



60
years

1960 - 2020

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Front cover photo, overall layout
and graphic design:

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Author Presentations

Stig Arlinger

Stig Arlinger, born in 1939, received a Master's degree in electrical engineering from the Royal Institute of Technology, KTH, Stockholm, Sweden in 1962, and a second Master's degree in biomedical engineering from the University of Pennsylvania, Philadelphia, USA in 1964. In 1976, he received the degree Dr. Med. Sc. from the Faculty of Health Sciences, Linköping University and in 2004, the PhD HC from the Faculty of Arts and Sciences, Linköping University.



Starting in 1966, he joined the newly established audiological clinic of the Linköping University Hospital. From that year until retiring in 2005, he was involved in daily clinical work with a focus on advanced diagnostic testing. Since 1991, he has been affiliated with Linköping University as an adjunct professor in technical audiology. He is the author or co-author of around 200 scientific publications concerning hearing impairment, diagnostics, hearing aids, hearing protection, and noise-induced hearing loss.

Since 1976, he has been active in international standardization concerning audiometry, audiometric equipment, hearing protectors and hearing aids. He has been active in national, Nordic and international organizations within audiology and was the chief editor of Scandinavian Audiology from 1983 to 1987 and of the International Journal of Audiology from 2002 to 2004.

Haakon Arnesen

Haakon Arnesen was born in 1962, received his MD degree at the University of Oslo in 1991 and a specialist degree in Ear Nose and Throat (ENT) in 2000. He has worked at the ENT department, Trondheim University Hospital (St. Olavs Hospital) since 1995 and holds a medical position responsible for the Hearing Center since 2000. Since January 2019, he has also been a lecturer, half-time, at Norwegian University of Science and Technology (NTNU).



Furthermore, from 2002-2015 he was a member of the audiological association committee of the Norwegian ENT association (2007-2012 as chairman). In 2015, he was elected chairman of the NAS board and was president of the NAS 2016 conference in Trondheim.

His main clinical interest is audiology and otoneurology with special interest in tinnitus and sound sensitivity. Among other things, he was in charge of the group that delivered the report “Behandlingstilbud for tinnitusrammete” on a mission from the Norwegian Directory of Health in 2005. He has also been chairman of the Reference Group for the National Treatment Service of Vestibular Schwannomas since 2013. At St. Olavs Hospital, he is a member of the cochlear implant group, the APD (auditory processing disorder) group and the newborn hearing screening group.

In his position as a lecturer, he is involved in teaching medical students, audiologist students and clinicians in audiology and otoneurology, including vestibular disorders.

Erik Berninger

Erik Berninger has broad competence and experience in audiology, industrially (3 years) and clinically (since 1983). He graduated in Technical Physics and Electric Engineering in 1980 (MScEE). His PhD work on quinine as a model for a common and hard-to-master sensorineural hearing loss (SNHL) has distinct clinical importance.



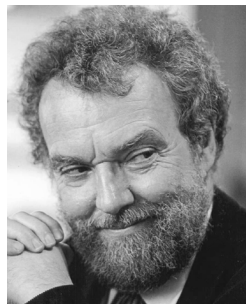
He is now an Associate Professor at Karolinska University Hospital, Karolinska Institutet, Stockholm, Sweden. Earlier positions are Head of Technical Audiology and Head of Research, Development, and Education. Erik Berninger and Kjell Karlsson introduced universal newborn hearing screening in the Stockholm area in 1998.

In addition to early intervention with hearing aids, Erik Berninger introduced clinical routines and methods for very early audiological diagnostics. Recently, he introduced next-generation sequencing in collaboration with Lisbeth Tranebjaerg (Denmark) and Richard JH Smith (USA) in paediatric research. Current research activities are within causes and mechanisms behind congenital SNHL, impact of early intervention during a sensitive period of development, and binaural processing.

Among his various interests are literature, sailing, down-hill skiing, and bird-watching.

Ture Dammann Andersen

Ture Dammann Andersen started in audiology as an engineer with a bachelor's degree in electronics and acoustics working with hearing aid (HA) design at a Danish HA manufacturer. This was back in the analogue era with discrete HA components. Becoming interested in the auditory system and the disorders in this system, he started as a medical student at the University of Southern Denmark in 1975. Since 1985, he has worked as an ENT doctor and medical audiologist at three Danish university hospitals.



From 1994 to 2015, he worked at the Department of Audiology at the University Hospital of Odense. Since 2006 and thereafter, he was an Assoc. Prof. at the University of Southern Demark. Here, he initially joined a working group designing a new study of audiology and subsequently became a lecturer in this field.

