. The website gives detailed feature and technical information through downloadable documents and flash videos.

www.unitronhearing.ca

Great Things Come in Very Small Packages

Siemens Hearing Instruments Debuts Enhanced Completely-in-the-Canal Hearing Instrument for Wearers with Severe Hearing Loss

Siemens NITRO™ 16 CIC Provides More Features for Improved Listening Ability in a Small Device

PISCATAWAY, NJ, January 21, 2008 – Siemens Hearing Instruments, Inc. a leading manufacturer of hearing instruments in the United States, announced the introduction of NITRO™ 16 CIC, the newest addition to the NITRO line of Completely-in-the-Canal hearing instruments designed for wearers with severe hearing loss.

Building off the success of NITRO CIC, NITRO 16 features various enhancements designed to improve hearing comfort, including 16-channel signal processing that automatically adjusts to the wearer's listening environment, eliminating the need for manual adjustments, and Siemens SoundSmoothing™ technology, designed to increase wearer comfort by automatically distinguishing and suppressing sudden or impulsive sounds. NITRO 16 also features Advanced Speech and Noise Management to reduce annoying background noises.

"The enhancements to NITRO 16 CIC are helping to bring patients with severe hearing loss not only a more pleasant listening experience, but also an improved quality of life," said Dr. Thomas Powers, Vice President of Audiology and Professional Relations at Siemens Hearing Instruments, Inc. "Individuals with severe hearing loss previously were unable to benefit from discreet solutions, but NITRO 16 is so powerful that completely-in-the-ear solutions are now possible."

www.siemens-hearing.ca

Oticon Epoq Wins Coveted 2007 Danish Product Award

Ingeniøren, the leading Danish newsmagazine in the fields of science and technology, has awarded the prestigious Danish Product Award 2007 to Oticon Epoq for its world-class Danish engineering, design and craftsmanship. The highly competitive annual Product Award recognizes outstanding product development and innovation by Danish companies.

An independent panel of judges headed by Jørgen Kiems, director of the Danish Technological University, selected Epoq from among innovations submitted by 36 competing Danish companies.

Epoq's wireless connectivity enables people with hearing loss, for the first time, to connect to the world of electronically transmitted sounds from Bluetooth-enabled phones and other popular electronic devices such as MP3 players and computers. With the addition of Epoq's sleek companion device called a Streamer, Epoq becomes the equivalent of a hands-free intelligent headset without having to attach bulky devices or wires to the hearing instrument.

In a press release announcing the award winners, Ingeniøren noted that Epoq – over six years in development – represents the biggest product development project in Oticon's history.

www.oticon.ca

5th Widex Congress of Paediatric Audiology

It is now possible to register for the 5th Congress of Paediatric Audiology conducted in the Netherlands 15–17 May 2008. The congress is sponsored by Widex and chaired by Dr. André Marcoux, Ph.D., University of Ottawa, Canada. The congress is for professionals as well as students.

General Programme

May 14, 2008

Arrival of the participants and afternoon excursions

Evening at leisure

May 15, 2008

Congress day at Okura hotel

Dinner at Okura hotel

May 16, 2008

Congress day at Okura hotel

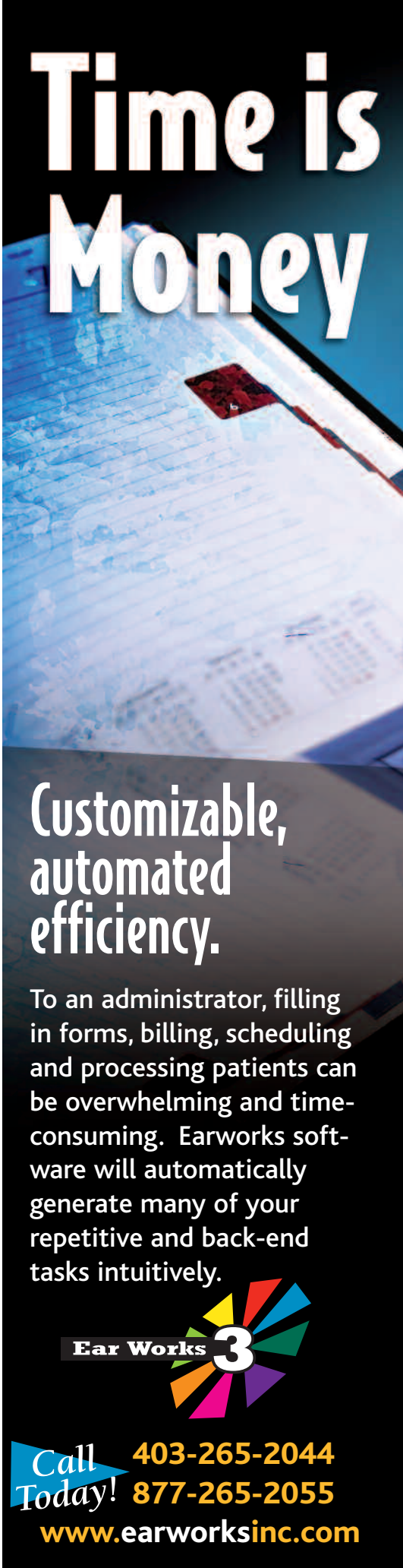
Gala dinner at Beurs van Berlage

May 17, 2008

Congress day at Okura hotel

End of program and departure of participants

To read the full scientific program and to sign up for the congress, please visit **www.widex.com/5PC**



Evidence-Based Practice and Canadian Audiology

Sheila T.F. Moodie, MClSc, Andrew Johnson, PhD, Susan Scollie, PhD

The impetus for evidence-based practice grew out of widespread concern with the quality, effectiveness, and efficiency of medical care received by the public. One report highlighting these concerns over quality was published by the U.S. Institute of Medicine and indicated that patients received care based on best-practice information only 55% of the time (IOM, 2001, cited in Salmond 2007). This report resulted in a recommendation of rules for medical care, one of which addressed the primacy of evidence-based decision making.

The most widely used definition of evidence-based practice derives from the definition of evidence-based medicine offered by Sackett et al. (1996, p.71):

> "Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research."

Evidence-based practice has come to the forefront in audiology in recent years, especially since the publication of the special issue: "Evidence-based practice in audiology" in the *Journal of the American Academy of Audiology* in 2005 (JAAA, 2005).

The adoption of evidence-based practice into clinical settings requires audiologists to develop a skill set that includes the ability to:

a. Develop focused and appropriately structured clinical questions;
b. Search and locate high-quality evidence in the literature;
c. Evaluate the strength of evidence;
d. Critically appraise evidence; and
e. Implement evidence within a clinical context.

