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Canadian Hearing Report

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Revue canadienne d'audition

AIM Companies Canada: Helping Children in Bali

Back to Basics

Founders of Our Profession: Mark Ross

CAA Canadian Academy of Audiology Heard. Understood.
ACA Académie canadienne d'audiologie Entendus. Compris.

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By the time you sit down to read this issue of *Canadian Hearing Report*, the snow will have melted (or at least I hope so) and we will be able to see the new landscape already changing – from a frozen tundra to a vibrant spring ... Well, so much for my attempt at poetry. But as reliably as the seasons change, it is also true that the hearing aid landscape is constantly changing. Just when you think that you have a handle on things, new technologies replace old ones and the old ones are, in some cases, just months old.

This feature of the new hearing aid terrain – that change is the only constant – has some advantages and disadvantages. The advantages include the continual introduction of newer technologies that are more transparent. In this sense, the term "transparent" means that the audiologist only needs to push a button to get many changes. It is like driving a car; if the technology is sophisticated enough, then we don't really need to ever look under the hood. Just as we don't have to understand fuel injection or anti-locking break technology, we don't have to know what is happening electro-acoustically with all possible input spectra when a button is pushed or when a software algorithm is implemented.

But *should* we understand what is happening? To me, the answer is obviously yes. I see this as the main disadvantage of the ever-changing newer technology. Not only is there limited independent evidence to support the supposed benefits of the new technologies, but just when we begin to understand the technology, newer technology comes along, and we are back at the beginning.

I don't mean to sound cynical, but this is clearly an inherent limitation of the hearing aid field. More than ever, the audiologist needs to be half clinician, half engineer, and half researcher. (And for those mathematicians among us, I realize that this doesn't add up.) It is not sufficient to simply obtain clinical knowledge from textbooks that may be out of date before they are printed, nor is it sufficient to take for granted that newer technology is better technology. The audiologist must independantly evaluate the technology and compare it with clinical experience and published research.

In many cases, audiologists need to go back to basics. We know that a binaural fitting is "generally" (but not always) better than a monaural fitting. We

La neige aurait fondu (ou du mois je l'espère), et nous serons en mesure de voir le changement du paysage – d'une Toundra gelée en un printemps vibrant, au moment ou vous allez vous assoir pour lire ce numéro de *la Revue Canadienne d'Audition*, ... Bien, voila pour ma tentative à la poésie. Mais tout comme les saisons changent, il est vrai que le paysage des appareils auditifs est en changement continu. Quand vous pensez que vous pouvez gérer, les nouvelles technologies remplacent les anciennes et les anciennes sont, dans certains cas, juste de quelques mois.

Cette caractéristique du secteur nouveau des appareils auditifs – que le changement est la seule constante- a quelques avantages et inconvénients. Parmi les avantages, la présentation continue de nouvelles technologies plus transparentes. Dans ce sens, le terme "Transparent "signifie que l'audiologiste a juste besoin de presser un bouton pour effectuer beaucoup de changements. Comme pour la conduite d'une voiture, si la technologie est suffisamment sophistiquée, nous n'avons jamais vraiment besoin de regarder sous le capot. Nous n'avons pas à comprendre la technologie de l'injection de l'essence ni celle du système antiblocage des freins, et nous n'avons pas besoin de savoir ce qui se passe électro- acoustiquement avec toutes les possibilités de spectres d'entrées quand un bouton est pressé ou quand un logiciel d'algorithme est mis en œuvre.

Mais *devrions* nous comprendre ce qui se passe ? Pour moi, la réponse est évidement oui. Je voie le changement ininterrompu de cette nouvelle technologie comme le principal inconvénient. Non seulement les preuves indépendantes avancées pour appuyer les bénéfices supposées de ces nouvelles technologies sont limitées, mais aussi juste au moment ou nous commençons à comprendre la technologie, de nouvelles technologies arrivent, et nous sommes de retour à la case départ.

Je ne veux pas paraitre cynique, mais c'est clairement une limitation inhérente du secteur des appareils auditifs. Plus que jamais, l'audiologiste doit être moitié clinicienne /clinicien, moitie ingénieur, moitié chercheuse/ chercheur. (Et pour les mathématiciennes/ mathématiciens entre nous, le compte n'y est pas). Ce n'est pas suffisant d'acquérir les connaissances cliniques des manuels qui sont peut-être dépassés avant même qu'ils ne soient imprimés, ce n'est pas suffisant non plus de prendre les nouvelles technologies pour les meilleures. L'audiologiste doit, de manière indépendante, évaluer la technologie et la comparer à l'expérience clinique et aux recherches publiées.

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know that a directional microphone is "generally" (but not always) better than an omni-directional one, especially for behind-the-ear hearing aids. And, we suspect that, when in doubt, wide dynamic range compression is better than a circuit with a higher compression ratio. Other technologies have little supportive independent research.

It is therefore an intent of the editorial board of *Canadian Hearing Report* to provide well-thought-out articles on various topics relating to our field. One such report is given in this issue by Calvin Staples who, indeed, goes "Back to the Basics." Future issues will include articles on other topics, such as hearing aid acoustics – something that was forgotten about with the advent of digitally programmable hearing aids in the mid-1980s but is still quite important. Other future issues of *CHR* will present discussions of the limitations (and strengths) of the 16-bit platform currently in use with modern digital hearing aids. A 16-bit platform may be quite sufficient for speech but not for louder inputs such as music.

Also in this issue of *CHR* we remember Fred Stork, who passed away in the fall of 2008. Fred was the founder of Canada's first hearing aid manufacturer – Unitron Hearing – and grew the business from a Newfoundland repair facility to a world-class manufacturer and designer of hearing aids, in Kitchener, Ontario. He is remembered by Unitron's first engineer (Bill Cole), first marketing manager (Alan Moore), and first audiologist (Pat Yoshioka).

And speaking of founders, the subject of this issue's "Founders of Our Profession" column is Mark Ross, professor emeritus at the University of Connecticut.

Also, courtesy of the publication *Hearing Review*, we have been given permission to reprint an excellent article that appeared in 2008 on cell phone/hearing aid compatibility.

We also dive into the sticky realm of cerumen management with the "E in ENT" column, and we also bring you Mary Beth Jennings from the National Centre for Audiology reporting "From the Labs." We continue with an overview of the humanitarian efforts of our members and of our manufacturing industry partners. In this issue, we learn about what AIM Companies Canada is doing in Bali.

Marshall Chasin, AuD, MSc, Reg. CASLPO
Editor-in-Chief

Dans plusieurs cas, les audiologistes ont besoin de retourner aux sources. Nous savons qu'un raccord biauriculaire est généralement (mais pas toujours) meilleur qu'un raccord monauriculaire. Nous savons qu'un microphone directionnel est : généralement (mais pas toujours) meilleur qu'un autre omnidirectionnel, spécialement pour les appareils auditifs situés derrière l'oreille. Et dans le doute, nous supposons qu'une compression dynamique de grande portée est meilleure qu'un circuit dont l'indice de compression est plus élevé. Autres technologies ont peu de recherches indépendantes pour les appuyer.

Pour ces motifs, le conseil de rédaction de *la Revue Canadienne d'Audition* a l'intention de fournir des articles pertinents touchant plusieurs sujets de notre secteur. Nous publions dans ce numéro un rapport similaire, écrit par Calvin Staples qui, sans doute, retourne vers les sources. Parmi les prochains numéros, des articles portant sur d'autres sujets, l'acoustique des appareils auditifs- Que nous avons oubliée avec l'arrivée au milieu des années 80 des appareils auditifs à programmation numérique, mais qui reste importante. Les autres prochains numéros de la RCA vont présenter des discussions sue les limitations et(les forces) de la plateforme à 16 éléments en cours d'utilisation dans les appareils auditifs électroniques modernes. La plateforme à 16 éléments peut être suffisante pour le language mais pas pour des apports plus forts comme la musique.

Nous allons aussi, dans ce numéro de la *RCA*, nous remémorer Fred Stork, qui est décédé à l'automne de 2008. Fred a été le fondateur du premier fabricant canadien d'appareils auditifs – Unitron Hearing- et a transformé son affaire d'une installation de réparation de Terre Neuve en un fabricant et concepteur d'appareils auditifs de renommée mondiale à Kitchener, Ontario. Il va rester dans la mémoire du premier ingénieur d'Unitron (Bill Cole), le premier directeur markéting (Alan Moore) et le premier audiologiste (Pat Yoshika).

En évoquant les fondateurs, le sujet de notre colonne 'les fondateurs de notre profession " est Mark Ross, professeur émérite à l'université du Connecticut.

Aussi, gracieusement octroyé par la revue *Hearing Review*, on nous autorisé a réimprimé un excellent article qui est apparu en 2008 au sujet de la compatibilité téléphone cellulaire/ appareil auditif.

Nous plongeons aussi dans le domaine de la gestion avec la colonne "Le O dans l'ORL " et nous avons le rapport « Des laboratoires » de Mary Beth Jennings du centre national pour l'audiologie. Nous continuons avec un aperçu des efforts humanitaires de nos membres et de nos partenaires de l'industrie de la fabrication. Dans ce numéro, nous allons en savoir plus sur ce que fait AIM Electronics à Bali.

Marshall Chasin, AuD, MSc, Reg. CASLPO
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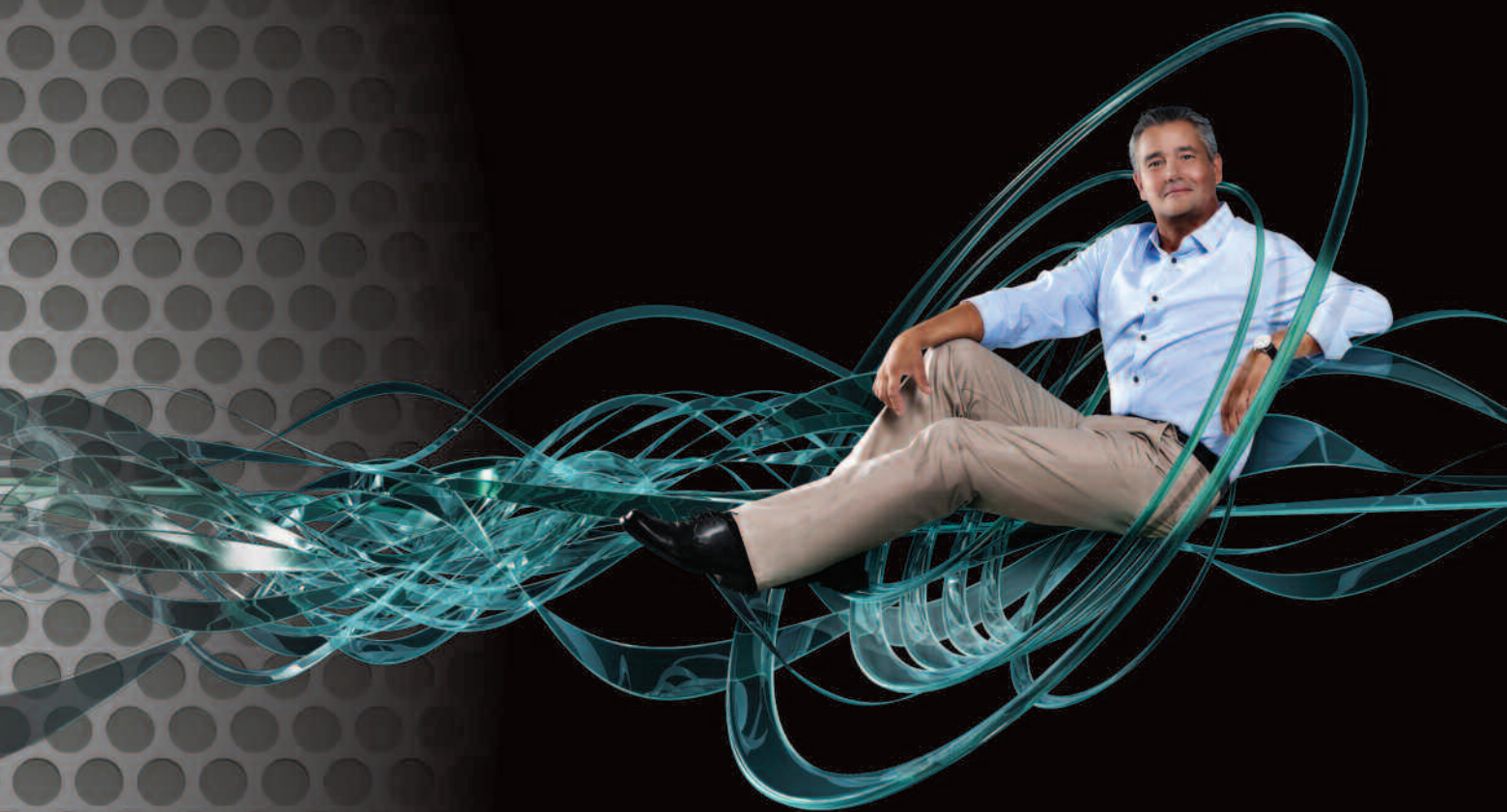

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As I write this president's message, I am sitting in the lobby of our conference hotel, the Westin Harbour Castle in Toronto, Ontario, musing over a very fruitful weekend (February 6–8, 2009) of strategic planning. I predict that 2009 will be a year of unprecedented growth for the Canadian Academy of Audiology (CAA).

Of note, we started the year by hiring Tom McFadden as our executive director. Tom brings with him a wealth of knowledge, experience, and enthusiasm from which CAA will benefit greatly. Please see his welcome letter to the membership in this issue of *Canadian Hearing Report* (*CHR*). Tom is available to answer any of your questions or concerns about CAA by phone (1-800-264-5106) or by email at director@canadianaudiology.ca.

Tom and I, along with your elected board of directors, have spent a very productive two days discussing the future of CAA, setting goals for the next few years and developing a work plan to achieve these goals. Following is an overview of the work plan, which I hope you will scrutinize. I look forward to hearing from you regarding these objectives.

Products and Services

Over the next three years, your board of directors plans to increase member services. What will these services be? Well, that really depends on you. Soon, a concise but comprehensive questionnaire will be sent out to you. Would you like CAA to expand educational opportunities, or introduce web-based services (i.e., online store, seminars, and resources)? Are you looking for published documents, guidelines and surveys, or are you looking for insurance and other affinity programs? Please, complete the questionnaire and let us know your wish list.

Profile, Leadership, and Influence

CAA will be engaging the services of a marketing consultant who will help our organization raise its profile as well as the profile of audiologists nation-wide. We will position ourselves as the "go to" organization for questions about audiology in Canada. We will increase our presence at the table with government agencies and policy makers. We will put CAA at the forefront with the public and the media when they have questions about hearing, balance, and audiology.

We will also target health care professionals to

Je suis en train d'écrire ce message de la présidente, assise dans le Hall de réception de l'hôtel ou se tient la conférence, Le Westin Harbour Castle à Toronto, en Ontario, méditant à propos d'une fin de semaine fructueuse de planification stratégique (Du 6 au 8 février 2009). Mes prédictions pour 2009 sont que cette année sera une année de croissance sans précédent de l'Académie Canadienne d'Audiologie (ACA).

Remarquez. Nous avons commencé l'année avec l'embauche de notre directeur exécutif, Tom McFadden. Tom a énormément de connaissance, expérience et enthousiasme dont l'ACA se verra bénéficier.