Kerttu Huttunen

Kerttu Huttunen, PhD, speech and language therapist, is a professor of Logopedics at the University of Oulu, Finland.

She has worked clinically among both children and adults with hearing impairments and educated speech and language therapy students in the field of hearing-related communication disorders. Additionally, she has conducted research on the impact of impaired hearing on children's development and quality of life of children, their families, and adults.



From 2014 to 2020 she has served as an NAS Board member.

Bue Kristensen

Bue Kristensen is a Vice President at Interacoustics. Formally educated as a teacher of music and philosophy, he joined Interacoustics in 1992. Following many years of being responsible for global sales and product management, recent years have been spent using his position as Vice President to work in external affairs of strategic importance. This includes overseeing the Interacoustics Research Unit that was started at DTU together with Claus Elberling in 2013 and holding the overall responsibility for globally operating the Interacoustics Academy.



A central area of interest has always been a deep involvement in identifying and maturing and implementing new technologies such as Wideband tympanometry, CE-Chirps and the new technologies in ASSRs.

He also holds positions on the Eriksholm Management Board, on the Eriksholm Scientific Advisory Board and additionally at DTAS.

Einar Laukli

Einar Laukli was born in Bodø, Northern Norway in 1944. He studied engineering at the Technical University of Norway (NTH), Trondheim. His Master's degree was in electronics/acoustics. After four years in the telephone industry, he joined the ENT Department at the University Hospital in Tromsø. In 1983, he presented his PhD thesis on auditory brainstem responses, and in 1986, he was promoted to a professor in audiology.



He has been the chief editor of Scandinavian Audiology, president of NAS, president of EFAS, associate editor of the International Journal of Audiology and council member of IERASG. He was the editor of the Norwegian edition of the Nordic textbook of audiology.

Claes Möller

Claes Möller MD, PhD, is an otolaryngologist (ENT) and Professor emeritus in Audiology and Disability Science at Örebro University and the Audiological Research Centre of Örebro University Hospital.



Professor Möller has about 200 publications in international journals, 24 book chapters, and approximately 1000 presentations. His research encompasses genetics, otolaryngology, otoneurology, paediatrics and audiology.

A special interest for more than 30 years has been research in syndromic deafness and deafblindness. Another special interest during the years has been Usher syndrome where professor Möller together with Professor Kimberling and co-workers during the years have described audiological, vestibular and visual features and made discoveries of genes in Usher types 1 and 2. In the last 10 years, the focus has been on inter-disciplinary biopsychosocial research in deafblindness within the Swedish Institute for Disability Research at Örebro University.

Claes Möller was the Chairman of NAS from 2006-2016.

Kristbjörg Pálsdóttir

Kristbjörg Pálsdóttir is an audiologist, MSc. She studied at Gothenburg University and obtained her BSc degree in 2007, after which she took MSc from Lunds University. She has worked in Iceland and Sweden.

Currently, she works at the Icelandic Hearing and Speech Instituted in Reykjavik, where she has worked since her school years. After she finished studying, she moved twice to Sweden where she worked at the Children's Hearing Habilitation Center in Rosenlund, Stockholm and at the Audiologist Reception at Hallands Hospital in Kungsbacka.



In Iceland, she works in general audiology, ABR/ASSR diagnostics and is responsible for habilitation of children 0-6 years of age.

Introduction

Haakon Arnesen, Norway, Chairman of NAS

The Nordic Audiological Society (NAS) was founded in 1960. Today, NAS consists of 28 member organizations from the five Nordic countries. The member organizations represent all the audiological professions and the user organizations for hard-of-hearing and deaf people. NAS is thereby an umbrella organization, the main goal of which is to increase knowledge on audiological topics and to inspire collaboration between its member organizations and their members.

In 2000, NAS published a yearbook representing the first 40 years of its history. In 2020, NAS decided to publish a similar yearbook mainly representing the last 20 years of its 60-year history together with some background information since the establishment of NAS in 1960.

Worldwide, 2020 turned into an unpredictable year. The coronavirus pandemic affected everyone in one way or another. Due to travel restrictions caused by the pandemic and to avoid the spread of infection between the participants, the NAS 2020 conference was first postponed from May to November 2020. However, the NAS board decided in June to postpone the conference to 2022 due to the general anticipation that the pandemic would continue throughout 2020 and even through most of 2021. The NAS board decided to keep the planned conference site as Odense, Denmark, in 2022. This 60th anniversary yearbook of NAS was planned to be published during the conference in June. Instead, it was decided to publish the yearbook in digital form and to present it at the NAS annual meeting September, 2021.