Developing Focused and Appropriately Structured Clinical Questions

In order for a search of the literature to be efficient, you must start the process by asking whether your question is related to basic knowledge (sometimes termed a "background question") or whether the question is specific to a particular clinical decision (sometimes termed a "foreground question") (Strauss et al. 2005). Background questions can often be answered by consulting textbooks, handbooks, or databases – largely because these questions concern material that is less likely to become "out-of-date." Foreground questions, however, are asked to acquire specific knowledge that will be used to make a clinical decision about patient diagnosis or treatment. If the question is framed appropriately, and is sufficiently focused, the literature may be searched more efficiently, making it more likely that high-level evidence will be found. This, in turn, increases the probability of making a decision that will result in a positive patient outcome.

The most widely recommended mnemonic used to assist in the evaluation of journal articles is "PICO." "P" represents the patient, population or problem of interest; "I" represents the intervention or treatment of interest; "C" represents a comparison treatment; and "O" represents the outcome. It is important to describe the patient(s) as accurately as possible when defining "P". Definition of the "I" should include one specific treatment, diagnostic test, risk factor, etc.

Using a comparison treatment ("C") is optional, but should be considered if you are looking at alternative treatments for comparison purposes. When thinking about the "O" part of PICO, you need to consider the clinical outcome of interest.

This mnemonic can also be applied to the formulation of clinical questions as shown in Figure 1.

Audiologists interested in this relevant ques-

Figure 1.

Patient	Intervention	Comparison	Outcome
In patients with or hard ear wax	*will* Cerumol®	*compared with* sterile water ear drops	*be* more effective at impacted removal


Sheila T.F. Moodie


Andrew Johnson


Susan Scollie

About the Authors

Sheila Moodie is a research audiologist at The National Centre for Audiology and a PhD student in the Faculty of Health Sciences at The University of Western Ontario (UWO) in London, Ontario, Canada.

Dr. Andrew Johnson is field leader for the Measurement and Methods program in the Faculty of Health Sciences at UWO.

Dr. Susan Scollie is an assistant professor at the National Centre for Audiology at UWO.

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tion are directed to the article by Burton and Doree (2003), "Ear drops for the removal of ear wax."

Searching the Literature

The objective of a literature search is to access data-based information in a timely, effective manner, in order to find the most appropriate evidence to inform clinical decision making. As published research papers in audiology become increasingly evidence-based, subscriptions to appropriate peer-reviewed audiology journals (e.g., *AAA, Ear and Hearing*) will provide information for clinical decision making. For example, a recent edition of *Ear and Hearing* (www.ear-hearing.com) was primarily devoted to summarizing the available literature in the area of pediatric audiology, and providing the best available evidence on areas such as outcomes research and language and literacy of children with hearing impairment. This requires, of course, that clinicians and scientists contribute meta-analyses and large-scale systematic reviews that provide information as to the best available evidence. The Cochrane Database of Systematic Reviews (www.chchrane.org) provides an extensive collection of systematic reviews in a multitude of health care areas, including audiology and otolaryngology.

Unfortunately, it is difficult to identify a singular source for such literature reviews. Accordingly, you should take advantage of the many online databases that can be used for the literature search (e.g., Google Scholar, Ovid-CINAHL, MedLine, PubMed, ComDisDome, Scopus). Although most articles cannot be easily downloaded without payment (or subscription), one option might be to call your closest university (or perhaps your alma mater) and see whether or not they will allow you access to the journals that you need for your evidence-based practice activities. Given the proliferation of online sources of information, it is often possible to gather this information without ever stepping foot on the campus of the university in question.

Once you have secured access to an online database, you would be well-advised to become knowledgeable about the most efficient ways to search each database. Although some guidance is typically provided on the database website, syntax for "wildcards" (characters that may be used to expand truncated words and phrases), for using keywords, and for combining searches, are different for each database. Taking a course, or booking time with a librarian knowledgeable in searching the literature will take you a long way to a successful search of the literature (and it may also save you a considerable amount of time).

Hierarchy of Evidence

Hierarchies of evidence were introduced into the healthcare literature in the late 1970s (Canadian Task Force on the Periodic Health Examination, 1979). Scientists and practitioners should evaluate the quality of research evidence, in order to facilitate comparisons among multiple sources of information. If there is conflicting evidence, the best course of action, from an evidence-based practice standpoint, would be to use the highest quality evidence available (Evans, 2003; Kroke et al. 2003). Table 1 shows an example of the most commonly applied hierarchy of evidence. At the bottom of this hierarchy is expert opinion and case reports, which are often unsystematic and can be subject to bias, thus making them the least "trustworthy" sources of information to use when making treatment decisions. Research studies that have been designed as randomized controlled trials (RCTs) are considered the most trustworthy because they are systematic and bias is greatly reduced; therefore they receive the highest ranking in the hierarchy of evidence.

TABLE 1.

Level of Evidence Hierarchy for High-Quality Studies
Systematic reviews and meta-analyses of randomized controlled trials or other high-quality studies
Randomized controlled trials (RCTs)
Nonrandomized intervention studies
Nonintervention studies: cohort studies, case-control studies, cross-sectional surveys
Case reports
Expert opinion

From Cox (2005)

Recognizing that different types of research evidence are necessary to answer different clinical questions about effectiveness, other hierarchies of evidence have been developed (see Evans, 2003). Table 2 shows one such hierarchy that moves beyond a focus on RCTs (Evans, 2003). This framework might be more suitable to fields like audiology, where RCTs are either unavailable, or inap-