Veuillez lire sa lettre de bienvenue aux membres dans ce numéro de *la Revue Canadienne de l'Audiologie* (*RCA*). Tom est prêt à répondre à vos questions et préoccupations au sujet de L'ACA par téléphone (1-800-264-5106) ou par courriel à l'adresse suivante Director@canadianaudiology.ca.

Tom et moi, avec votre conseil d'administration élu, avons passé deux jours de travail très productifs discutant du future de l'ACA, fixant des objectifs pour les années à venir et développant un plan de travail pour réaliser ces objectifs . Ce qui suit est une vue d'ensemble du plan de travail, que j'espère, vous allez examinez soigneusement. J'attends avec impatience vos réactions à ces objectifs. .

Produits et Services

Votre conseil d'administration a l'intention, sur les trois prochaines années, d'augmenter les services aux membres. Quels seront ces services ? Bien, ca depend vraiment de vous. Bientôt, on va vous envoyer un questionnaire complet et bref. Voulez- vous que l'ACA élargisse les opportunités pour la formation, ou proposer des services en ligne (par exemple, une cyberboutique, des séminaires, et des ressources) ? tes- vous en train de chercher des documents publiés, des lignes directrices et des enquêtes ou êtes-vous en train de chercher des assurances et d'autres programmes d'affinité ? Veuillez, s'il vous plait compléter le questionnaire et faites nous part de votre liste de vœux.

Profile, Leadership, et Influence

L'ACA va mobiliser les services d'un expert-conseil en marketing qui va assister à hisser le profile de notre organisation ainsi que le profile des audiologistes à l'échelle nationale. Nous allons nous établir comme l'organisation de référence au Canada pour les questions d'audiologie. Nous allons accroitre notre présence à la table des négociations avec les agences gouvernementales et les responsables des orientations politiques. Nous allons placer l'ACA au premier rang du publique et des medias quand ceux-ci ont des questions concernant l'ouïe, l'équilibre et l'audiologie.

Nous allons aussi cibler les professionnels des soins de santé afin de les sensibiliser à l'audiologie, clarifier le champ de

increase their awareness of audiology, clarify the scope of practice of audiologists, and help them understand why audiologist should be the "gatekeepers" for hearing and vestibular health care in Canada. Our goal is to establish with the health care community as well as the general public why they should see an audiologist and what makes us the most qualified professionals to help them with their hearing and balance problems.

Resources

In order to sustain our growth over the next 3 years the CAA board of directors has made revenue diversification a key component of the strategic plan. We are investigating a variety of options including: increased educational opportunities for audiologists and providing CAA products to our members and other individuals out there. What are your thoughts?

We also know that we need to increase our human resources. In 2009 we hired our first staff member and we plan on increasing that compliment in order to provide better service to and advocacy for our members.

Organizational Development

As you have heard me say before, "The strongest houses are built on the firmest foundations" and our final goal addresses this "foundation." Over the next year we will be developing policies and procedures that will allow us to continue to grow and evolve in the future to because THE voice of audiology.

Of course, none of this is possible without you. Audiologists are the lifeblood of CAA. We need your input and volunteer efforts to accomplish our goals. In the upcoming months we will be putting out a call to our members to help us help the academy grow. There are many volunteer opportunities and a variety of committees available. You don't have to make a 3-year commitment; you can be involved as much or as little as you like. Help us shape the future of CAA!

Please join us in making CAA the national association for audiologist in Canada.

Your board of directors looks forward to hearing from you. If you have any questions concerns or comments about CAA, contact me at president@canadian audiology.ca and/or our new executive director, Tom McFadden at director@canadianaudiology.ca.

CAA is an organization of Audiologists, for Audiologists. We need you to succeed!

Carri Johnson

President

compétence des audiologistes, et les aider à mieux comprendre les raisons pour lesquelles les audiologistes devraient être "les protecteurs du public " en terme de soins de santé auditif et vestibulaire au Canda. Notre but est d'établir, aussi bien avec la communauté des soins de santé qu'avec le publique en général, la nécessité de consulter une/un audiologiste et ce qui nous rend les professionnels les plus qualifiés à les aider à résoudre leurs problèmes d'ouïe et d'équilibre.

Resources

Afin de soutenir notre croissance sur les trois prochaines années, le conseil d'administration de l'ACA a fait de la diversification des revenus une composante clé du plan stratégique. Nous sommes en train d'étudier des options variées y compris: Plus d'opportunités de formation pour les audiologistes et l'offre des produits de l'ACA et pour nos membres et pour toute autre personne. Quelles sont vos réflexions?

Nous savons aussi que nous avons besoin d'accroitre nos ressources humaines. En 2009, nous avons embauché notre premier membre du personnel and nous projetons d'augmenter ceci pour fournir de meilleurs services et des droits de défense à nos membres.

Développement organisationnel

Voua m'avez déjà entendu dire que, "Les meilleures maisons sont construites sur des fondations solides" et notre objectif définitif touche cette fondation. Au cours de l'année prochaine, nous allons développer des politiques et des processus qui vont nous permettre de grandir et d'évoluer dans le future pour être LA voix de l'audiologie.

Bien entendu, rien de tout ceci ne serait possible sans vous. Les audiologistes sont la source de vie de l'ACA. Nous avons besoin de votre apport et de vos efforts de bénévolat pour réaliser nos objectifs. Les mois prochains, nous allons lancer un appel à nos membres afin qu'ils nous aident à accroitre l'académie. Plusieurs opportunités de bénévolat, ainsi qu'une variété de comités sont disponibles. Vous n'avez pas à prendre des engagements de 3 ans, vous pouvez vous impliquer autant que vous le souhaitez. Aidez nous à modeler le future de L' ACA.

Veuillez, s'il vous plait, participer à faire de l'ACA l'association nationale des audiologistes au Canada.

Votre conseil d'administration attend vos commentaires avec impatience. Veuillez m'adressez vos commentaires et suggestions, si vous en avez, à president@canadian audiology.ca et/ou notre nouveau directeur exécutif, Tom McFadden à director@canadianaudiology.ca.

L'ACA est une organisation d'Audiologistes, pour les Audiologistes. Nous avons besoin de vous pour réussir !

Carri Johnson

President

CAA Names New Executive Director

The Board of Directors of the Canadian Academy of Audiology (CAA) announces that Tom McFadden has been named CAA's new executive director.

Tom is a seasoned association executive director with extensive management, conference/event and fund development experience in the not-for-profit health care sector.

Tom McFadden

Tom has served as executive director of a number of prominent professional, charitable and special interest/agency-based organizations, as well as a self-regulatory college, at the local, provincial, and national levels. These include:

- The Ontario Association of Consultants, Counselors, Psychometrists, and Psychotherapists
- The Canadian Foundation for AIDS Research
- Therapeutic Recreation Ontario

Tom holds an honours bachelors degree in health and physical education and a master's degree in health studies and administration. He is a certified association executive (CAE) and a member of the Canadian Society of Association Executives and Meeting Planners International (MPI).

Tom is a welcome addition to the CAA team.

Nomination du nouveau directeur général de l'ACA

Le conseil d'administration de l'Académie canadienne d'audiologie (ACA) annonce la nomination de Tom Mc Fadden à la direction générale de l'ACA.

Tom est un directeur général d'association chevronné qui possède une grande expérience en matière de gestion, de conférences/d'événements et d'acquisition de nouveau financement dans le secteur des soins de santé à but non lucratif.

Tom a travaillé en qualité de directeur général pour des agences professionnelles et caritatives, à intérêts spéciaux œuvrant pour un certain nombre d'organisations ainsi que pour un collège d'autoréglementation, aux niveaux local, provincial et national. Parmi ces associations, on peut citer :

- L'association des consultants et conseillers en santé mentale, psychométriciens et psychothérapeutes de l'Ontario.
- La fondation canadienne de recherche sur le SIDA
- L'association de ludothérapie Therapeutic Recreation Ontario

Tom est titulaire d'un baccalauréat spécialisé en éducation physique et santé et d'une maîtrise en études de la santé et administration. Il est cadre d'association émérite (CAE), membre de la société canadienne des directeurs d'associations et membre du Meeting Planners International (MPI).

Nous sommes très heureux d'accueillir Tom au sein de notre équipe de l'ACA.

Message from the New Executive Director

I would like to take this opportunity to offer the board of directors and professional members of the Canadian Academy of Audiology my warmest greetings as your new executive director. I am excited and enthused about what lies ahead for the field of audiology as we start down a new road full of challenges and opportunities. Arnold H. Glasow once said, "The trouble with the future is that it usually arrives before we are ready for it." Well, the future is now. Together we will be part of an important turning point in the history of the CAA as we tackle more strategic areas regarding visibility, collaboration, and of course membership growth.

My experience with several prominent associations and community service organizations in the health care sector hopefully will come in handy as we develop a vital, action-oriented association, structured to provide new quality member services. Together we will enhance our collective ability to address specific professional issues by raising our profile with government so that we have more power to advocate and negotiate the best possible scenario for our members and our clients. We will continue to cultivate strategic alliances with like-minded individuals and organizations. As we all know there is strength in numbers when new legislation, accreditation and advocacy are concerned. The government will also be far more receptive to initiatives developed consensually and cooperatively by a broad base of the professionals who are affected.

Important to me will be the cultivating of camaraderie and close, meaningful relationships with those on the current board of directors as well as staff. These relationships will be the building blocks of CAA's future success, enabling all of us to act out opportunities with the right measure of consideration … and FUN!

Because I strongly believe that there are similarities between the management of an association and that of a business, my clear vision for CAA will focus on the following core business tenets:

- The need for visibility;
- The need for communication both internally and externally;
- The need for collaboration across diverse, like-minded stakeholders;
- The need for sound, cost-effective administration and management of resources.

Naturally an increase in visibility will result in many wonderful opportunities for collaboration, if professionally managed. For all of us, the future will be a potentially marvellous journey whose destination is determined if not predictable. I thank President Carri Johnson and her colleagues on the CAA Board of Directors for offering me this wonderful challenge.

Respectfully,
Tom McFadden, MPE, CAE
CAA Executive Director

Présentation du directeur général au conseil d'administration et aux membres de l'ACA

En tant que nouveau directeur général, je profite de l'occasion pour saluer chaleureusement le conseil d'administration et les membres professionnels de l'Académie canadienne d'audiologie. J'entrevois l'avenir du domaine de l'audiologie avec ferveur et enthousiasme étant donné que nous nous engageons vers une nouvelle voie riche en défis et en opportunités. Arnold H. Glasow a dit un jour « Le problème avec l'avenir, c'est qu'il arrive habituellement avant que nous soyons prêts. » Et bien l'avenir, c'est maintenant. Nous allons ensemble contribuer au tournant de l'histoire de l'ACA car nous allons nous attaquer à plus de problèmes stratégiques en matière de visibilité, de collaboration et évidemment d'adhésion de membres.

Mon expérience au sein des nombreuses associations importantes et des organisations de service communautaire dans le secteur des soins de santé sera très utile car nous développons une association vitale à vocation pratique, structurée de manière à offrir des services de meilleure qualité aux membres. Nous enrichirons ensemble notre capacité communautaire dans le but d'aborder certaines questions en valorisant notre image auprès du gouvernement afin d'avoir plus de poids pour défendre et négocier le meilleur scénario possible pour nos membres et nos clients. Nous continuerons à cultiver des alliances stratégiques avec des individus et des organisations animés par les mêmes idées. Comme nous le savons, le nombre fait la force lorsqu'il s'agit de réglementation, d'agrément et de défense de cause. Le gouvernement sera beaucoup réceptif aux initiatives mises au point de manière consensuelle et collective par un grand nombre de professionnels concernés.

Il est pour moi important d'entretenir la camaraderie et les véritables

liens autant avec les membres actuels du conseil d'administration qu'avec le personnel. Ces relations seront les éléments essentiels du prochain succès de l'ACA, ce qui permettra à chacun d'entre nous d'agir de la meilleure façon et avec joie!

Comme je crois fortement qu'il existe des similitudes entre la gestion d'une association et celle d'une entreprise, ma vision claire pour l'ACA s'orientera sur les doctrines d'entreprise principales qui suivent :

Le besoin de visibilité;

Le besoin de communication, tant à l'interne qu'à l' externe;

Le besoin de collaboration avec des actionnaires divers qui partagent notre état d'esprit;

Le besoin d'une administration saine rentable et des gestions de ressources.

Une augmentation de la visibilité entraînera d'excellentes occasions pour de nouvelles collaborations, si elles sont gérées par des professionnels. Pour nous tous, l'avenir se caractérisera par un voyage merveilleux dont la destination est déterminée mais imprévisible. Je tiens à remercier la Présidente Carri Johnson et ses collègues du conseil d'administration de m'avoir offert ce défi merveilleux.

Très cordialement,
Tom McFadden, MPE, CAE
Directeur géneral de l'ACA

Membership Application – 2009

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Last Name : _____

WORK ADDRESS:

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The Robert B. Johnston Aural Rehabilitation Laboratory National Centre for Audiology

The Robert B. Johnston Aural Rehabilitation Laboratory was established as a result of collaboration between the National Centre for Audiology, Widex Canada, and funding from the Canada Foundation for Innovation (CFI) and the Ontario Research and Development Challenge Fund (ORDCF). The lab is under the direction of Dr. Mary Beth Jennings.

Mary Beth Jennings, BA (Hons.), MCl Sc, PhD, Reg. CASLPO, Aud(C), FAAA, Audiologist

The Robert B. Johnston Aural Rehabilitation Laboratory is a state-of-the-art research facility. The laboratory includes a room suitable for group-based research and an adjoining work area for researchers that allow viewing of the research area via a one-way mirror. The laboratory is equipped with a miniature 360-degree camera system with a direct connection to a computer system for transfer of video and audio data. Current qualitative and quantitative data analysis software is available for the storage and analysis of research data. A Frequency Modulated (FM) system is available for group and individual use to ensure hearing accessibility for research participants.

Researchers within the Robert B. Johnston Aural Rehabilitation Laboratory also have access to The Bernafon Hearing Innovations Assistive Devices Laboratory. The laboratory is used both clinically and within research for individual and group assistive devices orientation, and for assessment and prescription of devices for individuals with hearing loss of all ages. The laboratory houses a variety of assistive technologies including assistive listening devices (one-to-one communicators, loop systems, FM systems, and infrared systems) for use in homes and public places. A variety of telephones and telephone accessories that are specifically designed for persons with hearing loss are also housed in the laboratory. Other assistive technologies include alarm clocks, smoke detectors, and carbon monoxide detectors, visual and vibratory alerting devices that can be used to alert individuals with hearing loss to important warning signals in their environments.

The Robert B. Johnston Aural Rehabilitation Laboratory has four current programs of research. The first is on group-based adult aural rehabilitation, with a special interest in assessing outcomes from group aural rehabilitation programs, the use of Goal Attainment Scaling as an outcome measure, and the impact of self efficacy on rehabilitation outcomes. Dr. Jennings' doctoral dissertation studied, "Factors that influence outcomes from aural rehabilitation of older adults: the role of perceived self efficacy." This work was supported by a Doctoral Studentship Award from the Provincial Rehabilitation Research Program, sponsored by the Ontario Ministry of Health and Long-Term Care, the Toronto Rehabilitation Institute, and the University of Toronto. This work was also supported by the Canadian Federation of University Women Charitable Trust's Beverley Jackson Fellowship. Dr. Jennings, in partnership with Dr. Jean-Pierre Gagné, Université de Montréal, Ecole d'orthophonie et d'audiologie are currently studying, the efficacy of a functional rehabilitation program for older adults with hearing loss. This project is funded by a Grant in Aging from the Canadian Institutes of Health Research (CIHR). This project continues the work started in Dr. Jennings' doctoral dissertation. Results will be used to inform a long-term program of research to study the efficacy of aural rehabilitation programs for older adults with hearing loss.