The two main activities of NAS are to arrange an audiological conference every other year and to maintain its ownership in the International Journal of Audiology (IJA).

The conferences alternate in a regular manner between the five Nordic countries, with each country arranging the NAS conference every 10th year. The maximum number of participants at single NAS conferences has been 550, but during the last few years, the NAS board has had a main concern in maintaining an adequate number of participants at NAS conferences. There is an obvious and continuously emerging strategy of employers (e.g., hospitals) to maintain lower costs, which restricts the number of employees who can obtain coverage of the conference costs by their employers. To inspire participation in the NAS conferences, the goal of NAS is to maintain topics with broad interest for people concerned with audiology and to invite Nordic and international speakers with great merits in their fields. Additionally, NAS must try to keep the conference costs down to make it possible for as many participants as possible to afford attending the NAS conferences. It will be a major concern for the NAS board in the future to maintain the balance between extraordinarily good presentations on audiological topics without exceeding reasonable costs for the participants of the NAS conference. In a world with growing availability to online knowledge, we in NAS still believe that conferences where we meet are crucial for the further development of audiological competence. An important factor in this is how we organize audiological care in Nordic countries in the best possible manner.

The International Journal of Audiology, IJA, is collaboratively owned by NAS, the British Society of Audiology (BSA) and the International Society of Audiology (ISA). Each of these three organizations has two members in the IJA Council. The chairman, secretary and treasurer in the IJA Council are regularly alternating every second year between the three abovementioned organizations. Although there is a growing number of audiological journals around the world, IJA has achieved and maintained its position as one of the top five audiological journals worldwide. The rank is based on the impact factor, which reflects how often the articles in IJA are cited in other scientific publications.

Among other tasks initiated by the NAS, the most demanding was working with the Nordic Textbook of Audiology, which was made in collaboration between the Nordic countries and completed in 2006/2007.

The textbook was then translated into Swedish, Norwegian, Finnish and Danish and, after that, published in the respective languages. Since 2007, NAS has supplemented the annual meetings between the NAS conferences (i.e., every second year) with a symposium to make the annual meetings more attractive to its member organizations. In 2015, NAS established a travel grant system to inspire its members (i.e., members of the member organizations in NAS) to give presentations at international conferences. NAS has funded a project developing the International Classification of Functioning, Disability and Health (ICF) core sets for hearing loss and initiated and funded a project on evaluating the status of audiological rehabilitation in each of the Nordic countries. This work was realized as one report from each of the Nordic countries published in 2015 and supplemented by a combined summary of the five reports.

The different topics in this 60th anniversary yearbook of NAS are written by persons who have been of great importance for the history of NAS. They have played a central role in NAS, achieving its position as a crucial actor in developing audiological education and patient care in Nordic countries.

I thank all the writers for their contribution to both the development of NAS and for their texts and photos to show the history of NAS. I hope that you, the reader of this yearbook, find it interesting to read about the history of NAS and that you are inspired to participate in the NAS conferences in the future.

NAS and International Relations

Einar Laukli, Norway

Introduction

NAS is an organization consisting of professional societies in each of the five Nordic countries together with societies for the hard of hearing. NAS represents several hundred thousand subjects, but the individual persons are not members of NAS but through their local societies. Member societies include ENT specialists, audiometricians, physicians/engineers and therapists, as well as societies for the hard of hearing. Other international societies are built up in different ways, and in the following, some of these other audiological organizations will be presented.

International Society of Audiology (ISA)

This is the oldest organization, established in 1952. In this organization, members are individual subjects from the whole world. ISA has world congresses every second year, and they started early publishing their own journal, International Audiology, later called Audiology. Today, this journal is incorporated in the International Journal of Audiology through a merging process with two other journals (discussed later). Central leaders of ISA for many years before and after 2000 were George Mencher from Halifax, Canada and Hans Verschuure from Rotterdam, The Netherlands, both PhD audiologists.

European Federation of Audiology Societies (EFAS)

EFAS was established at a meeting in Puerto de la Cruz, Tenerife in 1990, but the first congress was held in Cambridge in 1992. EFAS consists of organizations from different European countries, i.e., no personal members and no single professional society. Each country has one vote. Countries without a national audiology society had to arrange a certain model to make it possible to join EFAS. Congresses are arranged every second year. EFAS has no scientific journal. In 1999, a symposium was

arranged in Giessen, Germany. The aim was to describe a training model for a so-called general audiologist who should preferably be on a BSc level with three years of training. Several countries have adopted the model, at least partly, e.g., Norway.