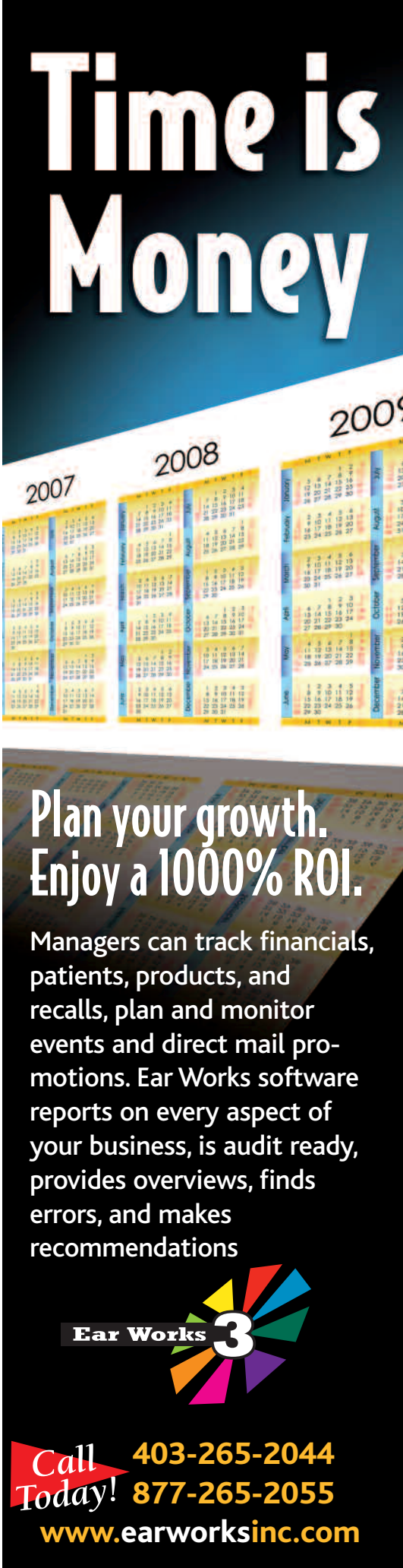

TABLE 2. Hierarchy of Evidence

	Effectiveness	Appropriateness	Feasibility
Excellent	Systematic review Multi-center studies	Systematic review Multi-center studies	Systematic review Multi-center studies
Good	RCT Observational Studies	RCT Observational Studies Interpretive Studies	RCT Observational Studies Interpretive Studies
Fair	Uncontrolled trials with dramatic results Before and after studies Non-randomized control trials	Descriptive studies Focus groups	Descriptive studies Action research Before and after studies Focus groups
Poor	Descriptive studies Case studies Expert opinion Studies of poor methodological quality	Expert opinion Case studies Studies of poor methodological quality	Expert opinion Case studies Studies of poor methodological quality

RCT = Randomized Controlled Trials
From Evans, 2003

propriate for the research question. This hierarchy recognizes that the optimal sources of information provide evidence not only of effectiveness, but of appropriateness (from the end-user's perspective), and also the extent to which it is clinically feasible to implement the treatment(s) in question.

Critically Appraising the Evidence

Regardless of the "level" of the evidence, all sources of information must be appraised for their methodological rigor, and for the extent to which they have controlled for critical clinical variables. This requires consumers of this information to become critical evaluators of research evidence. These critical appraisal skills take time to develop, but this is a worthwhile investment for any clinician interested in staying current with the advances within the field. Appraising a study entails not only looking at the level of evidence but also examining the quality and the relevance of the study, which will assist you in placing a particular article in the grid outlined in Table 2. Some of the important quality and relevance issues that should be considered are:

- Random assignment / concealment;
- Potential for bias around time of treatment or during outcome measures (blinding);
- Description of withdrawals, dropouts and those lost to follow-up; and
- Validation of outcome tools.

Clinical Implementation

Clinical experience complements the evidence obtained through literature searches and evaluation of the evidence. Clinical uptake of evidence that is not consistent with patient values and preferences will not be effective. In audiology, clinical practice guidelines facilitate systematic review of the literature to provide evidence for implementing research into clinical practice.

Barriers to Uptake of Evidence

Uptake of evidence to change clinical practice does not occur in isolation. There are many factors which could be considered barriers to implementing evidence-based practice in any health care profession. The Developing Evidence-Based Practice (DEBP) questionnaire developed in the United Kingdom as a comprehensive measure of evidence-based nursing in England consists of 49 items and is designed for self-completion (Gerrishet al. 2007). We have revised this questionnaire for use with audiology and hope that it will provide information on bases of practice knowledge; barriers to finding and reviewing evidence; barriers to changing practice on the basis of evidence; facilitation and support in changing practice and skills in finding and reviewing evidence for Canadian audiologists.

A link to the survey will be posted on the Canadian Academy of Audiology (CAA) website in the near future. It is our hope that you will take the 15 to 20 minutes needed to complete the survey so that we obtain an adequate sample size to accurately reflect what is happening in evidence-based practice in audiology in Canada.

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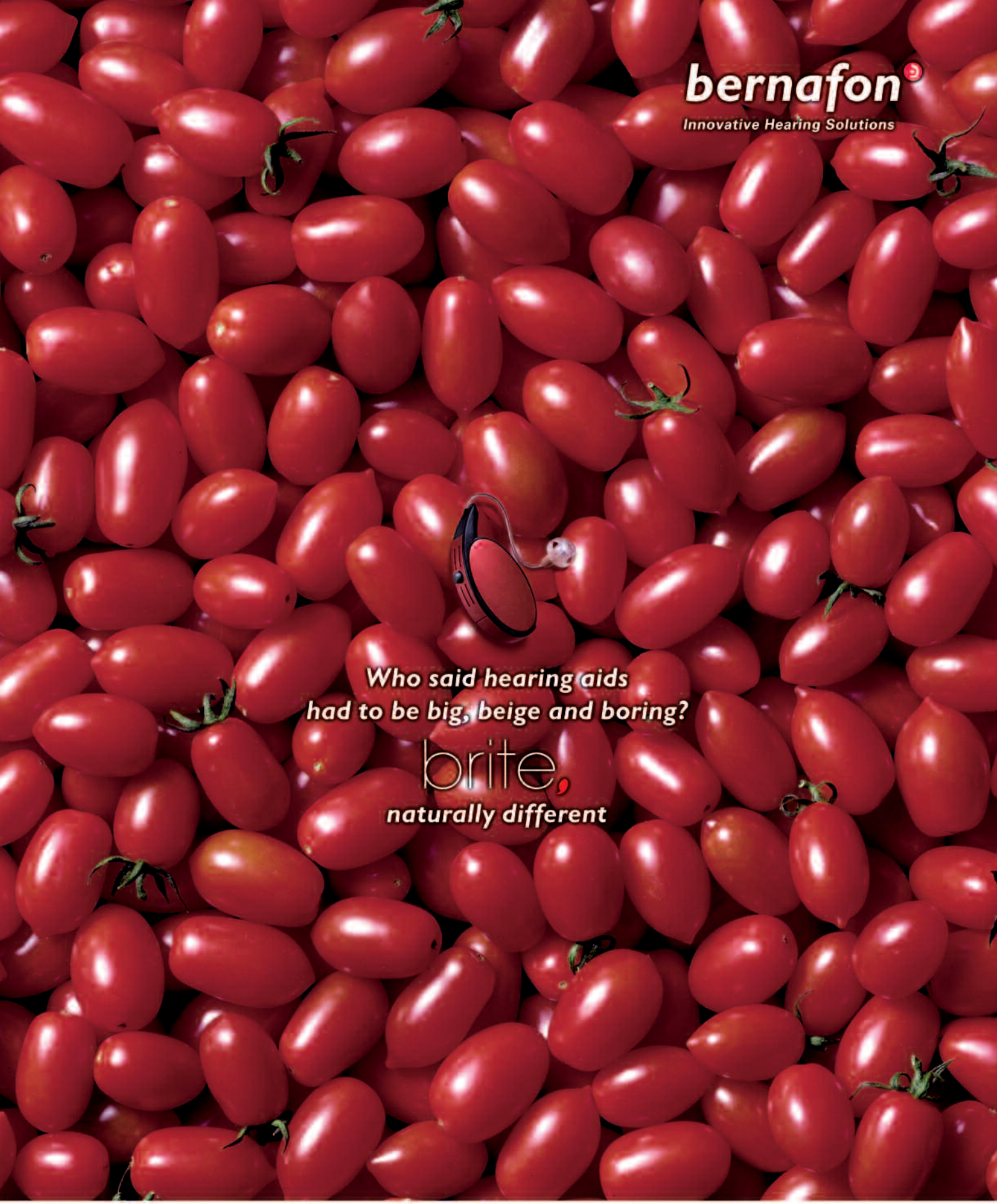

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School of Audiology and Speech Sciences, University of British Columbia

The audiology program at The University of British Columbia (UBC) is in an exciting time of transition, with a new curriculum, new faculty, and new facilities.