The second program of research is

on barriers and facilitators to the use of hearing assistive technologies for older adults. A master's-level student recently completed a research thesis on "Exploring hearing aid use through the use of narratives." This project was funded by a Social Sciences and Humanities Research Council (SSHRC) Internal Research Grant. This program of research will continue with a doctoral-level thesis that is currently underway. A second line of research in this area is the assessment of speech clarity of amplified telephones. This research is being done in conjunction with Dr. Vijay Parsa of the National Centre for Audiology and one master's-level student in engineering.

The third program is research is on the "Application of universal design principles to hearing accessibility in public places and to assessing workplace accessibility for older workers with hearing loss." Dr. Jennings is working in conjunction with Dr. Margaret F. Cheesman from the National Centre for Audiology, and Dr. Lynn Shaw and Professor Lisa Klinger from the School of Occupational Therapy at the University of Western Ontario on this interdisciplinary program of research. This program of research began with a classroom hearing accessibility evaluation of the most heavily used classrooms at the University of Western Ontario that was completed in 2007. This project was supported by the Office of the Vice-President Administration at the University of Western Ontario. Following this project the interdisciplinary research group, including one master's-level student in audiology, and two doctoral level students in health and rehabilitation sciences (one in the occupational science and one in the hearing science stream) began an exploration of "Universal accessibility and usability for hearing: Considerations for design," and a series of studies on "Workplace accessibility for older adults with hearing loss: An exploration of assessment and accommodation."

The fourth program of research complements the studies on workplace accessibility to study "Stigma and disclosing (or not) one's hearing loss in the workplace: The strategies used by people with hearing loss." Dr. Jennings is working in partnership with Dr. Jean-Pierre Gagné and doctoral student Mr. Kenneth Southall from Université de Montréal, Ecole d'orthophonie et d'audiologie on this project. The project is funded by a research grant from the Hear-the-World Foundation. Results from this study will inform a long-term program of research on stigma and hearing loss.

Mary Beth Jennings is assistant professor with The Robert B. Johnston Aural Rehabilitation Laboratory National Centre for Audiology Faculty of Health Sciences, The University of Western Ontario London, Ontario, Canada.

In the News

COME ON, FEEL THE NOISE — BUT RISK PERMANENT HEARING DAMAGE

Going up to 11 has long been a badge of honour in rock music. But there's a price to pay for those decibels, from Pink Floyd and the Who in the 60s to Manowar in the 90s to today's My Bloody Valentine a number of musicians have found to the cost to be permanent hearing loss.

People continue to ask, "Does it really need to be so loud?

www.taipeitimes.com/News/editorials/archives/2009/01/12/2003433524

LONG, LOUD IPOD USE NOW CAN BECOME DEAFNESS LATER

You've heard of BlackBerry Thumb? Now there's iPod Ear.

They're called the iPod Generation ? all those kids wired to earbuds and MP3 players. But they're at risk of becoming the "Huh? What?" Generation.

Similar concerns were raised with Sony's Walkman in the 1980s. However, as hearing damage is directly related to duration of exposure as well as volume, the latest portable stereos capacity for thousands of songs new longer-lasting batteries have exacerbated the problem.

www.capecodonline.com/apps/pbcs.dll/article?AID=/20090108/LIFE/901080302

SOUNDING OUT MUSICAL TALENT

One Friday evening at the headquarters of Kwangwoo MeDix, a distributor of medical equipment and supplies, children armed with clarinets –the Resound Orchestra – began showing up.

Under a teacher's direction, the children filled the room with the sound of their clarinets. Some players were out of tune at times, but the organizers are used to these kinds of problems. All the kids in the room are hearing impaired to varying degrees and wear cochlear implants that, unlike hearing aids, stimulate auditory nerves to improve hearing.

joongangdaily.joins.com/article/view.asp?aid=2899546

ONE IMPLANT MADE AN IMPACT. MIGHT TWO DO EVEN MORE?

For Family, Second Cochlear Surgery Was a Difficult Decision

If anyone had suggested just a few years ago to Anne Dooley that her deaf daughter should undergo intricate operations on both ears to receive cochlear implants, she would have recoiled.

But after Anne and her husband Aaron watched Ruthie drag home day after day, worn out from the demands of listening in school, they began to investigate ways to ease her difficulty. They found that medical research and anecdotal reports of other families pointed toward a second surgery.

www.washingtonpost.com/wpdyn/content/story/2009/01/05/ST2009010502259.html

PLAYING GOLF CAN "DAMAGE HEARING"

Players who use a new generation of thin-faced titanium drivers to propel the ball further should consider wearing ear plugs, experts advise.

Ear specialists, in a case outlined in the British Medical Journal, suspect the "sonic boom" the metal club head makes when it strikes the ball damaged the hearing of a 55-year-old golfer they treated.

news.bbc.co.uk/2/hi/health/7811143.stm

Cerumen Impaction:
New Evidence-Based Clinical Guidelines

By Albino Chiodo, MD, FRCSC and Brad Hubbard, BSc, MD

About the Authors

Albino Chiodo, MD, FRCSC, *received his medical degree at the University of Toronto and completed his general surgery training at Brown University School of Medicine and his otolaryngology residency at the University of Toronto. He is presently an assistant professor of Otolaryngology Head & Neck Surgery at the University of Toronto and practices at St. Michael's Hospital and Toronto East General Hospital.*

Brad Hubbard, BSc, MD *is a resident in the Department of Otolaryngology – Head & Neck Surgery, University of Toronto. Brad worked in the Canadian high-technology industry designing microchips for hearing aids and other biomedical devices. Brad is presently enrolled in the Otolaryngology – Head & Neck Surgery residency program at the University of Toronto.*

Cerumen impaction is a frequent complaint brought forward by patients to both audiologists and otolaryngologists. Estimated to affect one in 10 children, one in 20 adults and over 30% of the geriatric and developmentally delayed populations, it currently represents approximately 12 million patient visits per year in the United States, with over 8 million patients undergoing cerumen removal procedures annually.

The American Academy of Otolaryngology (AAO-HNS) recently released the first evidence-based clinical practice guidelines for cerumen impaction. The 22-page report was compiled by a multidisciplinary team of experts who surveyed the available literature and analyzed these papers and clinical trials to make evidence-based recommendations. The guidelines are intended to improve the diagnostic accuracy of cerumen impaction, and to outline the latest information on management strategies.

The report defined cerumen impaction as "an accumulation of cerumen that causes symptoms, prevents assessment of the ear, or both" (complete occlusion of the canal is not required). Symptoms that were recognized in the article included hearing loss, tinnitus, aural fullness, itching, otalgia, odour, discharge, or cough. Of special interest to audiologists, the report recommended that those patients with hearing aids should be examined and evaluated for cerumen impaction at each encounter, but that re-evaluations at intervals shorter than three months were not necessary. Cerumen impaction can significantly affect hearing aid function as sound reaching the tympanic membrane can be reduced by as much as 10–15 dB in mid-to-high frequencies. Further, estimates indicate that cerumen contact is responsible for 60 to 70% of hearing aid damage requiring repair.

Tympanostomy tubes, tympanic membrane perforations, stenosis of the external auditory canal, a diagnosis of diabetes, immunocompromised state or anticoagulation were highlighted as factors that modify the standard management guidelines provided in the report. Further, the compiled guidelines are not intended to apply to cerumen impaction that may be associated with dermatologic conditions, previous radiation exposure, previous typanoplasty or myringoplasty, or canal-down mastoidectomy.

Excluding any of the above modifying factors or complicating diagnoses, the evidence-based guidelines recommended treating cerumen impaction if the patient is symptomatic or if the impaction prevents the assessment of the ear. Appropriate interventions for treatment include cerumenolytic agents (water, saline, and oil-based solutions were all found to be equally effective), irrigation, and manual removal. These can be used alone or

in combination, and the guidelines advise practitioners to utilize the treatment with which they are most experienced, and follow-up with patients to monitor progress as appropriate. Home remedies for cerumen impaction such as candling, cotton swabs, or oral jet irrigators were examined and deemed inappropriate – offering no benefit or inciting potential harm.

Overall this guideline is an important milestone offering clinicians clear evidence-based guidance for the identification and management of cerumen impaction. However, despite the large amount of literature reviewed to prepare these guidelines, there remain significant gaps in knowledge regarding management of this condition. Some of the areas for further research highlighted in the guidelines included better elucidating the natural history of cerumen impaction, preventative options to avoid the condition, obtaining more data on manual cerumen removal, and assessing the best treatment options for removal by patient age and cerumen consistency.

Exciting times are ahead! This first guideline has given us a framework for management and provided future directions for study. I eagerly await the next revision which will hopefully further improve our understanding of cerumen impaction and improve our ability to effectively treat this condition.

The full text of the AAO-HNS "Clinical practice guideline: Cerumen Impaction" is available via PUBMED with PMID: 18707628, or through the AAO-HNS at http://www.entnet.org/

What's New In Outer Hair Cell Motility?

By Lorienne Jenstad, PhD
Associate Editor

"What's new in outer hair cell motility?" I get asked this question all the time at cocktail parties, as I'm sure most of us do. So I thought this might be good timing to look at the literature and see what the latest research tells us.

I'm sorry … what? You don't bring up this topic at parties? I suppose I don't, either. However, it's still a timely topic so, roll up your sleeves and let's go.

Let's start with some facts:

- The auditory system can encode and process a very wide dynamic range of signals and has very precise frequency resolution.
- The cochlear amplifier is responsible for the auditory system's frequency resolution and wide dynamic range.
- With most cochlear hearing losses, there is damage to the cochlear amplifier that results in a reduced dynamic range of hearing and reduced frequency resolution.
- Outer hair cell motility is thought to be the driving force behind the cochlear amplifier.

What I mean by motility is that the outer hair cells (OHCs) expand (lengthen and stiffen) and contract (shorten) in response voltage changes in the system, which are related to input levels to the auditory system. These changes likely affect the basilar membrane, and the sensitivity of the inner hair cell (IHC) response.

It has puzzled auditory researchers for years as to what mechanism drove this extremely fast reflex. It was thought that the mechanism was part of a very fast reflex loop that included the brain stem, but the neural transduction time required for such a reflex is too long for the time scale on which the OHC movement is observed. In addition, the OHC motility is observed when OHCs are isolated from the auditory system. If you haven't seen the famous video of the dancing OHC, I highly recommend this link:

www.physiol.ucl.ac.uk/ashmore/

The video, produced by Jonathan Ashmore, demonstrates clearly that OHC motility occurs even without a brain stem. Plus, there's music. See? I told you this would be appropriate cocktail party conversation.

Because this happens at the level of the hair cell itself, it was important to find out how it was possible for this to happen. The change had to be some-

thing mechanical within the cell membrane itself, which would lead to the altered shape change.

Through subtractive cloning techniques, Peter Dallos and colleagues (Zheng et al 2000) identified the DNA sequence likely associated with the motor protein in the OHC wall. In the subtraction techniques, they compared DNA from IHCs to OHCs. Among other assumptions, they assumed that because IHCs don't show motility, but OHCs do, that the sequence for the relevant motor protein could be identified by seeing what was left over after what was common between them was removed.

Dallos and colleagues called this motor protein Prestin (pres for short), which is a play on the musical term presto because of its speed. Researchers have had fun with additional puns surrounding this name; for example, the groan-worthy title of a 2003 article: "Auditory amplification: outer hair cells pres the issue" courtesy of Geleoc and Holt. Despite, or perhaps in addition to, the punny title, Geleoc and Holt's article is a very clear and concise, three-page summary of work in the area. If you have access to *Trends in Neurosciences* through your library, I highly recommend this quick read.

Recent research has shown that prestin is essential for the cochlear amplifier to work, (Dallos et al 2008) by creating a strain of mice with a mutation affecting only prestin and showing a subsequent loss of motility in the OHCs. This is pretty compelling evidence for the necessity of prestin, but doesn't tell us whether prestin is sufficient for OHC motility. There is evidence that other mechanisms are involved in the process (Dallos, 2008).

What to watch for in the literature: Is prestin the final answer regarding the cochlear amplifier? Yes and no. Prestin is essential for the OHC motility to happen, but may not be sufficient. Other proteins and mechanisms may soon be implicated. The role of prestin itself has been questioned as to which aspects of the cochlear amplifier it is responsible for: one as-yet-unreplicated study has suggested that prestin does not affect absolute sensitivity but only frequency tuning (Mellado Lagarde et al 2008). Perhaps once the mechanism is better understood there will be implications for restoration of hearing.

If it's been a while since you studied cochlear physiology, the website Promenade 'round the Cochlea (www.cochlea.org/) maintained by Remy Pujol, provides a fun refresher, with lots of pictures and clear explanations.

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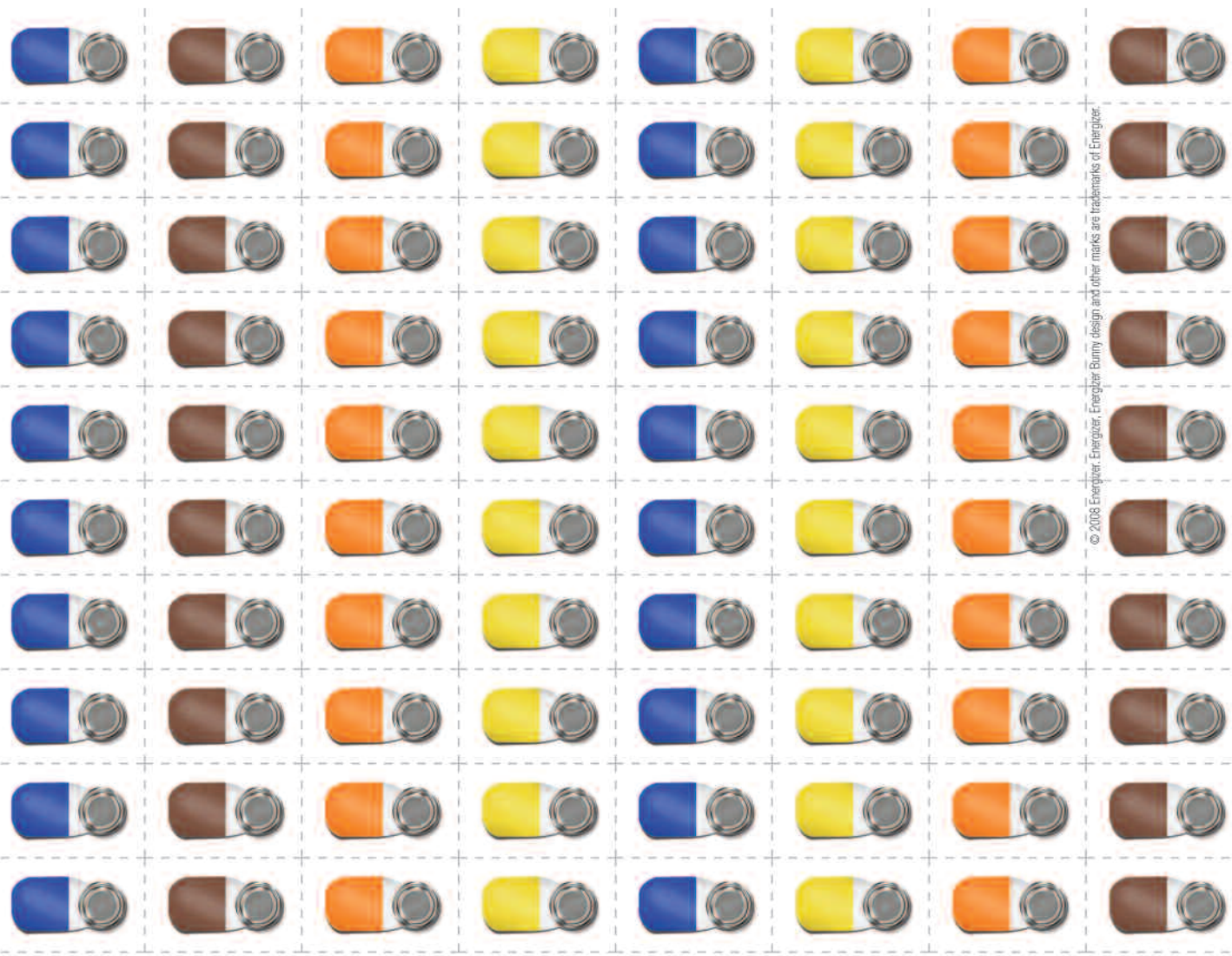