International Evoked Response Audiometry Study Group (IERASG)

The study group was established in 1960. The first chairman was the legendary Hallowell Davis, who worked with central auditory electrical responses in the 1930s. Originally, the name was the International Electric Response Audiometry Study Group, and auditory electrophysiology was the main subject. In the 1980s, otoacoustic emission was included, and the name of the group was changed to International Evoked Response Audiometry Study Group (IERASG). Conferences are arranged every second year. Single subjects are members of the study group for two years when joining a conference. The study group has a council consisting of people representing different parts of the world. For example, one person represented the Nordic countries, one for the USA, etc. The council members have the task of promoting the conferences.

Journals

NAS published Scandinavian Audiology from the beginning (1960). In the 1990s, subscription rates decreased, possibly due to economic reasons and the fact that there were too many journals. The council of NAS started a discussion with the British Society of Audiology who published their own journal, the British Journal of Audiology, for a possible merging process. They had the same experience as Scand Audiol. Later, ISA joined the discussion with their journal Audiology. In 2002, the discussions ended with the opening of a new journal, the International Journal of Audiology, and this journal has grown to one of the world's leading audiological journals. NAS started this process.

Neonatal Hearing Screening (NHS)

Marion Downs, an American paediatric audiologist, started in the 1980s discussion on the need for a mass screening of newborns. In her home

city, Denver, Colorado, a screening procedure was developed with the aim of testing 100% of all newborns. The method was based on the automated auditory brainstem response that had been developed in the US. In practice, approximately 80% of all children in the US were tested.

In 1978, David Kemp, UK, published the first paper on otoacoustic emissions, first called Kemp's echo. In the 1980s several studies, i.e., from the group of Claus Elberling from Gentofte Hospital in Denmark, found that the emissions were suitable for screening the hearing of newborns. Quite soon, many research groups and hospitals started a screening process, but until the beginning of the new century, few international mass screening projects were established. Many clinics started testing high-risk infants later, expanding to a 100% screening programme. The Italian physicist Ferdinando Grandori arranged a meeting in Milan in 1998 on this subject, and he and an American colleague, Deborah Hayes, had several international conferences in Como, Italy in 2000, 2002, 2004, etc. The Nordic countries were relatively late in this process, and in Norway, the health authorities established a 100% screening since 2008 based on transient evoked otoacoustic emissions (TEOAE).

The Nordic Society of Audiology and the International Journal of Audiology

Stig Arlinger, Sweden & Claes Möller, Sweden

The first Nordic journal in Audiology was published in 1950. The articles were published in Danish, Norwegian or Swedish. The establishment of the Nordic Society of Audiology (NAS) in 1960 was a further step in the increased cooperation between the professional groups involved in audiology in Nordic countries, and NAS became the formal publishing organization behind “Nordisk audiologi.”

During the 1960s, audiological services became increasingly organized within the public health systems in Nordic countries. This involved the establishment of special audiological clinics in some major hospitals staffed with multi-professional groups with medical, technical and psychosocial competences. Eventually, cooperation within NAS led to the decision to develop the journal “Nordisk audiologi” into a scientific journal to be published in the English language through a professional publishing house. Thus, the journal “Scandinavian Audiology” was started with its first issue appearing in March 1972. The publishing house was the Swedish company Almqvist & Wiksell in Stockholm, and through their marketing efforts, “Scandinavian Audiology” soon succeeded in attracting an increasing number of contributions from audiological scientists and thereby also attracted a reliable number of international subscriptions.

Among audiological professionals in Scandinavia and missing the old “Nordisk audiologi,” a need was felt for a more practical journal as a complement to the more scientific papers published in Scandinavian Audiology. This led to the publication “Audionytt” (Audionews), which appeared with its first issue in 1974. It was published in Swedish with support from the company LIC Audio and distributed to Nordic countries. Over a period of 40 years, the newsletter was a widely distributed and

much appreciated messenger of practical audiological information and knowledge until its last year of publication 2013.

On the international scale in addition to “Scandinavian Audiology”, there were two other scientific journals in the English language published by audiological societies: “The British Journal of Audiology”, published by the British Society of Audiology beginning in 1967, and “Audiology”, published by the International Society of Audiology beginning in 1971. The latter journal had previously been published as “International Audiology” during the period 1962-1970.

By the early 2000s, these three journals had increasing challenges with decreasing numbers of subscriptions. Therefore, discussions were initiated between the three organizations with the aim of joining forces and merging into one internationally stronger publication, which would attract high-quality contributions from scientists globally, providing a good basis for a high-quality, high-impact scientific journal. This would hopefully also attract a sufficiently large number of subscriptions to provide economic stability.