The School of Audiology and Speech Sciences (SASS) of The University of British Columbia has an international reputation for academic excellence and innovative research. We are a graduate department that offers both the Master of Science degree, and the Doctor of Philosophy degree for advanced training in both clinical and basic research in audiology, hearing sciences, and speech-language sciences. We strive to educate students to be strong critical thinkers, excellent researchers, and thoughtful clinicians by offering programs that (i) recognize inter-disciplinarity, and (ii) provide innovative, professional and inter-professional learning experiences. We are also committed to engaging in basic and applied research that will benefit society.

SASS welcomes many international student scholars, who enrich its learning and research environment, with recent visiting scholars from Japan, Germany, Denmark, China, and Brazil; and PhD students from India and Kuwait. SASS also welcomes visitors from all over the world to share in discussions and to develop research partnerships that will bring mutual benefit. Noted researchers from Australia, China, Turkey, England, and the United States have visited the school.

The implementation of our new **MSc curriculum** – which is the result of a collaborative effort among academic faculty, clinical faculty, and students – began in the 2006–2007 academic year. We are now in the second year of the new curriculum and looking forward to the graduation of our first cohort of students through the new curriculum in the coming fall. The students have been very patient "guinea pigs" throughout this process, for which we are all grateful! Feedback from educators and students has been very positive, confirming our expectations that the new curriculum provides improved learning opportunities in the areas of amplification, vestibular assessment, advanced electrophysiology, pediatric audiology, geriatric audiology, and evidence-based practice, just to name a few.

The Faculty

This new curriculum is being implemented by a group of enthusiastic faculty who are dedicated to excellence in student learning, the advancement of knowledge in hearing sciences, and the application of knowledge to the improvement of care for people with hearing disabilities. The audiology faculty group at SASS was recently expanded with the arrival of two new "recruits," Susan Small and Valter Ciocca. Susan and Valter joined David Stapells, Navid Shahnaz, and Lorienne Jenstad.

Susan Small (Assistant Professor) joined the School in July 2007. She completed her PhD here in the school with David Stapells on the maturation of bone-conduction hearing using electrophysiological measures. Susan's research areas include maturation of hearing in infants with normal or impaired systems and pediatric audiology. Her years of clinical experience and her stream of research on behavioural measures of hearing in infants provide a perspective that well-complements that of Dr. Stapells.

Valter Ciocca (Professor and Director) joined the school in January 2007 after years of experience in the Division of Speech and Hearing Sciences at the University of Hong Kong. As both a hearing and speech scientist, he brings diverse research interests that include auditory scene analysis and auditory psychoacoustics (in populations with either normal or impaired hearing abilities), and the perception and production of normal and disordered speech.

Lorienne Jenstad (Assistant Professor) joined our School in 2005. She completed her PhD in Audiology at the University of Washington (Seattle) working with Pamela Souza. Prior to this, she received her master's degree in Audiology in 1996 from the University of Western Ontario, where she subsequently worked for four years with Richard Seewald as a research audiologist. Lorienne's main research interests include hearing aid amplification, acoustic measures of hearing aid processing, and auditory aging, as well as clinical audiology.

Navid Shahnaz, (Assistant Professor) has been at SASS since 2002. Before joining The University of British Columbia, he was faculty in the Department of Speech and Hearing Sciences at University of Arizona. His research interests include: application of laser Doppler vibrometry, oto-acoustic-emissions, multi-frequency tympanometry, Wide-Band Reflectance, and acoustic reflex studies in understanding the function of the middle-

ear and its impact on hearing in normal and diseased conditions in newborns, children, and adults.

David R. Stapells (Hamber Professor of Clinical Audiology) is a hearing scientist with special expertise in physiological measures of hearing. Prior to joining SASS in 1996, he was faculty in the Department of Otolaryngology and the Department of Neuroscience at Albert Einstein College of Medicine, Bronx, NY. His research is both applied and basic, with two overriding themes: (i) development, refinement, and assessment of physiologic tests of hearing, especially in infants, and (ii) investigation of brain mechanisms underlying human auditory perception.

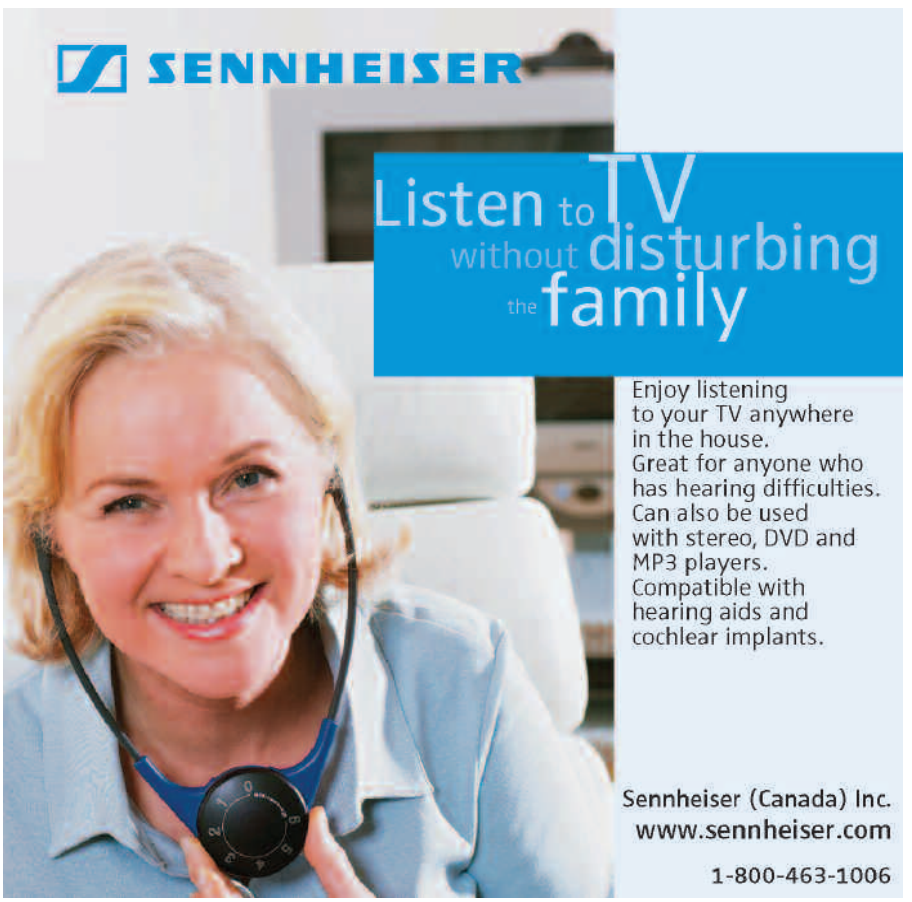
In addition to the above full-time faculty, the School has over 40 audiology clinical faculty members and several sessional instructors in the community. We rely on the collaboration of clinical faculty members and sessional instructors, who provide excellent educational opportunities for our students in a variety of settings, including classrooms, private practices, hospitals, public health facilities, non-profit organizations, and schools, from coast to coast. Our program and our students are also fortunate to have the support of **Sharon Adelman** and **Darlene Hicks**, our audiology clinical coordinators. In addition to coordinating and monitoring clinical externships, Sharon and Darlene provide instruction in both clinical and classroom settings.