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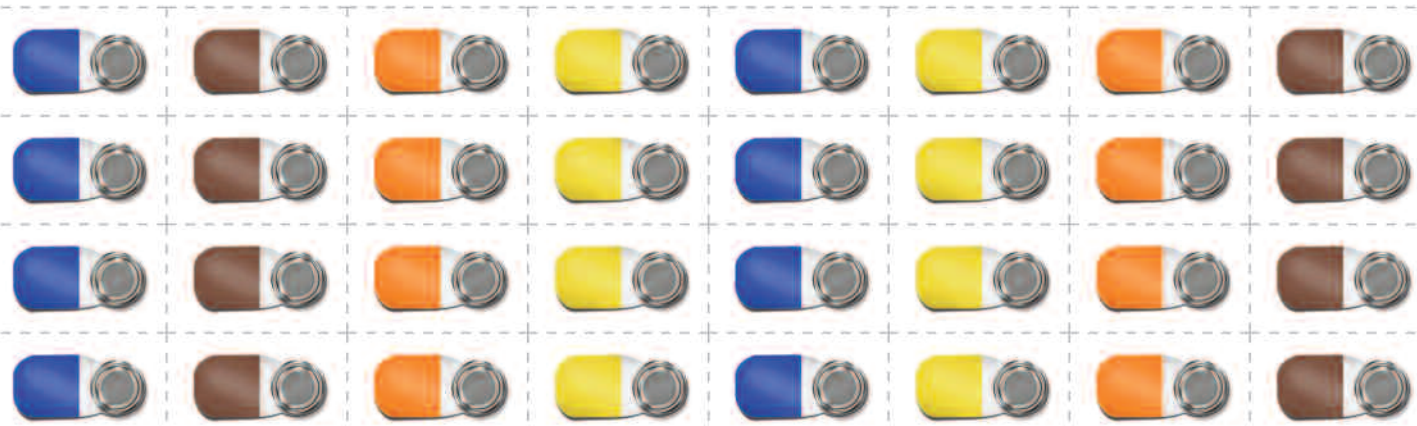


AIM Companies Canada:

Helping Children to Hear in Bali Indonesia

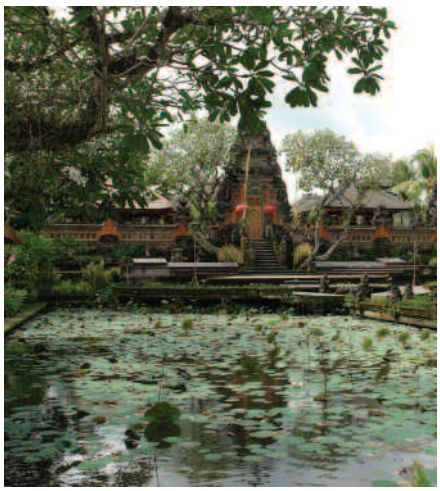
Bali is a beautiful tranquil island in the south pacific, famous for its beaches, rice paddies, friendly people, and rich culture. Tourists flock there from all over the world to enjoy the hotels where they receive warm welcomes and pampering by the gentle and generous Balinese. Few seem to notice that their attentive hosts leave the opulence of the tourist hotels at the end of their shifts each day to return to their poverty stricken homes.

Our projects in Bali started through the efforts of Nick Liem, who in his retirement, felt compelled to return to his native country of Indonesia and give back to the land of his childhood. An active Rotarian, he had been involved in Rotary International Projects in Africa to assist hearing-impaired children. He realized through his involvement in these projects that the children of Bali desperately needed the same sort of assistance and support.

Getting fitted for earmolds

To this end, he made an association with a Balinese owned company called Lumina, and embarked on a mission to procure the necessary training and skills needed to bring hearing care to local children. Fellow Rotarians, who were also involved in the African Projects, Vikki MacKay, a licensed hearing instrument specialist in B.C., and Jim Renshaw, an electronics technician specializing in audiometric equipment joined in the project. The three of them work together in Canada at AIM Instrumentation, a company that specializes in the supply, repair and calibration of audiometric equipment.

A plan to construct and equip the Lumina Hearing Centre was soon enacted, staff recruited and trained, and the concept was introduced through the local Rotary Clubs to the community. Very quickly the needs of hearing impaired children in Bali were recognized. Bali has several state-run schools for the deaf, but sadly they have no audiologic support, no hearing aids, and although the country does have its own sign language, it is



not taught in the schools. Facilities are "bare bones," and many hearing impaired children are abandoned by their parents at the school – orphaned because of a hearing loss.

Lumina's cry for help was caught by a humanitarian organization called YKIP (Yayasan Kemanusiaan Ibu Pertiwi) or the Humanitarian Foundation for Mother Earth, which is dedicated to helping the needy in Bali through health and education programs (http://www.ykip.org/). Together with YKIP, Lumina has developed several hearing projects and continues to strive to do more.

Our Projects

HEARING TESTING AND HEARING AID FITTING FOR SLBB STUDENTS

There are state-run schools for deaf children in Bali that carry the acronym SLBB. Children who do not learn to talk due to deafness are enrolled in these poorly equipped schools, where teachers sometimes must double as parents for abandoned children.

Over the past four years, Lumina and YKIP have developed a program that provides hearing tests for each child enrolled the school and hearing aids to those children that would benefit from amplification. Donated hearing aids are gathered from Canada and Australia, tested and issued to children. They are monitored and tested on a regular basis to ensure that their hearing aids are working well and remain appropriate for their needs. To date we are proud to say that we have over 200 children wearing hearing aids in our program.

SUSHRUSA PRESCHOOL FOR HEARING IMPAIRED CHILDREN

Our work in the schools opened our eyes to the need for much earlier identification and habilitation efforts for Balinese children. We quickly realized that children did not enter the school system until they were between 7 and 9 years old – unfortunately too old for successful language rehabilitation in a country with no universal SLP support. The children we were assisting found good benefit in using their hearing for environmental sounds, but only the very youngest began developing their speech.

Lumina and YKIP began the process of developing a pilot project to start a preschool for hearing impaired children. Expert Balinese educational consultants who specialized in teaching hearing impaired children were hired, and together we worked to develop a program that would meet the legal, educational, cultural and special needs of the children we sought to help.

Construction of the school began in early 2007, and it was opened in July to welcome its first little class of deaf-mute children. Each child had a hearing assessment and if they did not already have a hearing aid they were appropriately fitted with a donated pocket aid supplied by YKIP.

Within six months (the time between our visits) this quiet little group became a very noisy vocal class! They had found their voices – step one in learning to talk!

SOUND BOOTH AND AUDIOMETRIC EQUIPMENT INSTALLATION IN SLBB SCHOOLS

With ever expanding awareness throughout the school system, teachers soon began inquiring if there was anything more that could be done to facilitate the testing of the children in the SLBB schools. Again Lumina and YKIP responded by working together to develop and fund the construction of locally developed and built sound booth facilities.

The sound booths are designed by Engineer Nick Liem, to be up to international standards in their specifications, but to be made of locally available products and produced by local craftsmen.

They were constructed and

installed with a screening audiometer in several schools and are actively used to facilitate the testing of the children.

An important spin-off of this project is that these booths are now readily available to the ear-nose-and-throat (ENT) specialists on the island and have been installed in several clinics as well as one local hospital.

ENT PHYSICIAN EDUCATION, SUPPORT, AND TRAINING

Sadly, there are no audiologists on the Island of Bali. In fact, at last report, there are no audiologists in the entire country of Indonesia. ENT physicians struggle to make up for this deficit by doing as much as they can to understand the basics of hearing assessment procedures and through Lumina we support their efforts to our best ability.

In February of 2008 we sponsored a seminar featuring Indonesian ENT specialists in the field of OAE assessment, ABR assessment, and tympanometry. Many physicians attended and Lumina provided both equipment and training assistance.

Much, much more needs to be done here, and I am very pleased to say that we have recently made a connection with the Australian audiology community who has come forward to adopt our cause by offering their much needed and very valuable experience and knowledge! Bali is a favourite vacation spot for Australians; so many audiologists have come forward to donate a day of two of their vacation time, which has made a wonderful difference! We would welcome with open arms our Canadian audiology community as well!

THE INITIATION OF A UNIVERSAL HEARING SCREENING PROGRAM FOR INFANTS

In 2007 ENT physicians came forward with a request for assistance in establishing a universal hearing screening program for the Island of Bali. This is our most ambitious project to date and it would not have been possible to even consider it if Viasys Health Care (now a part of Cardinal Health) had not stepped forward with the generous donation of a fully equipped clinical Audera ABR unit

and two AudioScreener OAE/ABR screening units. Added to this is a third AudioScreener purchase that was jointly funded by AIM Companies Canada and YKIP.

A pilot project was begun in 2008, funded by YKIP, and these units were placed in three major hospitals in Bali. In a coordinated effort headed by Dr. Eka, ENT specialist, babies are screened at birth following a protocol set by a committee of ENT doctors and accepted by the Indonesian government. Results are collected and tracked by Lumina staff and submitted to a central database located at Sanglah Hospital.

Identified babies are retested at age three months and again at age six months. If they fail the screening at age six months, they receive an ABR assessment and after medical clearance may be fitted with a pocket aid that is subsidized by YKIP to ensure affordability for the families.

Identified children will be tracked, and their families will be given support to understand the nature of the hearing loss and how to help their child learn to speak to the best of their abilities.

We are now in the process of fundraising for phase two of this project, in which we hope to be able to place at least one OAE screening unit in each Bali hospital.

DEVELOPMENT OF CAREER OPPORTUNITIES FOR DEAF AND NON-VERBAL YOUTHS AND ADULTS

There is no "social safety net" to assist people who have communication limitations. As a result, once they have left their schools, if their families cannot support them the young adults must resort to begging in the streets. The schools do not provide any training in trades or life skills.

We have begun a process to develop a pig farming project to create sustainable employment for hearing impaired adults. At first impression you might say, "Why pig farming? and the answer is simple, it is sustainable, uses already established local knowledge, and has many related industries such as; farming to provide the feed; butchering facilities; meat processing facilities; animal husbandry jobs; and farm maintenance jobs. The more you think about it the longer the list gets. The best part is that most of the jobs do not require that the worker be able to speak – the farm and its related occupations can be substantially staffed by hearing impaired people!

Currently we have located some property that may be leased for the

purpose and are working to secure it and begin the development of the project. We need volunteers with expertise in pig farming to assist us with this project!

Upcoming Projects

THE ESTABLISHMENT OF AN AUDIOLOGIC TESTING FACILITY AT SANGLAH HOSPITAL

In order to facilitate the development of programs such as the Infant Hearing Screening Program, ENT training and now the ENT department's ambitious new Cochlear Implant Program, it is imperative that the Sanglah Hospital be equipped with an audiologic testing facility and receive training for their physicians. To this end we are working through our Rotary Clubs, YKIP, and other donors to raise the necessary $30,000 to pay for and install the sound room and equipment

ENT AND HEARING TESTING OUTREACH SERVICES TO RURAL COMMUNITIES

Currently, ENT and hearing testing services are only available in the capital city of Denpasar, which leaves all of Bali's poor rural population without access unless they can afford to travel. We are raising funds to purchase a van and ENT instruments and equipment to enable the doctors to travel out to the regional health stations to deliver services.

PEDIATRIC AND RURAL ACCESS ENT CLINIC

Currently there is only one place serving the needs of the rural population and no clinic that specializes in pediatric care for ENT services. Facilities are greatly overloaded. We have secured a location to establish a small treatment centre and are currently raising funds to equip it. Donations of used ENT instruments and portable equipment would be very gratefully accepted!

MOBILE ENT/HEARING CLINIC

We have drafted a proposal to outfit a bus with the equipment necessary to become a fully mobile clinic designed to serve the rural areas. This project will cost up to $500,000 to complete so it is an ambitious goal!

WHO KNOWS! THE SKY IS THE LIMIT!

There is no limit to what can be accomplished by dedicated people with a good cause! Thank you to everyone who has supported our efforts and welcome to anyone who wishes to join us in bringing hearing health care to the children of Bali! Each and every contribution – no matter how small, makes a positive change in the life of a child!

We are especially grateful for good used BTE hearing aids, the shared knowledge of volunteers, ENT equipment, and other invaluable gifts and cash donations. The projects are coordinated on the Canadian side by AIM Companies Canada, home of AIM Instrumentation B.C., AIM Instrumentation Ontario Inc., and AIM Technologies Inc. Jim, Nick, and Vikki work together there and provide financial support, training and ongoing guidance to the staff at Lumina.

For more information about the projects or to inquire about donating or volunteering please contact: Vikki MacKay CEO AIM Companies Canada at vikki.mackay@aiminstrumentation.com

What's she smiling about?

It's Friday, 430pm, and she's on her way home to play with her kids. She just filed $25,000 in Workers' Compensation claims with a single click.

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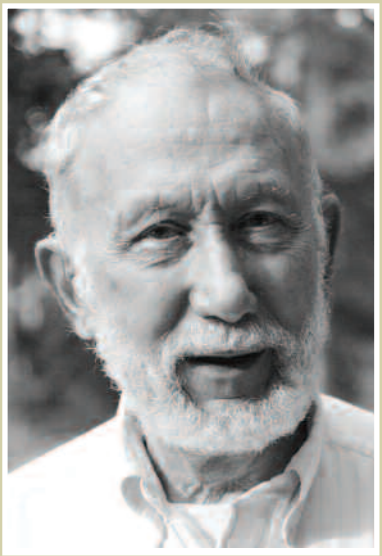

Dr. Mark Ross is professor emeritus of audiology, University of Connecticut and has served as vice president of the SHHH Board of Trustees. He writes a regular column for Hearing Loss Magazine – The Journal of the Hearing Loss Association of America, called "Developments in Research and Technology." *He has published and lectured extensively on topics dealing with hearing loss. Dr. Ross is considered one of the great pioneers of aural (re)habilitation. As an individual who has worn a hearing aid for over 50 years, Dr. Ross brings a special degree of credibility to his publications.*

In conversation with Marshall Chasin, Editor-in-Chief

Marshall Chasin (MC): I know that, at least partially as a result of your military service you had a hearing loss and then went to Walter Reed for aural rehabilitation services. Is that what interested you in audiology or were you interested before hand?