The first volume of the new journal, “International Journal of Audiology” (IJA), was published in 2002 with Stig Arlinger as its first chief editor and BC Decker Inc. as its first publishing house. At the beginning, each volume had 8 issues annually, and this was gradually increased to 12 annual issues. The first volume was assigned number 41 as a consequence of the oldest of the original journal “Audiology,” which published volume 40 in 2001.

The three societies that today own IJA are very different in their purposes and constituency. The British Society of Audiology (BSA) is a national society with individual members. The members are professionals working within the field of audiology in the United Kingdom. The International Society of Audiology (ISA) is a society also formed by professionals working in the field of audiology, and membership is worldwide. The Nordic Society of Audiology (NAS) is formed by different professional and user organizations. There are no individual members in NAS. From

the beginning, it was decided that the individual membership fee of BSA and ISA should include a subscription to IJA. Since NAS has no individual membership, it was decided that members from different organizations within NAS would be eligible to receive IJA at a very low cost. The owner societies of the journal (BSA, ISA and NAS) set up bylaws and rules to form an IJA council. It was determined that societies should have two members each. The terms chairman, treasurer and secretary were set at two years, and council members from NAS were selected based on their scientific and clinical background. It was agreed among the three societies that council members would be chosen to represent different backgrounds in audiology.

The NAS members in the council have so far been Finnish, Swedish and Norwegian. The council meets once a year somewhere in Europe and has regular teleconferences. From the beginning, there has always been a contract with a publishing company suited for IJA. BC Decker Inc. was selected initially. After some years, the IJA council recognized several publishing and economic errors, which led to termination of the Decker contract, and the IJA council sued BC Decker for lack of payments, which resulted in an extended process in different Canadian courts to recover a portion of the payments due. Some years ago, our lawyers advised the council not to pursue any more legal actions, and the council decided to close the case. A new publisher had been contracted – Taylor and Francis (TF). For an editorial office, a good relationship with a publisher is mandatory. In the first 10-12 years of operations, IJA had five different publication staff members and three different publishers. BC Decker, Informa and Taylor & Francis. The Chief Editor who followed Dr. Arlinger, Ross Roeser, in his own words explained the situation as follows: “I’ve told colleagues that changing publishers was like coming home one day, walking into your house and finding out your family had been replaced with another group of people—even the dog. I think IJA must have the record for changing publication staff as many times as we did in such a short time, but with the help of those involved, we kept the editorial and production schedule on target. It was a challenge, but all those involved in the IJA editorial office pitched in and made it work.”

Following Decker, Inc., Taylor & Francis was selected as the new IJA publisher and has been under contract to date, with the IJA council and Chief Editor very satisfied. Through excellent work by the first Chief Editor Stig Arlinger, IJA was quite rapidly indexed in PubMed and since then has had a steadily increasing impact factor. Ross Roeser was appointed as the Chief Editor following Stig Arlinger. During the transition, he visited Dr. Arlinger in Linköping and met him for the first time. He said he was very impressed with Dr. Arlinger and his organizational skills and the system he developed, which made the transition of the journal to Dallas, Texas smooth.

At the beginning, Ross Roeser was asked to be the first IJA Chief Editor. He initially refused because he had so much on his plate at the time. However, over a period of several months, and with a little coaxing from the IJA council, he finally agreed. He has a memory from this moment and in his own words “There’s a saying that if you want to get something done, ask the busiest person you know. The IJA council phoned me with an offer to become the new chief editor telling me that Dr. Stig Arlinger agreed to become the Chief Editor for two years, and then you will take over. Of course, I was speechless and after discussion, when I hung up the phone, and said to myself, I guess I just became the IJA Editor-in-Chief, booked my flight to Heathrow to meet the IJA council and the rest is history.”

In the beginning there were over one hundred manuscripts from the merger of the three journals that Stig had to deal with, and communication was by the old way of “snail mail.” On short notice, Stig was able to create an editorial board, assign the papers, process them and make final decisions so that there was no lag time for publication. As Ross Roeser remembers, “I was amazed not only by the magnitude of the work Stig had carried out but also the excellent process he developed.” The transition of changing chief editorship to Ross began with a meeting at Linköping University in Sweden. Over a two-day period, we discussed journal matters, specifics about how the transition would take place, and the transition from Sweden to Texas began.