Our strong links between full-time faculty and clinical faculty members have resulted in a number of collaborative research projects in the areas of newborn hearing screening and electrophysiological assessment, hearing assessment (such as clinical feasibility of the TEN test for detecting dead regions in the cochlea), amplification, and quality of life outcomes as a result of interventions. SASS is also very fortunate to have formal collaboration agreements with a number of publicly and privately funded organizations including the BC Early Hearing Program, the BC's Children's & Women's Health Centre, the Western Institute for the Deaf and Hard of Hearing, the Sound Hearing Clinic, and WorkSafeBC.

New Facilities

As our program expands, we are outgrowing the space we've been occupying, and so the school's facilities are increasing. In addition to the recent addition of the Audiology Research Unit with its three new research labs, faculty and students in the audiology program are looking forward to our move later this year into our new facilities in the Friedman Building on the UBC Point Grey Campus. (For those who are familiar with the school's current facilities, this means no more classes held in "portables.") The new site will provide increased space for research and learning activities, including a brand new Audiology Teaching Facilities suite. This suite will include facilities for pediatric audiology, amplification, auditory physiology, and general audiology. These facilities will be fully dedicated to providing the best learning environment for future audiologists and will be equipped with state-of-the-art equipment for the diagnosis and the management of hearing disorders in different populations.

Already known for their excellence, the master's and doctoral educational programs and faculty research at the UBC School of Audiology and Speech Sciences are entering an exciting period with new curricula, new students, expanded faculty and a significant space expansion.



Edgar Villchur, MS Ed

The Father of Multi-band Compression and the Acoustic Suspension Loudspeaker

In conversation with Marshall Chasin

After a notable career that included the development of the acoustic suspension loudspeaker and the dome loudspeaker tweeter, when others were thinking of retirement, Ed turned his attention to hearing aids. The result of his seminal *JASA* paper in 1973 was the development of the first multi-band compression hearing aid.

Marshall Chasin: How did someone who works with loudspeakers and radio systems get into working with hearing aids and compression?

Ed Villchur: The thing that drew me to work with loudspeakers was the same thing that drew me to work with hearing aids: the need for improvement. Back in those days, people would go out and buy an amplifier chassis and put tube sockets in them and play around with electronic circuits, because that was the easy thing to do. But that was not what the need was. Amplifiers were practically as good then as they are today. What motivated me to work on loudspeakers was that there was a lot of room for improvement. The same with hearing aids – when I started working in audiology back in the late 1960s, hearing aids were pretty awful and there was a great need for improvement. That is what attracts you to a field – the need for improvement.

MC: One of the many things that you are well known for is the "acoustic suspension loudspeaker" which dramatically improved the bass response and miniaturized the size of loudspeakers.

EV: Well, back in the 1950s you could buy an amplifier for home use with a half of 1% distortion or less, even at the frequency extremes and at full rated power. With loudspeakers, however, distortion figures in the bass were 20 to 100 times that amount. When I looked into it I found that the largest fundamental problem was the non-linearity of the loudspeaker suspensions. That is, when the speaker cone makes large excursions for high-intensity bass sounds, the mechanical suspensions holding the cone in place don't stretch evenly and start to bind. It occurred to me that the volume of air in the cabinet is a near-perfect spring, far more linear than the best mechanical suspension system. All you would have to do to use it is throw away most of the elastic stiffness of the mechanical system and replace it with the acoustic stiffness of the volume of air in the cabinet (hence the name "acoustic suspension"). The free-air resonance of the speaker becomes subsonic, and is raised to its operating value by the elastic stiffness of the air. This system reduces bass distortion, extends bass response, and requires reducing the size of the cabinet.

MC: I seem to recall that your name is also associated with loudspeaker tweeters.

EV: That is true; I developed the dome tweeter. In those days, in order to make high-frequency tweeters, they shrunk the size of the large cone speakers, but they couldn't go too far because the voice coil became too small to handle enough power. What I did was to place the voice coil at the large diameter of the diaphragm, and when you do that the shape of the diaphragm emerges almost naturally as a dome.

MC: By this time you had had about 80 technical papers that you had published in the realm of high fidelity sound and had actually "retired" in 1967, but like many amazing people you developed a second career and published a seminal paper on multi-band compression in 1973. (Signal processing to improve speech intelligibility in perceptive deafness. *JASA* 53 1646–57).

EV: I retired from "gainful employment" in 1967, but I didn't call it retirement, I called it going back to work. I was no longer distracted by things having to do with business and sales. It's not that audiology was totally divorced from my former design work, but I did have to re-educate myself.

MC: I know that the 1973 article served as the basis for an entire generation of multi-band compression hearing aids.

EV: After my *JASA* article on compression came out, there was a substantial amount of literature either showing that compression didn't work or that it actually reduced intelligibility. This was similar to what happened after I came out with the acoustic suspension loudspeaker system. A large part of the literature "proved" that the system violated the laws of physics and couldn't work. But today almost all speakers are either acoustic suspension or acoustic suspension combined with bass reflex, and one of my speakers is on display at the Smithsonian Institution. The same thing happened with compression hearing aids. After the voluminous articles came out explaining how compression is bad, today it would be pretty hard to find a hearing aid that doesn't have compression.

MC: One of the criticisms of compression is that the signal-to-noise ratio became more adverse because the noise component of the ratio would be increased.