Mark Ross (MR): I was in the army during WW II and then when the Korean War came along I re-enlisted in the airforce, not necessarily out of any surge of patriotism, but to get out of cutting dresses for a living. I spent four more years in the military, during which time I attended Walter Reed for hearing aids and aural rehabilitation. When my enlistment was up I was 28 years old and I needed to decide what I wanted to do with my life. I didn't want to stay in the Air Force. I had been through this two month training program at Walter Reed, and I had learned about hearing aids and hearing loss, and I thought that I could sell hearing aids. So I started out as an undergraduate at age 28 at Brooklyn College to learn more about audiology so that I could sell more hearing aids. I tried part time for nine or 10 months going door to door trying to sell hearing aids. In that time I think I sold one hearing aid. So clearly I was not well suited to that. I used to use a Maico body aid at that time. Around that time, Zenith came out with a hearing aid that sold for $50. The Maico cost $200. I still remember this – I stopped at one house and was giving my pitch to buy a Maico hearing aid. I was asked what the difference was between the Maico hearing aid and the $50 one that was just advertised. I said that I didn't think there was any difference, and that took care of my sales career! I had to take a lot of courses to get into audiology – I went on and did an MA and then a PhD, and here I am. There was a lot of serendipity. I started out in one thing and ended up in another. Actually as an undergraduate and graduate student, I also worked as a speech therapist with people who had various speech and language problems. Then I went to Stanford and they looked at my hearing loss, and my hearing aid, and they assumed I was interested in audiology – I thought that was fine, and went along with it.

MC: Looking back at the *Vanderbilt Report* in 1981, you were the first to coin the phrase "communication access" ("Communication Access", Vanderbilt Hearing Aid Report, G. Studebaker and F. Bess (Eds.), Monographs in Contemporary Audiology, pp. 203–208) which is essentially like the wheelchair ramp for the hard of hearing. What led you to become involved with communication access?

MR: I can't really pinpoint a specific time with adults. I started my work first with children and from that, the issue of communication access started, and from there we went to the use of FM systems and improving the signal to noise ratio. Later on, we applied the same standards of acessibility to adults. As you know, in 1964 or 1965 there was a rubella epidemic and many children who had lost their hearing as a result of maternal rubella were referred to our clinic. As a profession were we very new and not equiped to deal with this or the reactions of their parents. In Connecticut we had myself and one other audiologist in New Haven, and that was it. There was a great deal of pressure on

us in the academic field to start turning out audiologists to work with these kids. And from that point there was a great expansion of audiology, particularly pediatric and educational audiology. Coming out of that we had to invent and develop skills that we just didn't have, in order to assess children, such as counselling skills for the parents and learning to deal naturally with young children, as opposed to adults with noise induced or presbycusic hearing losses. At the same time, there was another revolution in the field of audiology and this was the psycholinguistic revolution. We began to be aware of the biological basis of language (Lennenberg, "The biological basis of language") and natural ability of young children to learn their native language, when provided with the appropriate conditions (acoustic and experential). These works were very useful because it provided us with a formal structure to perform language-based tests for hard of hearing children. Also, the early work on auditory deprivation came out. We were made aware of the need to find these kids, test them, and then to provide the best auditory signal we could, as early as we could. This led to a number of nursery schools for hard of hearing children, some of which I helped to develop. We used to fit them with binaural body aids and try to teach them language via an auditory approach. The problem was that many of these nurseries were in basements with hard walls and a lot of echoes. When the teacher spoke to me two feet away I couldn't understand what she was saying – the acoustics of the situation made it impossible for me to understand. If it was impossible for me to understand the teacher's language, and I'm competent in the language, how could a hearing-impaired child develop language in that kind of acoustical environment? That naturally led to my interest in improved room acoustics, and in the late 1960s when FM systems came along, I used that as well. And from there, I moved to working with adults as well and ensuring that they had not only optimal hearing aids, but everything else they needed to have communication access.

MC: What do you think audiologists should know about children (or adults) with hearing loss, but don't?

MR: They should be learning a lot of information on speech acoustics. I sometimes find it odd that audiologists who are so concerned with the hard of hearing have such a poor grasp or awareness of the entire area of acoustic phonetics, which includes the dynamic as well as the static cues in speech that are so important for intelligibility. Haskins Lab which is still in New Haven, Connecticut, did some early wonderful work on determining which cues are important for optimal speech intelligibility and much of my early training consisted of reading and comprehending their research. Audiologists may amplify a speech signal but they don't always consider the various cues and other spectral and temporal features necessary for optimal speech intelligibility. Also, in audiology programs now we may learn about speech perception, but we don't concentrate enough on the reciprocal and crucial relationship between speech production and speech perception. And, of course, more information about interpersonal counselling, for parents and adults, is always welcome.

MC: Let's talk abit about real ear measurement. There are a number of audiologists who don't want to use real ear measurement because they don't want to get tied up in matching a "target". They want the ultimate fitting to be an interaction between the individual hard of hearing person and themselves without having to "stop" when a target is achieved. What is your opinion of real ear measurement?

MR: When an audiologist makes a change in my hearing aid (or an implant) and asks about whether the change is good or bad, it depends so much on my auditory memory of what I heard maybe 30 seconds before. It is difficult to make such comparisons unless they are really dramatic, which few are. If you make a rapid paired-comparison between two different settings, using the same material and the same acoustic environment, then these comparison can be done more validly. However, since we don't have this capability at the present time, we need to rely on real ear measurements as the basis to see whether any adjustments should be made. Real ear measurement is really only saying how much audibility is available for various speech cues and frequency components for that individual in their individual ear canal. It does tend to make the assessment more objective for some things. It shouldn't be used blindly of course, but I think that it's an essential test. To depend on the "first fit" programming of a hearing aid and hoping that there is sufficient output and frequency response is just wishful thinking. We have a tool to verify what we think we are programming and we should be using it. We have a 2 cc coupler and this is useful but it doesn't tell us much about what happens in someone's ear.

MC: What do you think may be the next technical innovation in our field – the 1940s saw the development of the 2 cc coupler, the 1970s saw the development of evoked response audiometry, the 1980s real ear measurement, the 1990s otoacoustic measures, and next what?

MR: I would love to see some integrated hearing aid/FM systems no bigger than the thumb. The FM receiver should be an integral part of the hearing aid and not just an adjunct. Everyone should have this capability and everyone could point a ballpoint pen sized directional microphone across a table and would be able to listen to whatever they would like. Consider a typical wedding, where you have 8–10 people at the table, a band playing, people talking and singing. Such a mic can help you hear Uncle Ben who is sitting across the table, and ignore Aunt Sadie sitting next to him. Improving the signal to noise ratio is really the best thing that we can do to improve our ability to hear in noise, and an integrated hearing aid/FM technology with a directional microphone would be the best way to do that. It doesn't have to be an FM system – any way of picking up the signal directly and reducing the background noise and reverberation, would be useful. Incidentally, the first BTE FM system that was developed came out of a conversation I had at an audiology meeting in Jerusalem with Barak Dar of AVR Sonovation (the frequency transposer hearing aid). Moe Bergman sent him over to me because he wanted to get my opinion of frequency transposition. He asked about that and I told him that if he really wanted to make a difference he should build an FM/hearing aid into a BTE shell. Six months later he did just that – a transmitter that was 6 to 8 inches long and an extendable antenna built into it, and a FM/BTE with an external antenna. That was the first. From then on in, I kept advocating for smaller transmitters and receivers that had dual purposes – for example, a pen sized transmitter that was also a 2 GB digital memory stick.

MC: This last question comes from Dr. Richard Seewald who has just been appointed distinguished professor. Of all your previous students who live in Canada, who is your favourite?

MR: Ha, Ha ... As a teacher I get the most pride and a feeling of accomplishment from my students. I take special pride in Richard who has risen to such a high level and has contributed so much to the field. He came as a student, listened to some of my ideas, and went far beyond them, which is exactly what I would have wanted. He has since made some magnificent contributions and accomplishments, recognized throughout the audiological world.

PHONAK AD TO COME

Remembering Unitron Founder and Industry Pioneer Fred Stork

Unitron's founder and long-time president, Fred J. Stork passed away this past October at the age of 81.

Unitron's beginnings go back to Newfoundland where Fred Stork managed a plant for German-based United Cotton Mills. When it closed in 1956, Fred, Rolf Dohmer, and Rolf Strothmann started a TV repair business but they were manufacturers at heart. Casting about for product ideas, they identified electronic thermometers and hearing aids as two possibilities. By 1962, they had decided to become the first Canadian hearing aid manufacturer and left "the rock" for Kitchener where they founded Unitron on Oct. 14, 1964 and the rest, as they say, is history.

Remembering Fred Stork

Alan Moore, Unitron's first national sales manager

In the early 70s the company had started to grow and needed some more structure. Two engineers were hired. One was Dave Hogg who became the marketing manager, and Bill Cole, one of Canada's premier experts then and now on micro electronics as engineering manager. They met a technical salesman at the local IEEE meetings, and convinced him that "hearing aids have a good solid future". So I joined them as the first national sales manager. The title sounded good, but in as much as I was the only sales person at that time, it was a little misleading. Both Bill and Dave went on to other fields, and left me in the industry "with a good solid future" where I am to this day.

My recollection of Fred was the basis of my approach to the industry. Always do the best you can with what you have, and treat people fairly.

One of my favourite memories of Fred, was during some clean-out of the storage area, we found an old rack that had been used to mount test equipment. I mentioned to Fred that a hospital was looking for a rack for audiology test equipment. He said "if they come and pick it up, they can have it for $50.00." The deal was set, and the head of the clinic arranged to pick it up. As he had to drive to get to Kitchener to get the rack, I decided I would handle my end of the deal by taking him for lunch. I was always good at that.

So the lunch was enjoyed, the rack was packed in to his van, and I gave the $50.00 to Fred. At the end of the month, when the credit card bills came in, Fred called me into the office and questioned me about "this $65.00 lunch bill in Kitchener." I explained the events to him and he looked at me and said "you mean you spent $65.00 to sell an old rack for $50.00?" He was not impressed. He suggested the next time we should give the old stuff away, and let them buy me lunch.

Fred was always a fair manger, and he really had a feel for the industry. He always had his finger on what was going on, and had a bottle on cognac to help celebrate our successes with customers and staff. He was a true gentleman, and a heck of a good salesman who firmly believed that "no deal is a good deal unless both sides are happy." I look back with fond memories of my time with Fred, and believe that he was not only a pioneer in the manufacturing side of the industry, he was a true mentor to me and many others in our industry.

Bill Cole, Unitron's first engineer

When I became Unitron's first engineer, in 1973, they occupied a 4,000-square-foot building on Wabanaki Drive. It was designed like a hearing aid – no wasted space. My office/lab was about 10 x 10 feet and was shared with John Ksiezopolski and his drafting machine. Fred soon found

that engineers had expensive habits – my first purchase was an HP-35 scientific calculator which cost well over $500 (in 1973 dollars) and my second was an oscilloscope which cost five times as much.

Fred's system for managing the business was characteristically simple and effective. He always kept a single sheet of paper under his blotter which was updated daily and which he consulted whenever I wanted to make a major purchase. He always knew what he could afford. Each morning at 10:00, he had "breakfast" with his two partners in his office so he always knew the status of operations. At the other end of the day, when others were heading home, Fred would come into my office with a bottle of Coke and sit on the corner of the desk and ask "Well William, how's it going?" and that kept him up to date on engineering and R&D projects.

My first assignment was to redesign a BTE hearing aid that had been copied from a Bosch pocket aid. This hearing aid had wide dynamic range syllabic compression (55 dB threshold and 10 – 20 ms release time) and it had input compression. And people hated it. It was terrible in noisy and reverberant environments (a common problem with fast WDRC) and it had so many parts that manufacturing yield was a problem. After several months of experimentation and listening, I had a hearing aid that used fewer parts, worked well in noise and reverberation – and was no longer a fast-acting WDRC aid. The threshold was at 70 dB SPL, the release time was adaptive and extended to nearly 2 seconds and it used input compression so the user had control over the maximum output. We called this the 205A and it was Unitron's best seller for many years.

We didn't always get it right though. In 1974, we hired an industrial designer to design our next generation hearing aid and I decided it should be constructed using modules for easy servicing. The result was the B500, an "ergonomically correct" hearing aid with adjustable directionality and great sound that looked ugly and was very difficult to manufacture. Fred and his partners never said "we told you so" but I knew that we had let them down. After that we listened a lot more carefully to the voices of experience.

Fred knew that Unitron needed to reach a critical mass in order to survive and become a major player in the hearing aid industry and 1974 was a pivotal year. He recruited Dave Hogg (who had recruited me and is now president of High Performance Solutions Inc.) as marketing manager. Before the end of the year we had a new logo, new-look brochures and data sheets, and a new newsletter. Bill Hooper opened a US sales office; we held the first Oktoberfest seminar and sales topped one million dollars for the first time. In October of 1974, Minister of Industry and Tourism Claude Bennett, came to present Unitron with the "A for Achievement" award – one of only 80 awarded since it was established in 1963. By the end if that year, the plant had grown to 9,000 square feet and I had a real R&D lab with an anechoic chamber and the first KEMAR manikin in Canada.

In 1975 and 1976, we introduced new models with our very successful new compression circuit and brought out new directional and power models – some 17 in all as I recall. During that time we recruited Alan Moore, now president of Bernafon Canada, as Canadian sales manager and Klaus Woerner (who would go on to found Automated Tooling Systems) joined us as a manufacturing engineer.

I left Unitron in 1977 to return to microcircuit design, much wiser for the experience and much richer for the many friends I made in the company and in the field. These were exciting times with a real sense of accomplishment and I will always look back with fondness on my years at Unitron. Fred always said "Work gotta be fun." And it was!

Patricia Yoshioka, Unitron's first audiologist

Circa 1980: Our audiology family tree sprouts its first branch for manufacturer sales representatives. Prior to this time audiologists in Canada were primarily diagnostic clinicians. Some did hearing aid fittings through funded agencies or clinics, but many audiologists did hearing aid prescriptions only. Many audiologists worked in combined speech and audiology departments.

In 1980 after three wonderfully busy years at Sunnybrook Hospital in Toronto I moved from clinical audiologist to become the first audiologist at Unitron Industries, and thus also became the second audiologist in Canada (the first Canadian audiologist) to work for a hearing aid manufacturer. Predating me by about a year was Debbie Frye of Widex, Canada's first audiologist hearing aid representative. At the time my personal decision to move into indirect patient/client care did not seem revolutionary and the new technical support role was greeted positively by audiologists all across the country. However, I soon found my new job was rather controversial for speech pathologists, and more importantly in our industry it was downright provocative for some long-time hearing aid dealers (as they were called at the time).

So why did Unitron's president Fred Stork and Koni Jakowidis,

Fred Stork and his wife Ruth were also well known for their charitable efforts. Some of their more recent contributions included:

- $2 million investment in local hospitals (Grand River Hospital Foundation and St. Mary's Hospital Foundation)
- $2 million to the Kitchener-Waterloo YMCA towards construction of the new Stork Family YMCA in Waterloo to break ground in 2009
- $1.5 million for the Waterloo Centre for German Studies at the University of Waterloo
- $1 million to KidsAbility Foundation
- $100,000 to the Canadian Hearing Society

Unitron's Canadian sales manager, hire an audiologist knowing the political climate and the fuss it would cause in some parts of the country? Koni always told me it was his idea but it was Fred Stork's pioneering nature (and chequebook) that supported the bold step. Fred always had his eyes on the future. What Unitron might have lost in sales from some established hearing aid businesses at the time, they made up in professional reputation amongst the rapidly expanding number of new audiology clinics and educational programs for hearing aid professionals.