Through the years with Ross Roeser as Chief Editor, IJA has made significant strides in accomplishing the goal of being one of the leading high-quality publications in audiology in the world. He formed an editorial office together with Dr. Jackie Clark as Managing Editor, established a well-tuned process for overseeing the production and peer review process and enlisted the support of excellent associate editors to carry out an efficient and effective review process from around the globe. The number of pages has steadily increased, as have the submissions of published articles. The introduction of Manuscript Central, the electronic submission and tracking system, has significantly improved the efficiency and effectiveness of the entire editorial office process. Unfortunately, the large increase in manuscripts and demands of high scientific standards has resulted in a rather low acceptance rate, but this is only a sign of excellence and is now true for all major reputable journals within scientific fields, including audiology and otolaryngology. The main bulk of manuscript submissions are from the USA and Europe. From the beginning, IJA has been fortunate to partner with a number of groups, and organizations and regular supplements have been published on different topics. These supplements have been well received and not only provide valued articles for the readership but also revenue for societies. Today, like many publications, IJA subscriptions are mainly from university countries, and revenue is generated through bundling with other publications from our publishers. The revenues have provided a steady yearly income to NAS and the two other societies. This economic revenue is extremely important for NAS and has ascertained that NAS has been able to organize conferences every second year.

During the last five years, the IJA council and the chief editor have made several important decisions regarding the journal. One of them was the transition from paper copies to an electronic journal, which today is the accepted standard for all scientific journals. In the beginning of this transition, there was considerable hesitation about going to an all-electronic format, particularly from ISA, because of the fear that this format might reduce membership if IJA was not to be printed in paper copies monthly. The transition has, however, been smooth, and IJA is today, similar to

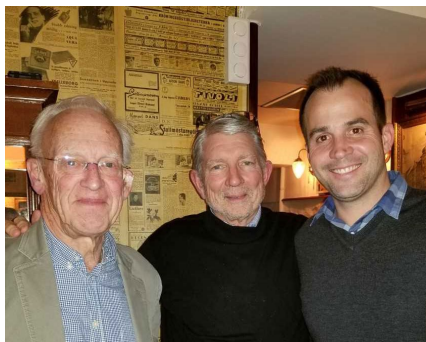
nearly all other scientific journals, electronic. The electronic handling of manuscripts has improved the efficiency of the editorial process and has made the time from submission to acceptance and publication significantly shorter.

Another issue has been the question of open access, which means that published papers are made available to the public without cost. In recent years, open access has increased, and from 2020-2024, most journals will transfer from subscriptions to open access. This has been enforced by the EU and different national research funds. Open access will ensure that all those wanting it will have access to research immediately or soon after publication.

In 2017, the IJA council appointed De Wet Swanepoel from South Africa as the IJA Chief Editor, beginning in 2019. Today, IJA is in the top five audiological journals and the top 10 Otolaryngology journals.

The future of IJA and the economic revenues for NAS will probably change. The numbers of scientific journals are rapidly increasing and open access has had

a major impact/effect on the publishing world. Today, there are approximately 40,000 scientific journals solely in Medicine. The advantage of IJA is that it is truly international with referees and editors from all parts of the world. IJA is a journal where papers in basic and clinical audiology are considered equally important. The Nordic Audiological Society can be proud of being one of the owners of the International Journal of Audiology and thank all those involved in making it what it is today.



Chief editors of IJA from the left Stig Arlinger, Ross Roeser and DeWet Swanepoel.

Photo: unknown.

Nordic Audiological Society – A Perpetual Source of Inspiration

Erik Berninger, Sweden

The Nordic Audiological Society (NAS) is a perpetual source of inspiration, partly due to its good economy. The financial situation developed from the brink of bankruptcy (early 2000) to well-being (2016). Many factors contributed. Royalties from the scientific journal *The International Journal of Audiology* (IJA) and a growing, somewhat unexpected, number of conference participants were the main reasons for the upside. Plausible explanations for the numerous participants — up to 550 — were attractive scientific programmes, free oral paper sessions, panel discussions on current and relevant topics, wide range of topics, room for social interactions, and enjoyable gala dinners.

A regular, albeit minor, income from the *Nordic Textbook of Audiology* with Stig Arlinger as editor should also be mentioned as part of the upside. To increase the number of conference participants from Finland, translation to English of all the presentations was important. It contributed to quite a few conference participants from Finland. Enrichment of the conferences was thereby achieved scientifically, professionally, and socially.

One anecdotal experience bears mentioning. Thanks to NAS's smart local organization committee for the biannual conference in Reykjavik, 2008, they were able to transfer the financial surplus to Sweden, despite the general, and abrupt, closure of the international part of the Icelandic economy. The secret was a small, agile, local bank. The conference surplus was transferred just a couple of hours prior to general closure. During several years, no exchange rate and no possibility of transferring money existed. Consequently, the Icelandic member associations eliminated member fees for some years.