EV: That is correct in many, if not most situations. (An exception is the case when compression increases the gain for low-level speech in one channel relative to the gain for noise in another channel.) Noise is a basic problem in hearing aids, and a lot of the effort directed at solving this problem has been to improve the signal-to-noise ratio electronically. If the noise is generated by a random noise generator, you can design a

circuit that will distinguish between the noise and the speech that you are trying to understand. But in the real world, the typical noise interference that hard of hearing people encounter is speech that they are not interested in hearing. Now imagine a hearing aid microphone and computer placed in front of two or three people. The hearing-impaired person listening wants to hear one of those speakers but not the others. How is an electronic device going to distinguish between the desired speech and the interfering speech? It needs a tremendously powerful computer – one that can identify the subject being talked about and the mannerisms and accent of the desired speaker. It would be totally impractical to have a hearing aid computer do that. But every person owns such a computer; it's called the brain. Broadbent in the 1950s showed that we have a capacity for "selective listening"; we can pay attention to the speech of interest and reject competing speech. But we can't do that with two unintelligible speakers. We have to understand them in order to be able to select one over the other. Compression, along with frequency-response shaping, restores perception of the redundant cues of speech so that when some of these cues are destroyed by masking, more cues are left. (Cecil Coker, 1974. Speech as an error-resistant code. *JASA* 55; 476A.) So, increasing the intelligibility of the speech, even though the signal-to-noise ratio gets worse, gives you greater immunity to the interfering noise. Yes, multi-band compression in most situations does increase the interfering noise, but it also gives the listener a powerful tool for listening in noise. This works because of the ability of the human brain and the natural redundancy of speech. (see also his comments in the *American Journal of Audiology*, vol. 2, no.2). Most of the effort in solving the noise problem has been in improving the signal-to-noise ratio, but compression/equalization improves the ability of hearing-impaired listeners to understand speech at a given signal-to-noise ratio. It does this by restoring to their perception redundant speech cues they have lost. When you do work to improve the signal-to-noise ratio it should be done acoustically, with directional microphones and other assistive listening devices. Mead Killion has a telling phrase on electronic noise reduction; he points out that when you throw away noise electronically it has speech cues attached to it, and that's why it doesn't improve intelligibility. Procedures to improve speech recognition in noise need to increase audible speech cues, not reduce them.

MC: If my memory serves correctly, one outcome of your 1973 *JASA* paper was an early ReSound hearing aid that used multi-band compression. How did that come to be?

EV: I was invited to give a talk at the Audio Engineering Society (AES) meeting in New York at one of their monthly sessions, on the work that I was doing then. It so happened that Fred Waldhauer, who was a senior scientist at Bell Labs, was present and he said "this is what Bell Labs ought to work on." So Bell Labs took up the project; they came up here to my lab in Woodstock, New York in groups of eight. AT&T took over and after they (Bell Labs) had spent several million dollars on the project they decided to give it up. Rodney Perkins in California took it over with venture capital and started a company, based on the multi-channel compression design, called ReSound. Bell Labs had gone about half way in converting my rack-mounted equipment to a wearable hearing aid, and ReSound, which had taken many of the Bell Lab scientists including Fred Waldhauer, developed a wearable hearing aid which had the fundamentals of the one I had developed in my lab. If you wanted to wear my hearing aid, you would have to walk around with a wheelbarrow and trailing wires.

MC: My last question is that since you live in Woodstock, New York, do you have anything to say about Max Yasgur's farm and the 1969 Woodstock music festival?

EV: Every once in a while people come up here to my place and ask if I can show them how to get to Yasgur's farm, where the festival took place. I point south and say about 60 miles that way. They don't believe me and think I am putting them down. The music festival took place about 60 miles from here and had nothing to do with Woodstock. Woodstock had a glamorous name I guess, and we now have all these recording studios here. The festival actually took place in a small town named White Lake. When they planned a revival they wanted to have it in Woodstock, but Woodstock doesn't have a place that big.

MC: Thank you Ed for talking with me.

EV: My pleasure. I got out of the loudspeaker field in 1967 when I was 50, so if you do your math you'll realize you have been talking to an old man. Someday I may think of retiring.

ACADEMY NEWS

Public Relations and Visibility Committee News

Your committee has many projects on the go for the year 2008. Currently, we are working on:

- Making a poster for the National Audiology Week which will take place during October 19–26 of this year.
- Creating Public Interest Messages for the National Audiology Week.
- Designing a poster explaining what it means to be an audiologist that can be placed in your waiting rooms.
- Creating a brochure that explains what it means to be an audiologist.
- Designing an 8? x 11 panel describing the qualifications of an audiologist that can be placed in an office.
- Creating a brochure explaining what it means to be an audiologist targeting students in order to promote audiology as a career choice.

I encourage audiologists to begin reflecting on which activities you would like to plan or take part in during the National Audiology Week in order to promote our profession. The more activities that we have, the more attention will be brought to the public eye! If you would like to get involved in this committee, do not hesitate to contact me via the Canadian Academy of Audiology.

Ronald Choquette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Edgar Villchur, MS Ed

Le père de la compression multibande et du haut-parleur à suspension acoustique

Entretien avec Marshall Chasin

Après une carrière remarquable marquée par le développement du haut-parleur à suspension acoustique et du haut-parleur de registre aigu à dôme, à une période où d'autres songent à la retraite, Ed s'est penché sur les prothèses auditives. Son article précurseur paru dans la revue *JASA* en 1973 a mené à la mise au point de la première prothèse auditive à compression multibande.

Marshall Chasin : Comment quelqu'un qui travaille sur des haut-parleurs et des systèmes de radiocommunication s'est-il retrouvé dans le domaine des prothèses auditives et de la compression?

Ed Villchur : La raison qui m'a amené à travailler sur des haut-parleurs est la même que celle qui m'a amené à travailler sur les prothèses auditives, c'est-à-dire le besoin d'amélioration. À l'époque, les gens se procuraient un châssis d'amplificateur, y installaient des supports de tube et jouaient avec les circuits électroniques parce que c'était la chose la plus facile à faire. Cela ne permettait toutefois pas de répondre aux besoins. Les amplificateurs étaient pratiquement aussi bons à cette époque qu'aujourd'hui. Le fait qu'il y avait beaucoup de place à l'amélioration m'a motivé à travailler sur les haut-parleurs. La situation fut la même pour les prothèses auditives – quand j'ai commencé à travailler en audiologie, vers la fin des années 1960, les prothèses auditives étaient très mal conçues et il y avait un grand besoin d'amélioration. Le besoin d'innovation, voilà ce qui pousse quelqu'un à oeuvrer dans un domaine en particulier.

MC : Une des choses pour laquelle vous êtes bien connu est le « haut-parleur à suspension acoustique ». Un outil qui améliore grandement la réponse dans les basses fréquences et la miniaturisation des haut-parleurs.

EV : En fait, dans les années 1950, il était possible d'acheter un amplificateur pour utilisation domestique avec 0,5 % de distorsion ou moins et ce, même aux fréquences extrêmes et à la puissance nominale. En comparaison, la distorsion dans les basses fréquences avec les haut-parleurs était de 20 à 100 fois supérieure. Mes recherches m'ont permis de constater que le principal défaut des haut-parleurs était la non-linéarité des suspensions, c'est-à dire que quand le cône (diffuseur) du haut-parleur fait de grandes excursions pour des sons de basse fréquence à haut intensité, la suspension mécanique retenant le cône en place ne s'étire pas uniformément et commence à courber. Je me suis dit que le volume d'air dans le cabinet constitue un ressort presque parfait, beaucoup plus linéaire que le meilleur système de suspension mécanique. Pour utiliser ce volume d'air, il suffit d'éliminer la plus grande partie de la rigidité élastique du système mécanique et de la remplacer par la rigidité acoustique du volume d'air dans le cabinet (d'où le nom « suspension acoustique »). La résonance à l'air libre/apport d'air du haut-parleur devient subsonique, et elle atteint sa valeur opérationnelle grâce à la rigidité élastique de l'air. Ce système réduit les distorsions des graves, étend la réponse à celles-ci et requiert une réduction de la taille du cabinet.