My years at Unitron, 1980 to 1987, were exciting times for the whole hearing aid industry, for Unitron as a company and especially for me professionally. I fondly remember the challenge of stretching my clinical thinking to fit into engineering-focused discussions and making my user-oriented comments count at many technical (all-male) meetings. I was there as Unitron's first-generation custom in-the-ear products were born along with a total retooling of the production process. Unitron's workforce doubled in size giving Fred Stork a celebratory reason to build new corporate headquarters on Beasley Drive. I was given the opportunity to travel across our beautiful country from coast to coast, to meet many wonderful people, and to learn how differently each province handled audiology services and hearing aid dispensing. I acquired an enormous respect for the sole charge, general practitioner audiologist who was involved in everything related to hearing and noise in their community. As the first audiologist to step into many hearing aid offices, I also gained valuable insights into what it meant to run a small business in Canada and provide long-term customer service, especially in towns where everyone knows everyone, a big lesson for someone from a background of large, staff-salaried big-city hospital.

I always will be grateful to Fred Stork and Unitron for giving me the opportunity of a lifetime, to be there in the formative years for our profession and industry, as milder hearing loss and smaller hearing aids became more widely accepted. Few Canadians have the vision and drive to build a respected company from scratch and stay relevant and competitive through all the changes in technology. I am proud to have worked for Fred Stork, a true pioneer in our field and accomplished Canadian.

Back to Basics: For the First Time

By Calvin Staples

About the Author

Calvin Staples has worked clinically and as in-house audiologist for a total of 7 years. Currently he is employed at Bernafon Canada Ltd. as the in-house audiologist with the following responsibilities: technical support, education, training, and research support. Previously he was employed at Hamilton Health Sciences and Eastern Oklahoma Ear, Nose, and Throat. At both places of employment he was a clinical audiologist dealing primarily with adult audiology and hearing aids. His education was completed at Missouri State University whereby he received a master's degree in communication sciences and disorders with an emphasis in audiology.

Although modern hearing aid technology has advanced in leaps and bounds in recent years, all too frequently, I find myself being excited about a new piece of technology or a new term used in the hearing aid literature only to find out that all too often it's an old idea that has merely been re-invented. As a relatively young audiologist I have been fortunate enough to be surrounded by researchers within the field of Canadian hearing health care. And through my many interactions with this league of extraordinary gentlemen (and ladies) I have found out that all of our advances lead back to one place: audibility – audibility which is achieved with appropriate use of compression. The clinician merely needs to recognize this simple formula: If you cannot hear it, you cannot understand it.

Hearing aid manufacturer websites and promotional literature generally market each advance or modification of hearing aid technology as "the" long-awaited solution to the problems faced by people with hearing loss. It would be fair to say new technologies have made huge strides towards improving the listening experience of end-users. However, in many cases, more attention has been paid to advanced functions and technological developments than to the most basic (but most important!) function of hearing aids: to appropriately amplify speech so that it can be heard. This misplaced focus has likely cost many clinicians the ability to take full advantage of advanced technologies. The gain/output has to be correct in the first place to fully take advantage of the tools the manufacturer provides. All tools provided to the clinician to manage the sound of the instrument are direct or indirect manipulations of gain (Neil Hockley, personal communication, 2008), and many of these tools are designed to manage listener comfort so that audibility doesn't have to be sacrificed (Steve Aiken, personal communication 2007). When audibility is overlooked, these tools are of little value. The goal of this article is to remind the clinician that adaptive features and tools are merely interior decorating in the fitting process and that gain/output and compression provide the true foundation for hearing aid success.

Current hearing aid advanced features can be divided into three benefit-based categories (1) features that improve ease-of-use/end-user functionality, (2) features that help manage comfort so we do not have to sacrifice audibility and (3) features that may improve intelligibility. Ease-of-use/end-user functionality features include devices such as remote controls and Bluetooth receivers. These accessories accompany hearing aids and can provide increased overall satisfaction to a select group of end-users but have little or no effect on hearing aid performance. Features that improve comfort include noise reduction, open fittings, feedback cancellation, and soft-sound suppression algorithms. If these are implemented correctly, these can provide more effective audibility without the degree of compromise seen in the past. For instance, feedback cancellation may enable the use of a vent that is large enough to

eliminate the occlusion effect without severely restricting high-frequency audibility. Features that may improve intelligibility include implementations of directionality (e.g., multi-band adaptive directionality), frequency transposition, and (possibly) binaural integration. Whether these features are new to our field or simply managed in a new fashion through DSP (e.g., multi-band directionality), the goal has not changed: to improve speech audibility and understanding in quiet and in noise. Frequency compression allows us to compress the speech signal into a smaller frequency range in hopes of improving the audibility of speech cues in frequency regions where audibility is not possible. And hearing aids that employ binaurally synchronized processing are intended to preserve binaural cues and thereby facilitate sound localization and hearing in noise. The appropriate use of these features will likely translate into increased end-user satisfaction, but In order to make optimal use of these features, clinicians should understand their purposes and intended acoustic effects. Verification of these features is almost as important as verification of gain and compression. Time should be spent performing acoustic measures on the features to ensure that they are meeting their design goals (e.g., to improve comfort and increase audibility). A solid understanding of how software controls impact the response of hearing aid is also required to ensure we have optimal performance.

Unfortunately, the many features that can be used to increase end-user benefit and satisfaction also increase the complexity of modern hearing aids, and clinicians are frequently tempted to rely on software algorithms (i.e., "quick-fit" routines) to fit these newer hearing aids (Venema 2006). These software algorithms are notoriously inadequate for this purpose, and numerous studies have shown that these algorithms do not produce optimal audibility for most listeners (Keidser et al. 2003; Aiken and Staples 2006; Mueller et al. 2008; Seewald et al. 2008). Ironically then, the very presence of features that might increase end-user benefit encourages reliance on first-fit algorithms and likely results in poorer audibility (and thus reduced end-user benefit) in many cases.

Default and/or proprietary fitting algorithms tend to provide inadequate audibility and, most software fitting algorithms also do a poor job of adjusting hearing aids to published hearing aid gain and output targets (Keidser et al. 2003; Aiken and Staples 2006; Mueller et al. 2008; Seewald et al. 2008). In a study presented at the 2006 Canadian Academy of Audiology Conference (Aiken and Staples), software-based proprietary first-fit algorithms and target matches were assessed for 14 different Thin Tube Open Fit BTEs from nine different manufacturers (Figure 1). Not only did many of the first-fit algorithms provide poor audibility, but few provided reasonable approximations to DSL [i/o] and NAL-NL1 fitting targets (Figure 2). Each outcome measure provided in Figure 2 is the specific manufacturers' default setting compared to DSL [i/o] or NAL-NL1. Seven of the 10 outcome measures in Figure 2 are specific manufacturers' interpretations of DSL [i/o] or NAL-NL1 whereas three are manufacturer proprietary rationales. The worst NAL-NL1 target match provided a Speech Intelligibility Index value of 13 for soft (50 dB) speech. Based on the work of Sherbecoe and Studebaker (2003), this score would predict a score on the Connected Speech Test (Cox et al. 1987; Cox et al. 1988) of approximately 8%. Simply put, the NAL-NL1 software-based target match on one of the aids would have enabled the end-user to understand less than 10% of the words in ongoing speech. This is clearly unacceptable.

In the United States, clinicians rely

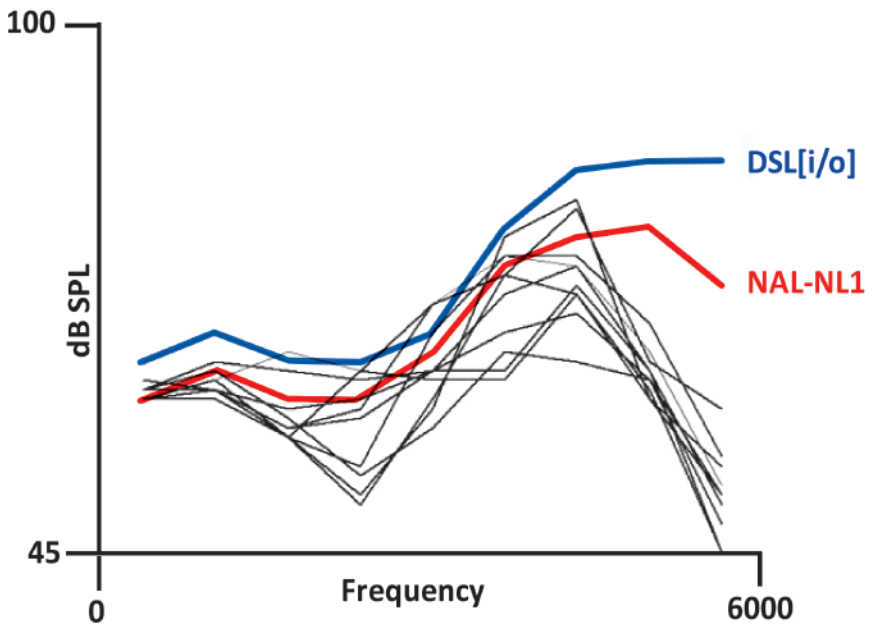

Figure 1. Manufacturer software-based proprietary first-fit algorithms and target match approximations to NAL-NL1 and DSL [i/o]. A mild hearing loss generated the response curves.

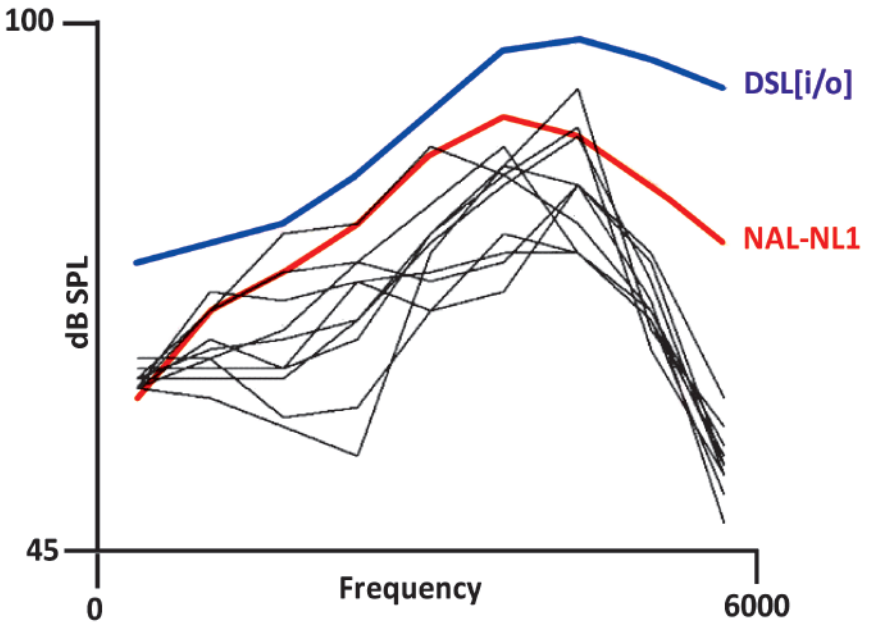

Figure 2. Manufacturer software-based proprietary first-fit algorithms and target match approximations to NAL-NL1 and DSL [i/o]. A moderate hearing loss generated the response curves.

on software algorithms to fit hearing aids (with no further verification) in approximately two-thirds of all fittings (Mueller 2005). In Canada, reliance on first-fit algorithms without verification appears to be less prevalent. A survey conducted by Bernafon Canada (2008) revealed that 63% of Canadian clinicians verify 100% of hearing aid fittings and that only 2% of Canadian clinicians rely entirely on first-fit algorithms (Figure 3). In sum, these data suggest that two-thirds of American clinicians and one-third of Canadian clinicians are relying on fitting techniques that are known to provide inadequate gain and output, and that many individuals with hearing loss are receiving sub-optimal treatment. Although there have been many positive developments in the design of hearing aids, these developments are of little value when audibility has not been achieved. Perhaps it is time to focus on the basics of hearing aid fitting.

At the most basic level, hearing aids provide gain to make speech sounds audible, but this gain is rarely static over time. The use of compression to fit hearing aids became common practice in the mid-1990s.

Compression is often described as a tool to make the signal softer, but it can also be used to make the signal more intense (i.e., in conjunction with increased gain). The perspective depends on which "side of the fence you are looking from" when you view compression. Compression can help amplify soft sounds more than loud sounds, but it can also decrease loud sounds with increasing level. At its most basic level, compression is the tool that allows us to provide more gain/output for soft sounds than loud sounds. Increased gain for soft sounds is thought to be a reasonable substitute for the gain typically provided by the outer-hair-cell-based cochlear amplifier. Venema (2006) distinguishes two functions of the outer hair cells: (1) they selectively amplify the softer sounds by increasing displacement of the cochlear partition and (2) they improve frequency selectivity by sharpening the peak of the traveling wave. Hearing aids can increase gain for soft sounds through the use of compression, but the broadly

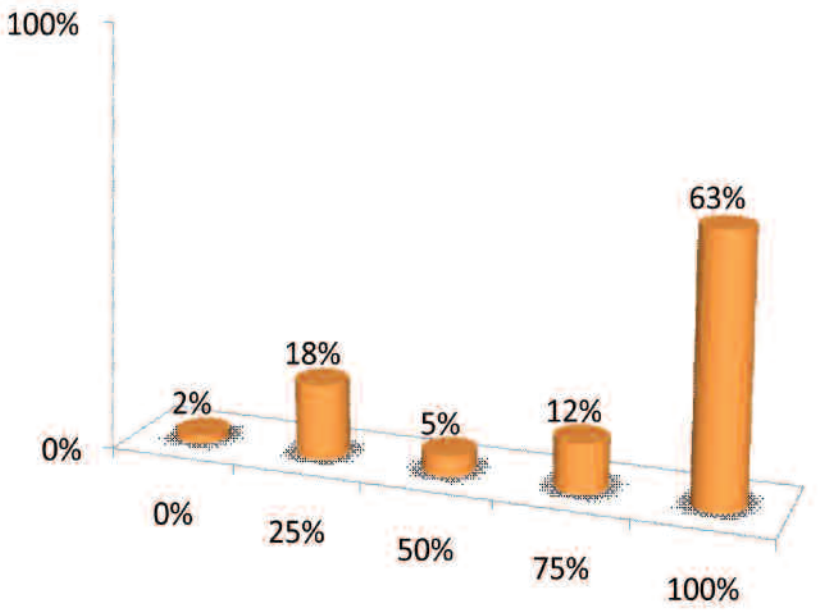

Figure 3. Percent of Canadian clinicians verifying hearing aid performance. The x axis indicates the proportion of aids that are verified using real-ear equipment.

peaked traveling wave in an impaired cochlea is unfortunately left unchanged. However, a fast compression algorithm which mimics cochlear function and a digital signal processor that selectively emphasizes speech cues might possibly be able to mitigate this problem.