Regular board meetings in real life

Board meetings in real life are crucial for the development of a friendly and constructive atmosphere of the board. High efficiency is the outcome. One yearly board meeting took place either at the annual NAS meeting or at the biannual NAS conference. Another yearly board meeting took place in one of the Nordic countries, according to a circular scheme. In addition to telephone conferences, these meetings allowed for detailed planning of upcoming conferences and focused studies on, for example, rehabilitation across Scandinavia. The project on international classification on functioning (ICF) received targeted funding from NAS. Subscription of IJA was subsidized by NAS. Each of the 120,000 members of the 32 NAS member associations could subscribe to IJA for the modest cost of 600 SEK per year.

As conference planning is a somewhat risky business and the turnover for each conference is approximately 2 MSEK, there was always room to inform the board on personal payment responsibility— not that difficult bearing in mind the hard times of 700,000 SEK deficit from 2004-2005. However, the stable financial situation allowed much risk-taking, which in turn formed a positive inclination. We paid great attention to informing upcoming NAS conferences. Flyers, massive distribution of emails, and advertisements in journals were keys for the marketing of the conferences.

Biannual conferences

In addition to the broad perspective on audiology that is characteristic of NAS, we further developed the scientific approach with parallel sessions for oral papers, poster sessions, and not least, several invited international speakers to increase the educational focus and for a wide audiological outlook. Every second biannual conference was thematic (e.g., paediatric). We always had a distinct focus on the hard of hearing and their organizations' opinions, as well as the exhibitors' requests, when planning the conferences. The combination of researchers, professionals, and representatives for the hard of hearing has been a good spiritual mix for the association.

The NAS 50-year anniversary took place during the 2010 conference in Copenhagen with 500 participants.

Many keynote speakers were invited to broaden and deepen the exchange of knowledge at biannual conferences

A wide range of topics have been scrutinized throughout the years. Some examples are central auditory plasticity, cognition, tinnitus, genetics, interplay between advanced technologies and medicine, new technologies, mathematical models of hearing from the periphery to the auditory cortex, early intervention following the introduction of newborn hearing screening, quality of life, and rehabilitation from a broad perspective. Thanks to the good economy, hotels, conference fees, and travel expenses for the invited speakers were always covered by NAS. These expenses amounted to approximately 250,000 SEK for each conference.

In addition to our prestigious and renowned keynote speakers from Nordic countries, I will just mention some of the invited international keynote speakers that come to mind. That is, only a minor part of all the invited speakers are mentioned below.

Anu Sharma (USA) visited NAS as an invited speaker several times. The focus of her research is above all on central auditory plasticity, for example, brain function in early development. Her research on development, i.e., normalization of some brain activities, following early intervention with cochlear implants for severe-to-profound congenital hearing losses is well known.

The present studies are oriented towards cross-modal reorganization in children with cochlear implants. For children with milder hearing losses, Teresa Ching (Australia) showed positive effects on hearing after early intervention with hearing aids. Early intervention improved language outcomes. Developmental outcomes for children who were fitted with differential hearing aid fitting algorithms were also scrutinized.

The positive effect of bilateral beamformers in hearing aids was the focus in one of Harvey Dillon's (Australia) presentations. He also talked about acoustics and psychoacoustics in general. For the group of single-sided deafness, Antje Aschendorff (Germany) demonstrated enhanced communication capacity for adults and children using a cochlear implant.

Another often invited speaker is Sue Archbold (Great Britain), who mostly talked about rehabilitation from a broad perspective. Kathleen Pichora-Fuller (Canada) provided a comprehensive review of hearing and cognitive impairments. The topic of tinnitus was thoroughly described by Margaret and Pawel Jastreboff (USA), including their neurophysiological model for tinnitus, sound therapy, and the counselling approach.

In the field of genetics, William Kimberling (USA) estimated that approximately 20% of patients with Usher syndrome had a specific gene mutation, while Richard JH Smith (USA) demonstrated future clinical applications of next-generation sequencing.

The importance of combining advanced technology with medicine was the focus of Thomas Lenarz' (Germany) presentation. An institute dedicated to intensifying basic research and development within, for example, various types of implants (Institute of Audio- and Neurotechnology, Hannover) was established.

Ross Roeser (USA, past editor-in-chief, IJA) talked about the positive development of the journal but that it sometimes could be hard to find reviewers for submitted scientific manuscripts that need to undergo review. Up to 17 potential reviewers might decline to participate in the review process. Perhaps this dilemma is in part due to increased clinical burden.