MC : Il me semble que votre nom est aussi associé aux haut-parleurs deregistre aigu.

EV : C'est vrai, j'ai mis au point le haut-parleur de registre aigu à dôme.

À cette époque, pour créer des haut-parleurs de registre aigu, les spécialistes ont réduit la taille des haut-parleurs à cône, mais ils ont atteint une limite de taille quand la bobine acoustique est devenue trop petite pour supporter la puissance nécessaire. Pour remédier à la situation, j'ai installé la bobine acoustique au point où le diamètre du diaphragme est le plus élevé, ce qui fait en sorte que la forme du diaphragme joue presque naturellement le rôle de dôme.

MC : Au moment de votre retraite officielle en 1967, vous aviez publié environ 80 articles techniques dans le domaine du son de haute fidélité. Toutefois, comme plusieurs personnes extraordinaires, vous vous êtes lancé dans une deuxième carrière et vous avez publier un article précurseur sur la compression multibande en 1973. (Signal processing to improve speech intelligibility in perceptive deafness. *JASA* 53. 1646–57).

EV : J'ai quitté le milieu du travail rémunéré en 1967, mais je considère ce moment comme un retour au travail et je ne l'ai jamais appelé une retraite. Je pouvais désormais travailler sans être distrait par les problèmes liés aux affaires et aux ventes. Ce n'est pas que l'audiologie était entièrement distincte de mon travail précédant, mais j'ai dû suivre une nouvelle formation.

MC : Je sais que l'article de 1973 a servi de base pour une génération entière de prothèses auditives à compression multibande.

EV : Après la publication de mon article sur la compression dans *JASA*, un nombre considérable de publications ont montré que la compression ne fonctionnait pas et qu'elle entraînait plutôt une réduction de l'intelligibilité. Cette situation est semblable à celle survenue après le lancement de mon système de haut-parleur à suspension acoustique. Une grande part des publications « prouvaient » que le système violait les lois de la physique et qu'il ne pouvait pas fonctionner. Aujourd'hui toutefois, presque tous

les haut parleurs possèdent une suspension acoustique combinée ou non à une enceinte reflexe pour basses fréquences, et un de mes haut-parleurs figure dans la collection de la Smithsonian Institution. La même chose s'est produite dans le cas des prothèses auditives à compression. Bien que de nombreux auteurs aient expliqué dans de volumineux articles pourquoi la compression est une mauvaise technique, il serait assez difficile aujourd'hui de trouver une prothèse auditive qui n'y a pas recours.

MC : Une des critiques dont la compression est l'objet est que le rapport signal sur bruit empire en raison de l'augmentation du bruit.

EV : C'est juste dans plusieurs, voire la majorité des cas. (Le cas où la compression augmente le gain relatif à la parole à faible niveau dans un canal par rapport à la hausse du bruit dans un autre canal constitue une exception.) Le bruit est un problème fondamental pour les prothèses auditives, et une bonne part des efforts visant à résoudre ce problème consiste à améliorer le rapport signal sur bruit grâce à l'électronique. Si le bruit est généré par un générateur du bruit aléatoire, il est possible de créer un circuit qui fera la distinction entre le bruit et la parole. Dans la vie de tous les jours toutefois, l'interférence qui cause des problèmes aux personnes présentant des troubles auditifs consiste habituellement en des paroles qui ne les intéressent pas. Maintenant, imaginez un microphone et un processeur d'une prothèse auditive placés devant deux ou trois personnes. La personne présentant un trouble auditif veut entendre un des interlocuteurs mais pas le ou les autres. Comment un dispositif électronique va-t-il pouvoir faire la distinction entre la voix désirée et les autres? Un processeur d'une puissance extraordinaire est nécessaire. Ce processeur doit pouvoir identifier le sujet dont il est question, le maniérisme et l'accent du locuteur que la personne désire comprendre. La création d'un tel processeur serait difficilement réalisable et ce, même si chaque humain en possède déjà un.... le cerveau. Dans les années 1950, Broadbent a démontré que nous avons une capacité « d'écoute sélective ». Nous pouvons prêter attention aux paroles d'intérêt et rejeter celles qui interfèrent, mais nous ne pouvons le faire en présence de deux interlocuteurs inintelligibles. Nous devons les comprendre pour être en mesure d'en choisir un et d'ignorer l'autre. La compression, de même que la modulation de la réponse fréquentielle, rétablit la perception des indices redondants de la parole de façon à ce que lorsque certains de ces indices sont détruits par masquage, davantage d'indices demeurent. (Cecil Coker, 1974. Speech as an error-resistant code. *JASA* 55; 476A.) Ainsi, l'augmentation de l'intelligibilité de la parole confère une plus grande immunité contre le bruit parasite et ce, même si le rapport signal sur bruit se dégrade.

Il est vrai que la compression multibande entraîne, dans la plupart des cas, une augmentation du bruit parasite, mais elle constitue également un outil puissant d'écoute en présence de plusieurs sources de bruit. Cet avantage est possible en raison de la capacité du cerveau humain et de la redondance naturelle de la parole. (Voir également les commentaires de M. Villchur dans *American Journal of Audiology*, vol. 2, no.2). La majorité des efforts de résolution des problèmes dus au bruit a consisté en l'amélioration du rapport signal sur bruit, mais la compression et l'égalisation améliorent la capacité des personnes présentant un trouble auditif à comprendre la parole à un rapport signal sur bruit donné en restaurant la capacité de perception des indices redondants de la parole.

L'amélioration du rapport signal sur bruit devrait être effectuée sur le plan acoustique à l'aide de microphones directionnels et d'autres aides de suppléance à l'audition. Mead Killion a mis le doigt sur un fait révélateur relatif à la réduction du bruit par le biais de l'électronique quand il a montré qu'une telle réduction du bruit est nécessairement accompagnée d'une perte d'indices de la parole, ce qui explique pourquoi la réduction n'améliore en rien l'intelligibilité. Les procédures visant à améliorer la reconnaissance de la parole en présence de bruit parasite doivent accroître le nombre d'indices de la parole et non le réduire.

MC : Si ma mémoire est juste, une conséquence de votre article paru dans le *JASA* en 1973 a été la création d'une première version de la prothèses auditive ReSound qui faisait appel à la technologie de la compression multibande. Comment cela s'est-il produit?