Remember, compression maintains the gain for soft sounds (e.g., speech) while limiting the gain for the louder input levels. The point where the nonlinearity begins is known as the kneepoint, and the degree of nonlinearity is known as the compression ratio (CR). The CR should differ with the type of hearing loss and frequency range of the input (Keidser et al. 2007). Based on the work of Keidser and colleagues (2007), a CR between near 1:1 and 1.8:1 appears to be the optimal choice for low frequencies and a value of no more than 3:1 appears to be optimal for the high frequencies. However, this data is based on individuals with severe to profound hearing losses, which usually includes inner hair cell loss in conjunction with outer hair cell loss. Therefore, the value of mimicking outer hair cell function might be less. Furthermore, it could be argued that in cases of inner hair cell loss, higher CR values distort the signal too much and benefit is better achieved by maintaining a near-linear function.

Mimicking outer hair cell function requires more than just setting the compression kneepoint and ratio. To ensure optimal audibility of the speech signal, the attack and release times should not be ignored. The attack and release times can play a significant role in impacting an end-user's ability to hear in noise. All hearing aids are judged by how they work in noise, so clinicians should understand and be comfortable with the compression settings available in the manufacturer's software. The appropriate combination of kneepoint level, compression ratio, and attack/release time speed might be the difference between a successful and unsuccessful fitting. The attack time is simply the amount of time it takes the compressor to react to a signal and move to within 3 dB of steady-state again. The release time is similar in that it is the amount of time it takes the hearing aid to come out of compression, but be within 4 dB of its steady-state level. A long release time corresponds to any value between 500 ms and 20 s and a short release time is any value between 5 ms and 200 ms. A long or slow-acting compressor is typically called an Automatic Volume Control (AVC) and a short or fast acting compressor is known as a Syllabic compressor (Moore 2008).

There are many pros and cons to slow-acting and fast-acting compression, but the focus here will return to our primary concern, hearing speech in noise. The primary advantage of slow acting compression is that the envelope of speech is maintained close to its original form. This means that the shape of the signal is the same at the output as it was at the input, giving nearly all the amplitude envelope cues necessary for speech understanding. The end-user benefit from this type of compression appears to be that comfort is maintained while speech intelligibility is obtained in quiet or moderate listening environments.

However, in multi-talker noisy environments (the real area of concern for people with hearing impairment), slow acting compression is unable to react quickly enough to provide additional amplification for soft sounds. Multiple talkers in the same environment do not produce steady (e.g., white or pink) noise, since speech is a temporally modulated signal. Background noise thus tends to fluctuate, providing drops or dips in the signal where critical speech elements are available, such as the fundamental frequency. Normal hearing persons can take advantage of these dips to improve speech understanding, and possibly to help distinguish one talker from another; this phenomenon is known as "listening in the dips." For example, the fundamental frequency information heard "in the dips" may provide a grouping cue that makes it easier for target speech and background noise to be streamed into separate tracts (Hopkins and Moore 2009). People with hearing loss tend to be less successful at taking advantage of dips (Moore 2008). The ability to use the information in the dips appears to depend on the ability to perceive temporal fine structure (Hopkins and Moore, 2009), and this ability is often degraded in people with hearing loss.

Fast-acting compression may help people to hear the soft sounds in the dips, whereas slow-acting compression is likely unable to respond quickly enough to apply the appropriate gain to these low-level dips (Moore 2008). Perhaps a hearing aid could have two sets of compression parameters: one for quiet, easy, and comfortable listening environments (slow-acting compression) and another for busier and more challenging listening environments. Fast-acting compression could provide additional benefit for the more challenging environments by amplifying weaker sounds and making it possible to listen in the dips. However, it should be noted that although fast acting compression can provide increased speech understanding while in noise, cognition plays an important role in the ability to use the speech information in the dips (Gatehouse et al. 2006). Fast-acting compression appears to have a great chance of improving speech intelligi-

bility if cognition is intact: the better the cognition the better the ability to listen in the dips and therefore the better the acceptance of a fast acting compression system (Gatehouse et al. 2006). The downside of fast-acting compression is that it can distort the temporal envelope of speech and reduce spectral contrasts, thereby degrading speech cues (Moore 2008). Slow acting compression appears to be a safe option, whereas fast acting compression may involve higher risk but a higher potential reward. Arguably there is a need for a multi-speed compression system to meet the variable needs of hearing impaired listeners. The variables of degree of hearing loss, slope of loss, lifestyle and cognition all come into play when selecting an appropriate amplification scheme. And when dealing with compression, the clinician has to acquire enough information about the end-user to decide whether or not the improved moment-to-moment audibility of fast-acting compression outperforms the penalties associated with reduced temporal and spectral contrast (Gatehouse et al. 2006).

In the end, the basics of hearing aid fitting can be reduced to a few simple questions regarding audibility.

For hearing aid selection, the relevant question is: Is there value in amplifying the softest parts of speech for this listener so that he/she can listen "in the dips." If the answer is yes, the optimal approach is likely a fast-compression system (even though this produces more distortion than a slow-compression system). Research suggests that this is associated with cognitive function and with an ability to take advantage of temporal fine-structure. If the answer is no, the optimal approach is likely a slow-compression system that maintains the spectro-temporal pattern of speech with minimal distortion.

For hearing aid fitting, the relevant question is: are speech sounds suitably audible. The only way that this can be determined is by measuring hearing aid gain or output for speech in the real ear (or in a 2 cc coupler when real-ear to coupler differences are taken into account). Manufacturer first-fit algorithms may be used to set hearing aids up quickly, but these cannot be simply accepted without verification.

Acknowledgement

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On-Ear Verification of Open-Fit Technology Using Verifit Speechmapping

By David J. Smriga, MA

About the Author

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In 1997, North American BTE market share was 18.8%,[1] a figure consistent with the annual domestic market share reported during the two decades preceding 1997. In 2007, BTE market share was 51.4%,[2] Clearly, over the past 10 years, BTE's have enjoyed a remarkable renaissance. It was specifically after the introduction of open-fit and receiver-in-the-ear (RITE) technologies in 20032 that serious growth in BTE market share became apparent. Today, 64% of dispensers fit at least 26% of their patients with open-fit technology, and 38% of dispensers fit over half of their patients with open-fit products.[3]

Although the concept (and patient satisfaction advantages) of minimal occlusion are not new, the capabilities associated with today's digital signal processing hearing aids allow us to exploit these advantages more effectively than ever before. Digital feedback suppression technologies allow for greater access to feedback-free usable gain – a key barrier in prior non-occluded fitting applications. In addition, digital hearing aids provide substantial programming control of the hearing aid's frequency response, with greater access to gain in the higher frequencies than analog systems offered. And, lest we forget, BTE designs are far more cosmetically appealing today, especially when thin-tube or RITE designs are involved.

As cosmetically appealing and acoustically comfortable as open-fit technologies appear to be, their efficacy in providing meaningful hearing improvement is no less necessary to validate than with any other hearing instrument design. Anyone with consistent experience in fitting hearing instruments knows that what appears on the hearing aid's fitting software screen may not necessarily be what is happening in the patient's ear. This may be even more likely to be the case when open fit applications are involved. In order to truly know what the open fit instrument is providing to the patient, one must measure the performance of the hearing instrument on the patient's ear.

On-Ear Measurement Using Speech Stimuli (Speechmapping)

On-ear measurement of hearing aid performance using probe-microphone technology has evolved over the past three decades as well. With the highly interactive and adaptive functionality characteristic of today's digital hearing aid designs, the following probe-microphone procedure provides one of the most scientifically defensible ways to quantify aided speech audibility and associatively, the utility of digital hearing instrument settings:

1. Use the probe-microphone to measure aided eardrum SPL (the REAR) instead of measuring insertion gain (the REIG). This approach directly quantifies the aid's effectiveness in rendering the input condition audible.
2. Stimulate the instrument with level and spectrum controlled speech. This forces the dynamic interactivity of digital wide dynamic range compression to be engaged during the fitting procedure, thus insuring that the impact of this compression function is accounted for in the measured result. And, because the input condition is controlled, measured results can be used to specifically quantify hearing instrument performance.
3. Quantify the aided speech measurement by displaying it on the fitting screen as an aided "speech banana." The banana display allows for meaningful quantification of both gain and compression ratio effects.
4. Compare the aided speech banana with the patient's SPL audiogram thresholds and UCL levels to insure that the gain and compression settings have been set to maximize the resulting speech audibility.

In Figure 1, the gain and compression settings of the hearing instrument have been adjusted so that the aided speech banana (green shaded area) for 65 dB speech input resides between the patients SPL threshold line (the red line) and the patient's SPL UCL line (the asterisk line) in a fashion that emulates a normal hearing sensation. The gray shaded area on this graph is the speech banana of the 65 dB input signal. The difference between the gray shaded area and the green shaded area quantifies how the aid has amplified the input signal and how normal conversational speech is now reaching the eardrum. Gain is used to move the input signal into the patient's audible range, and compression is used to squeeze the banana so that it is properly nested within the patient's reduced dynamic window.

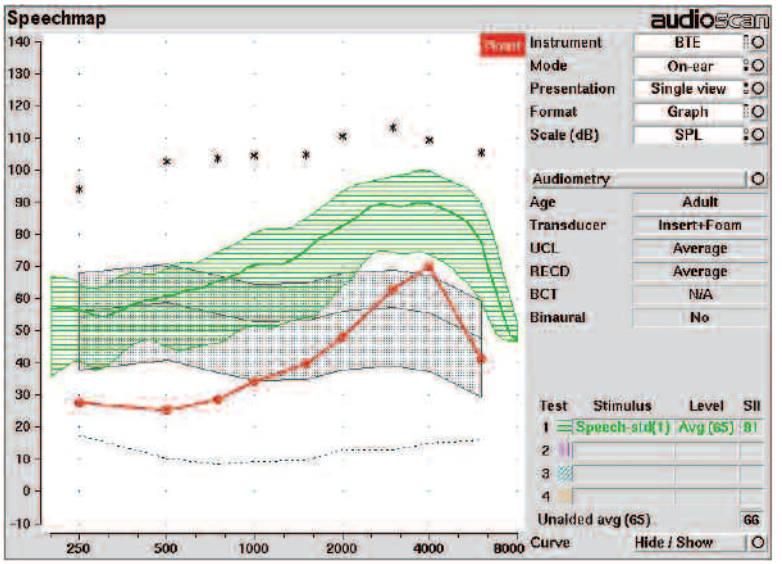

Figure 1. Speechmapping result on a conventional BTE. Green shaded area is the aided "speech banana" measured at the probe tip in the presence of 65 dB speech. The gray shaded area is the input signal "speech banana."

Using Speechmapping to Verify Open-Fit Programming

This same on-ear verification methodology can be used to quantify the performance of open-fit products, although some procedural modifications are needed to insure the quality of the result.

ISOLATING THE REFERENCE MICROPHONE DURING OPEN-FIT SPEECHMAPPING

When a conventional On-Ear Speechmapping test is initiated with the Verifit, the resulting input stimulus condition consists of two components. Initially, the input stimulus is a calibration pulse of approximately one second in duration. This calibration pulse is immediately followed by a calibrated speech stimulus recording (usually the "carrot passage") that is approximately 11 seconds in duration. The calibration pulse is used to check the SPL from the sound-field speaker that is reaching the reference microphone on the probe assembly at the patient's ear. Depending on the SPL measured during the calibration pulse, the subsequent speech passage level is automatically adjusted up or down by the Verifit to insure that the target test level chosen, is the level reaching the patient's ear. Normally, this levelling procedure is part of the speechmapping test paradigm, and is repeated with each calibration pulse presentation throughout the duration of the test while the hearing instrument is present, on and being programmed.

When conducting speechmapping with an open-fit hearing instrument, the calibration pulse – which is not only reaching the reference microphone on the probe assembly, but is also reaching the hearing aid microphone at the patient's ear – will be amplified by the hearing aid. This amplified hearing aid output could "leak" out of the open ear canal and reach the reference microphone. If this happens, the level that is read at the reference microphone would be a combination of the SPL from the sound-field speaker and the SPL leaking out of the open ear. Such a reading would result in a false representation of speaker SPL.

To eliminate the potential of this occurring, the "Open" instrument fitting protocol on the Verifit has been altered. When "Open" in the "Instrument" menu has been selected, the test procedure will initially display an "Equalization" bar. Prior to starting this equalization step, the open-fit hearing instrument must be on the patient's ear with the probe tube/assembly properly positioned. But, the hearing aid should be "Off" or muted through the programming software. When starting the equalization step, the calibration pulse will be presented in isolation, and the SPL level measured at the reference microphone will be recorded and stored by the Verifit system. Once this calibration step has been completed, turn the instrument "On." Then start the test, which will begin immediately with the speech passage. No calibration pulse will precede the speech passage presentations. The patient will need to sit still while the test is being conducted. This two-step procedure insures that the calibration level will be free from any amplified signal leakage.

GRAPHIC QUANTIFICATION OF OPEN-AIDED BENEFIT

As Figure 2 indicates, the vent effects of a thin-tube, or open fitting are substantial in comparison with more conventional venting techniques.[4] It is likely that in an open-fit condition, the hearing instrument will not enhance input signal audibility below 2 kHz. Thus, in order for a patient to be a good open-fit hearing instrument candidate, unaided speech energy below 2 kHz should be audible. If this is not the case, a less open coupling would be required. Figure 3 depicts a typical audiogram condition that would represent an ideal candidate for an open fitting. The unaided speech banana (grey shaded area) is above this patient's SPL thresholds below
2 kHz, but amplification is required above 2 kHz to maximize speech audibility.

In Figure 4, an open fit product has been fit to this patient, and the instrument has been adjusted to maximize audibility above 2 kHz, which is evident through the positioning of the green shaded area (aided speech banana for 65 dB input) relative to the patient's eardrum SPL threshold.

An additional step that is useful when analyzing the aided speech banana result of an open-fit product is to compare it to an "aid-off" speech banana at the same 65 dB input level. This has been done in Figure 5. The difference between these two bananas quantifies what the hearing instrument has contributed to the aided condition. In most open-fit cases, these two bananas will look virtually identical below 2 kHz, indicating that this open-fit product is indeed providing no change in eardrum SPL compared to the unaided condition in this frequency range. However, above 2 kHz, the aided speech banana is more completely above threshold than was the case in the "aid-off" condition.

Although graphically, this aided result may seem a bit underwhelming, it indeed can provide substantial utility in terms of speech audibility.

SII QUANTIFICATION OF OPEN-FIT-AIDED BENEFIT

To the right of each Test button on the Verifit Speechmap screen, there is a Speech Intelligibility Index (SII) score. This score reflects the contribution speech audibility plays in overall speech intelligibility and ease of listening. The SII calculation is the updated version of the Articulation Index (AI) and was published in ANSI S3.5 – 1997.5 The percentage value that is displayed on the Speechmap screen represents SII idealized speech recognition for long term averaged speech stimuli (LTASS) in the unaided and each aided condition. Unlike more conventional speech discrimination testing, the SII calculation takes into account factors of audibility that conventional speech discrimination tests don't. Specifically, it is possible to score 100% on a conventional single word or connected speech discrimination test even though portions of the speech banana are still inaudible. The SII score accounts for all elements of the speech banana that are audible or inaudible. A higher SII score means more of the speech banana is above threshold, and therefore more redundancy in speech

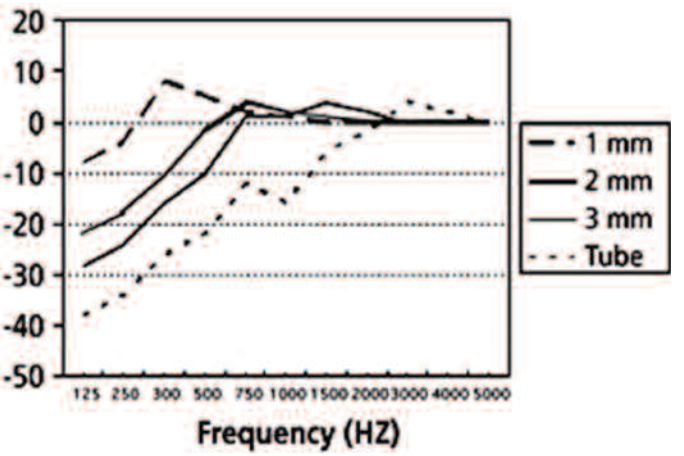

Figure 2. The comparative vent effects of an open "tube" fitting to other more conventional parallel vent diameters. (From Fabry D. "Facts and Myths: The 'Skinny' on Open Fit Hearing Aids." Hearing Review May, 2006.

