Editor's note
Éditorial

Special Issue: Audiology and Neurosciences

Acoustics is a broad subject matter that currently employs hundreds of us across Canada in fields as different as teaching, research, consulting and others. To reflect such diversity the Canadian Acoustics has been regularly publishing over the last 40 years a series of special journal issues to highlight thematic topics related to acoustics. Therefore, it is my pleasure to present this special issue which includes research topics on audiology and in neurosciences related to acoustics and/or music.

Among the articles included in this special issue, you will find: a contribution aiming to raise the awareness of the damage to the integrity of the peripheral auditory system, an article about the development of an acoustical beamformer based on eye movements recordings and several articles investigating the effect of bilingualism, musical training, and intermittent noises on the auditory brainstem responses.

I would like to thank all the authors whose contributions are the essence of this special issue. I would also like to acknowledge the reviewers for their support and their promptness during this busy time of the year. This was much appreciated.

Before closing this editorial, I would like to welcome Pierre Grandjean, PhD student at Université de Sherbrooke, who kindly accepted to be our new Copyeditor, as I am stepping down from this role.

I wish you a pleasant reading, and a pleasant summer!

Olivier Valentin
Guest editor-in-chief

Édition spéciale : Audiologie et Neurosciences

L'acoustique est un vaste domaine qui offre des centaines d'emplois à travers le Canada, et ce, dans différents secteurs tels que l'éducation, la recherche, la consultation professionnelle, et bien d'autres. Afin de bien refléter cette diversité, l'Acoustique Canadienne a publié régulièrement au cours des 40 dernières années une série de numéros spéciaux pour souligner les divers champs d'applications de l'acoustique. C'est donc avec plaisir que je vous présente ce numéro spécial portant sur des thématiques recherche en audiologie et en neurosciences en lien avec l'acoustique et/ou la musique.

Parmi les articles de ce numéro spécial, vous trouverez : un article de sensibilisation sur les principales atteintes du système auditif périphérique, un article traitant du développement d'un *beamformer* basé sur l'enregistrement des mouvements oculaires et plusieurs articles portant sur l'effet du bilinguisme, de l'apprentissage musical et des bruits intermittent sur les potentiels évoqués du tronc cérébral.

Je tiens à remercier tous les auteurs dont les contributions sont l'essence même de ce numéro spécial. Un grand merci également aux évaluateurs pour leur support et leur promptitude en cette période de l'année souvent très chargée.

Avant de terminer cet éditorial, je tiens à souhaiter la bienvenue à Pierre Grandjean, étudiant au doctorat à l'Université de Sherbrooke, notre nouveau relecteur-réviseur.

Je vous souhaite, à toutes et à tous, une bonne lecture et un été agréable !

Olivier Valentin
Éditeur-en-chef invité

AUDITORY FUNCTIONS OF THE PERIPHERAL HEARING SYSTEM AND THE COMMON CONDITIONS AFFECTING SOUND CONDUCTION

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Résumé

Le système auditif périphérique combine une transmission mécanique et électrique via les différentes structures de l'oreille externe, moyenne et interne. L'Organisation Mondiale de la Santé estime que 6,1% de la population présente une atteinte auditive bilatérale. Cet article résume le rôle des différentes composantes du système auditif périphérique et présente les causes les plus communes de perte auditive touchant la transmission mécanique des sons chez l'humain. Quelques causes fréquentes d'atteinte auditive touchant la transmission neurale sont aussi abordées. Plus précisément, l'occlusion du conduit auditif externe, l'otite externe (dans le cas où l'enflure est si importante qu'elle bloque le conduit auditif), la dysfonction tubaire (trompe d'Eustache), l'otite moyenne séreuse et aiguë, la perforation tympanique, le cholestéatome, la discontinuité ossiculaire, l'otosclérose, la maladie de Ménière, la presbyacousie et la perte auditive causée par l'exposition au bruit sont brièvement abordés dans cet article afin de sensibiliser l'ensemble de la communauté de l'Acoustique Canadienne à ces problèmes et pathologies.

Mots clés : système auditif, anatomie, physiologie, conduction mécanique, pathologies

Abstract

The peripheral hearing system combines mechanical and electrical transmission through the different structures of the outer, middle and inner ear. The World Health Organization estimates a prevalence of 6.1% of the world population living with a bilateral disabling hearing loss. Here, the roles of the different peripheral hearing system structures are reviewed and the most common causes of hearing loss related to mechanical transmission in the human ear are presented. Some common causes of sensorineural hearing loss are also discussed. More precisely, ear canal blockage, external ear infection (when the ear canal is blocked due to severe swelling), Eustachian tube dysfunction, serous and acute otitis, tympanic membrane perforation, cholesteatoma, ossicular chain discontinuity, otosclerosis, Meniere's disease, presbycusis and noise-induced hearing loss are briefly presented in this paper in an attempt to highlight these problems and pathologies to the Canadian acoustical community.

Keywords: hearing system**,** anatomy, physiology, mechanical transmission, pathologies

1 Introduction

The prevalence of hearing loss worldwide is difficult to estimate. Studies on the subject use different measuring tools, ranging from subjective questionnaires (completed by the subject or by someone in the household) to clinical evaluations in a sound-attenuating booth. Moreover, the criteria to conclude the occurrence of hearing loss vary in terms of intensity and frequencies.

For example, Goman and Lin (2016) determined the prevalence of hearing loss in the US by using an average criterion to sort the impairments by severity. This average criterion was computed using pure-tone thresholds estimated at 500, 1000, 2000 and 4000 Hz in a sound-attenuating booth. If the average criterion was superior to 25 dB HL, individuals were considered to present a hearing loss [1]. Using such methodology, Goman and Lin concluded that the prevalence of hearing loss in the US for 12 year olds and older is estimated at 23% [1]. Their study also reported that mild hearing loss was more frequent (estimate of 25.4 million cases), except for individuals aged 80 years or older for whom a moderate hearing loss (mean threshold between 41 and 60 dB HL) was more frequent than a mild hearing loss (mean threshold 26 to 40 dB HL). Using the same severity criterion and average frequency method, Feder et al. (2015) estimated that 19.2% of Canadians aged between 20 and 79 years old presented a hearing loss and that 12% of Canadian adults suffer from a mild hearing loss [2]. Their study also reported that the prevalence was more important in younger subjects (less than 10%) and reached 50 to 65% in 70-79 years old [2].

As for children and teenagers, Feder et al. (2017) studied 2434 individuals aged between 6 and 19 years old with valid audiometric results. In this study, they defined the hearing loss as a pure-tone average (for each ear separately) of more than 20 dB HL in individuals aged between 6 and 18 years old and of more than 25 dB for individuals aged 19 years old, using different pure-tone average frequencies. A global average was computed using thresholds estimated at 500,

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