EV : À l'époque, j'ai été invité à présenter mes travaux lors d'une réunion mensuelle de la Audio Engineering Society (AES) tenue à New York. M. Fred Waldhauer, alors chercheur principal de Bell Labs, était présent à cette réunion et ma présentation l'a amené à penser que Bell Labs devrait travailler sur le même sujet que moi. Bell Labs ont donc souscrit au projet, et des groupes de huit personnes sont venus visiter mon laboratoire de Woodstock (État de New York). AT&T a pris le relais lorsque Bell Labs a abandonné le projet après avoir investi plusieurs millions de dollars. M. Rodney Perkins, en Californie, a pris la tête du projet avec des capitaux de risque et a mis sur pied l'entreprise ReSound en se basant sur le concept de la compression multicanal. Bell Labs avait réalisé environ la moitié des travaux nécessaires à la conversion de mon équipement monté sur châssis en une prothèse auditive portable. Par la suite, ReSound, qui a retenu les services de plusieurs chercheurs de Bell Labs, y compris M. Fred Waldhauer, a mis au point une prothèse auditive portable qui possédait les caractéristiques fondamentales de la prothèse que j'ai conçue dans mon laboratoire. Quelqu'un qui aurait voulu porter ma prothèse auditive aurait été obligé de se promener avec une brouette avec de fils à la traîne.

MC : Puisque vous vivez à Woodstock dans l'État de New York, j'aimerais profiter de ma dernière question pour vous demander si vous avez des commentaires à faire à propos de la ferme de Max Yasgur et du festival de musique de Woodstock de 1969?

EV : Une fois de temps en temps, des gens viennent chez moi et me demandent si je peux leur indiquer comment se rendre à la ferme Yasgur. Je pointe vers le sud et je leur dis qu'elle est située à environ 60 milles dans cette direction. Ils ne me croient pas et ils pensent que je les induis en erreur. Toutefois, le festival de musique a bel et bien eu lieu à environ 60 milles d'ici et n'a rien à avoir avec la ville de Woodstock. J'imagine que Woodstock est un nom charmant, et la ville compte maintenant un grand nombre de studios d'enregistrement. En fait, le festival a eu lieu dans la petite ville de White Lake. Woodstock a été la ville envisagée par ceux qui ont planifié une reprise du festival, mais la ville ne possède pas un espace suffisant pour accueillir un tel évènement.

MC : Merci de votre collaboration M. Villchur.

EV : Tout le plaisir est pour moi. Je me suis retiré du domaine des haut-parleurs en 1967 quand j'avais 50 ans, donc si vous faites le calcul vous allez vous rendre compte que vous venez de vous entretenir avec un vieil homme. Peut-être que je penserai à la retraite un jour.

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Welcome to Spotlight on Science!

Watch this space in each issue of *CHR* for brief reviews and summaries of recent journal articles or not-ready-for-clinical findings. Our goal is to bring research to you that might otherwise be inaccessible, due to lack of time to read the literature, lack of access to the journal, or, simply put, difficult to read jargon. We plan to look at original research from a variety of areas related to audiology and hearing science, from the research that forms the theoretical basis and underpinnings of our field, to the research that may have direct clinical implications today. It is our hope that these brief snapshots will pique your interest to read further on your own.

Meanwhile, enjoy this inaugural column written by Marshall Chasin (reprinted with permission from ListenUp Canada!) summarizing a very timely article by Henderson et al. on those buzz words we see in the media a lot these days: free radicals and antioxidants. Do we tell our clients to eat their blueberries and leafy green veggies to prevent hearing loss? Read further for the answer …

Lorienne Jenstad, PhD
Associate Editor

Noise-Induced Hearing Loss and a Bit About the Underlying Mechanisms:

By Marshall Chasin, AuD, MSc, Reg. CASLPO, Doctor of Audiology
Associate Editor

Reference: Henderson D, Bielefeld E, Carney Harris K and Hu BH. "The role of oxidative stress in noise-induced hearing loss." *Ear and Hearing* 2006;27:1:1–19.

This review article describes several biochemical reactions that may lead to cochlear hair cell death. Cell death appears to be metabolically related to increased levels of Reactive Oxygen Species or ROS. Anti-oxidants can minimize, and in some cases, reverse the deleterious effects of increased levels of ROS brought about by excessive noise exposure. The following is a review of this article:

ROS are "free radicals" (or can create free radicals through a chemical process) meaning that an unpaired electron is free to pair with an otherwise stable compound, thereby making it unstable. This unstable compound may be toxic to the ear and cause hearing loss. Anti-oxidants that "soak up" the free radicals can improve the functioning of the cochlea.

Although this is speculative only at this point, it appears that high noise levels cause the mitochondria (the power source) in the cells to use up a lot of oxygen. Since this metabolic process is less than optimal, there is a creation of high levels of a waste product called superoxide – a precursor to ROS.

High noise results in high levels of ROS which can be toxic to the ear. It should be pointed out that most of the experiments with anti-oxidants involved injecting it directly into the cochlea. Ingesting foods that are reportedly "high in anti-oxidants" may have no or little effect, unless it can get to the cochlea.

There are two forms of cell death – necrosis and apoptosis. Up until 1972 it was thought that all cell death was from necrosis. This is a passive process where a cell swells and eventually bursts, dumping out its contents into the surrounding tissues. This process tends to damage nearby surrounding cells. In contrast, apoptosis is an active process that uses specific enzymes called caspases that systematically disables a cell. This process has very little effect on surrounding cells and appears to be a necessary mechanism for eliminating unwanted cells. However, unlike necrosis, the process of apoptosis can go awry and start disassembling a large number of cells, especially as a result of loud noises. Pharmacological inhibition of several of the main caspase enzymes may decrease apoptosis in the presence of loud noise, and thereby help to maintain hearing levels.

Other than biochemical imbalances in the cochlea, mechanical, and impedance changes can also result in hearing loss. For example, the tips of the outer hair cells can become disconnected from the tectorial membrane and result in a hearing loss. However, there is a period of time that the hair cells can become reconnected to the tectorial membrane thereby re-establishing the previous hearing levels. This is the most probably explanation for temporary threshold shift or TTS. Also, the supporting structures of the hair cells can become damaged and this results in an impedance change which yields a hearing loss. Mechanically, the loss of supporting structures can also damage outer hair cells, thereby bringing about further sensori-neural hearing loss. The collapse of already weakened supporting structures – which brings down many of the remaining hair cells – may occur much later, and this is one possible mechanism for how hearing loss may continue to deteriorate after removal from the noise source. TTS may also be brought about by glutamate ototoxicity. Glutamate is an excitatory neurotransmitter substance that occurs in the synapse between the inner hair cells and the VIII auditory nerve. With high levels of glutamate brought about by high levels of noise, this substance can become ototoxic and cause the post-synaptic cells to swell. This is thought to be a temporary condition which is why this may be another explanation of TTS. In fact, using a glutamate blocker will minimize TTS in some experimental situations.

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