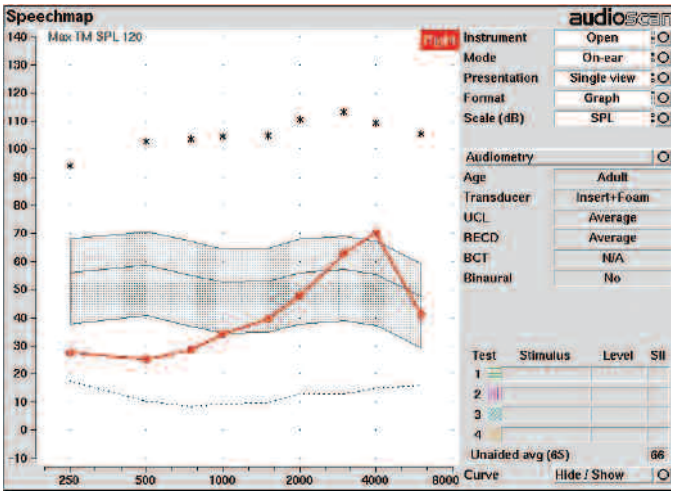

Figure 3. Red line is the SPL thresholds of a moderate high frequency hearing loss. Gray shaded area is the "speech banana" for 65 db speech. Note how low- and mid-frequency energy is audible in this unaided condition, but high frequencies (above 2 kHz) are not.

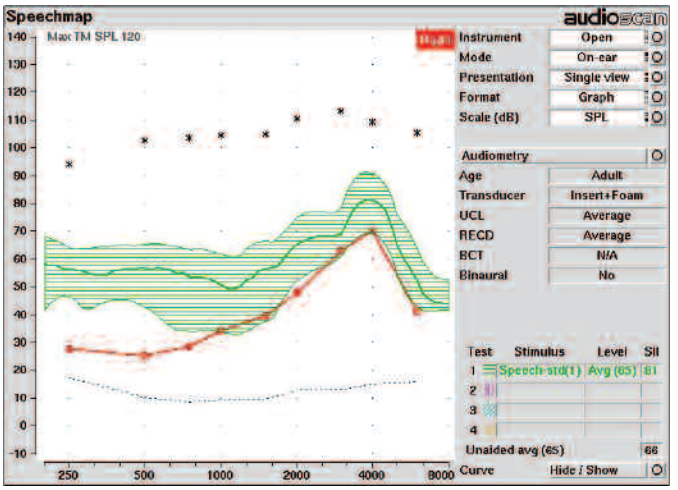

Figure 4. The green shaded area represents the aided "speech banana" delivered at the probe tip by an open-fit hearing instrument adjusted to maximize speech audibility for the 65 dB speech input condition used.

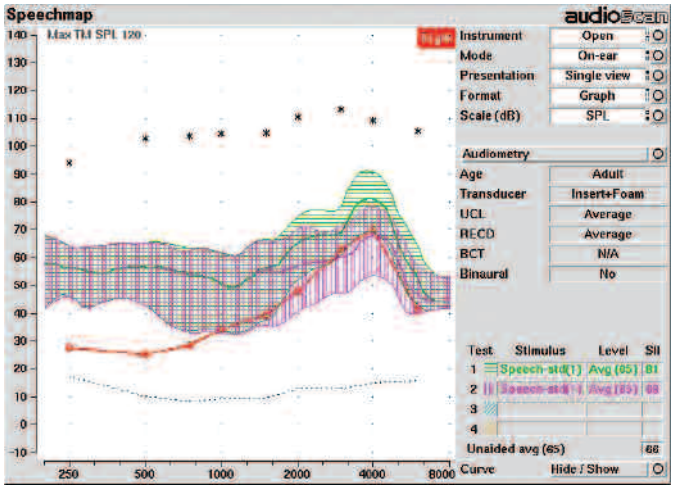

Figure 5. The pink shaded area is the eardrum SPL "speech banana" for 65 dB speech input measured at the probe tip with the open-fit hearing aid turned OFF. The green shaded area is the eardrum SPL "speech banana" with the same hearing aid turned ON. The difference between the two indicates where amplification has reached the eardrum.

queues are now available, enhancing overall speech intelligibility and ease of listening in varied listening situations.

In the case of Speechmap verification of open-fit utility, this SII score becomes increasingly more useful in quantifying the value of hearing aid performance. In the Figure 5 example used earlier, the SII score associated with the aid-off speech banana result is 68, whereas the SII score associated with the aid-on speech banana result is 81. Although an SII score above 70 can represent sufficient audibility to produce 100% discrimination from a peripherally hearing impaired patient, a delivered SII result of 81 indicates that there are substantially more speech queues now audible for that patient in the aided condition, increasing the overall speech intelligibility and ease of listening experience that the patient will have. When one considers the importance of high frequency speech queues not only in speech understanding, but also in listening quality in the presence of background noise, this substantive improvement in the SII score is particularly relevant. Thus, referencing the SII score result can become an important tool in counselling.

Measuring Open-Fit Technologies on a 2 cc Coupler

Generally, hearing aid coupler measurements are occluded measurements, whether on an ITE or a BTE coupler. As such, they cannot be used to meaningfully represent the open-fit hearing aid performance that is likely to be delivered to the patient's ear. For the purposes of quantifying certain hearing aid functions, occluded coupler measures of thin-tube or RITE products can be made, as long as the individual collecting these measurements does not use them as a basis to judge aided audibility potential.

Summary

Speechmapping is both an effective and a preferred method for objectively quantifying a hearing instrument's ability to provide audible speech energy at the eardrum. Using a dynamic input such as speech forces the dynamic and frequency specific compression characteristics of today's digital hearing aids to be engaged during the fitting procedure. Therefore, speech input is the preferred input when fitting digital hearing aids. Measuring aided eardrum SPL (the REAR) in the presence of speech input and comparing this result to the patient's eardrum SPL threshold is a direct way of verifying whether or not the hearing aid's gain and compression settings are sufficient to deliver audible speech.

Open-fit technologies can be measured using Speechmapping provided that steps are taken to insure that the reference microphone levelling procedure is not contaminated by vent leakage. Once this is done, the gain and compression settings of open fit products can be verified as can be done with more conventional hearing instruments.

Typically, a thin-tube or RITE coupling of the hearing aid to the patient's ear will eliminate gain below 2 kHz from reaching the eardrum. This circumstance should be taken into account when selecting open-fit candidates, or when choosing the coupling option to be used with an open-fit product.

Measuring the REAR for speech with the hearing aid on the patient's ear, but turned off (or muted), and then comparing this speech REAR result with the result obtained on the patient's ear with the hearing aid on, can graphically quantify the frequency range of delivered aided performance.

Comparing the SII score obtained with the hearing aid off to the SII score obtained with the hearing aid on, can quantify the impact delivered aided performance has had on speech intelligibility. The SII score is more sensitive than traditional speech discrimination scores in quantifying subtle improvements in audibility that nevertheless contribute greatly to speech intelligibility and ease of listening.

Hearing aid coupler measurements, by design, are occluded measures, and should not be used to estimate actual hearing aid utility. The only way to accurately quantify hearing aid utility is through direct measurement of hearing aid performance on the patient's ear using a probe microphone.

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Cell Phone and Hearing Aid Compatibility

The cell phone industry finally has embraced HAC

By Larry Brethower, ScD, BC-HIS

During the 1970s and 1980s, custom in-the-ear (ITE) hearing aids became very popular. Many hearing care professionals – and their clients – soon realized that a telephone handset held closely to one of these custom aids would generate a "whistling" or feedback condition. This created a need for an induction coil to be installed inside the aid – the advent of the telecoil or t-coil option.

Various compatible accessories were developed for use with the telecoil option. In the 1990s, cell phone use gained tremendous popularity. The hearing aid telecoils did not work well (some not at all) with cell phones. In fact, it was found that, when cell phones were used with hearing aids equipped with or without telecoils, a loud buzzing/whistling would occur (i.e., poor compatibility between cell phones and hearing aids).

In the late 1990s, many hearing aids were introduced with a digital technology platform; however, cell phone/hearing aid compatibility did not improve. Since 1995, the hearing aid industry has been collaborating with the cell phone industry to develop standards that would allow hearing aids to perform well with cell phones. The results of this collaborative effort developed a standard set of immunity and emissions requirements, including testing protocols,[1] that both devices must adhere to. During this development process, the hearing industry was able to improve the immunity standard (shielding) of their digital hearing instruments, far surpassing previous performance levels. Having achieved this level by 2002, the hearing aid industry was surprised to learn of no emissions improvement by the cell phone industry.

In July of 2003, the FCC reopened hearings to address the cell phone industry's lack of improvement. The FCC defined more specifically the standards to be met by 2006 for the cell phone industry. Since then, the cell phone industry has quickly achieved and surpassed the standards. They currently offer over 90 models of phones with an acceptable M-3 emissions rating.

Assessing the Phones: T- and M- Ratings

The cell phone and hearing industry have developed a scale by which the consumer may accurately judge the compatibility/performance of their products. The immunity ratings for hearing aids are on a scale of 1 to 4, with 4 expected to be the best performance level. The emissions rating for cell phones is also on a scale of 1 to 4; again, with four resulting in the best cell phone/hearing aid compatibility. The compatibility is further segregated into a performance analysis using a hearing aid telephone coil option (t-rating), and a performance level using the hearing aid microphone only (m-rating). When the consumer is attempting to discern the best performance between a hearing aid and cell phone, the numbers from the m-ratings of both the cell phone and hearing aid should be added together (summed). Of course, if telephone coil compatibility/performance is to be assessed, the t-ratings of each device should be summed. T-ratings should not be summed with m-ratings; the two ratings should always be kept separate.

A hearing ability scale has also been developed for the consumer. This scale ranges from 1 to 6 – with 6 expected to have excellent telephone

Since 1995, the hearing aid industry has been collaborating with the cell phone industry to develop standards that would allow hearing aids to perform well with cell phones.

communication performance, and 5 to be considered a "normal" expectation level for the consumer.

The collaborative efforts between the cell phone and hearing aid industry have resulted in many aids and cell phones achieving a summated score of 5 – a "normal" level of cell phone communication performance. A good hearing aid user goal would be a hearing aid with an M-3 immunity rating, added to a cell phone with an M-3 emissions rating, summating to a total of 6 – an excellent hearing aid/cell phone communication ability result!

Since 2006, the major hearing aid manufacturers have most of their current product lines at a minimum M-2/T-2 immunity rating. Some hearing aid manufacturers have certain hearing aid models available at M-3/T-4 immunity ratings. This, of course, provides better compatibility results with a broader variety of cell phones (e.g., those that may have only an M-2/T-2 rating). As mentioned earlier, over 90 cell phone models currently have M-3 ratings.

Hearing aid wearers should always ask cell phone carriers what the emissions ratings are for any new phone being considered for purchase, and cell phone providers should have this information available. Additionally, nothing takes the place of an actual field test of the cell phone.

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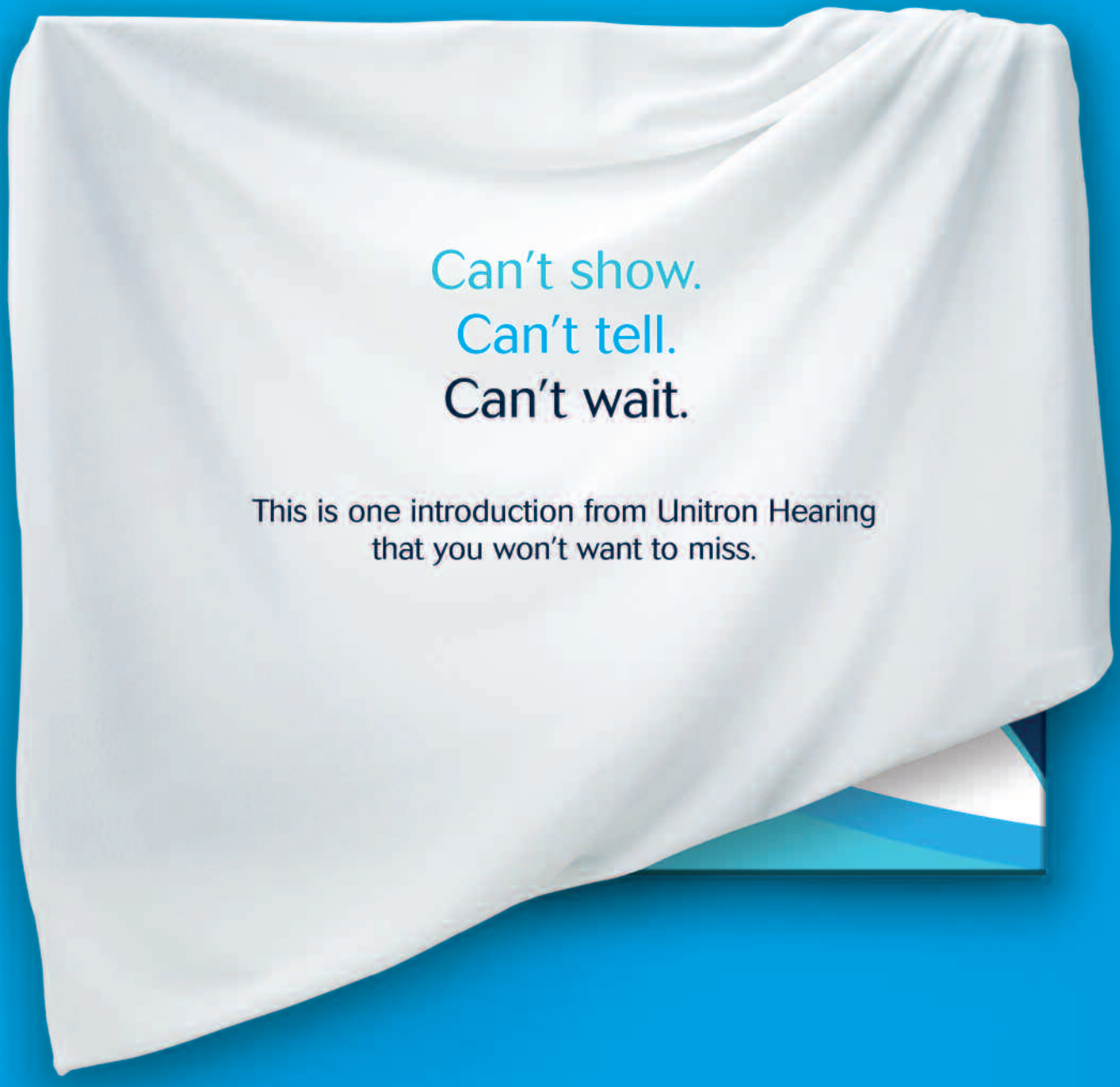

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