To meet and listen to our prestigious and renowned Nordic keynote speakers, please visit some of the upcoming NAS conferences!

Poster sessions to allow active participation and thorough discussions

NAS introduced poster sessions as part of the biannual conferences in Reykjavik, 2008. Posters are good for presenting new findings, somewhat resembling brief scientific publications. Above all, it allows immediate interaction and thorough, constructive, and not least, dedicated discussions. Poster sessions also allow more participants to visit the conferences, as active participation is often mandatory for leave. Approximately 550 persons attended the 2008 conference in Reykjavik.

Development of the biannual meetings while not conferencing, including some outskirts

The economy allowed symposia with invited, often local, speakers to increase the attractiveness of NAS annual meetings. We also started to invite one representative from each of the NAS member associations to enhance the spirit of the meetings and to facilitate networking across the Nordic countries on a more regular basis. Earlier, the number of participants in the annual meetings was rather low, except during conferences. Hence, the earlier meetings were quite formal, dismissing the possibility of interacting and discussing audiology from a future perspective.

Symposia were included in the annual meetings for the first time in Stockholm, 2007, on the topic of newborn hearing screening and early intervention, then Helsinki, 2009, on genetics followed by a panel discussion on rehabilitation. The meeting in Svalbard, 2011, was focused on remote hearing tests. Happily, 16 member associations were represented. Genetics was the main topic of the 2013 meeting in Reykjavik, while rehabilitation was in focus in Torshavn, 2015.

For such an organization as NAS with a wide educational assignment, the board found it important to depict how audiology could be performed in some of the Nordic outskirts, such as Svalbard and the Faroe Islands.

How can hearing loss be managed in children if only one family lives in a distant place? A family told us about the situation in Longyearbyen,

Svalbard. They needed to go by air to reach the paediatric hearing team for regular consultations. It worked well. In addition, remote-controlled audiometry was successfully performed from Svalbard to a rural part of South Africa, which should be a Guinness record. Remote audiometry was performed by deWet Swanepoel (the present editor-in-chief for IJA).



Remote-controlled audiometry between South Africa and Svalbard. Photo: Elina Mäki-Torkko.

Polar bear risks are obvious, as polar bears are a natural part of the environment in Spitsbergen. They have no natural enemy and their response to humans is unpredictable. They live mostly at the ice border but can at times be seen in Longyearbyen. When at least one in a group is properly armed and trained, you can enjoy journeys in beautiful surroundings.

Another remote part of the Nordic countries is the Faroe Islands with its lovely capital Torshavn. During the meeting in 2015, studies on rehabili-

tation from each of the Nordic countries were presented. All the studies were funded by NAS and are available at NAS home page (www.nas.dk). Intense discussions on this topic took place during an afternoon session, accompanied by more informal discussions during the following dinner in Torshavn together with all the representatives. The situation with fragmented audiology appeared to be similar across Scandinavia. The Faroe Islands are lovely with a green rolling landscape and discrete close to nature buildings. Perhaps it may be interesting to know that there are as many sheep as inhabitants on the Faroe Islands (70,000). Furthermore, the inhabitants are very fond of rowing, and their female football team is highly ranked.



Excursion on the Faroe Islands. Photo: Jonas Birkelöf.

Travel grants

NAS decided to introduce travel grants in Stockholm 2015 to encourage researchers from Nordic countries to present their findings at international scientific conferences. This is an important way for NAS to promote hearing research. Travel grants are granted under the restriction that

the member association in question paid the member fee for NAS (i.e., another way to enhance the willingness to pay the member fee).

A dozen researchers received travel grants from 2016-2018. Summaries from international conferences are published on NAS homepage. This is an important way to establish a vivid homepage and provide sustainable communication of new scientific findings (see www.nas.dk).

Interaction with the industry

The exhibition area is an utmost important arena for discussions on new innovations, audiology at large, and life. We struggled always to find an attractive place to facilitate these important and informal exchanges of thoughts. Almost always, coffee, refreshments, and sometimes lunches were served in the exhibition hall. The dialogue between colleagues, exhibitors, and representatives for the industry is fundamental for the development of Nordic audiology. It was also encouraging to see quite many exhibitors taking part in the scientific programme. To further promote this kind of interaction, the hard of hearing were publicly invited to take part in the latest products and innovations exhibited.

To further emphasize the role of the industry, they had the possibility to serve as sponsors of the conferences, thereby achieving an attractive place for marketing in the scientific programme. Moreover, one session during the conference was devoted to scientific presentations by the industry to share and expose their latest scientific breakthroughs.

Concluding remarks

The Nordic Audiological Society is an important organization for the further development of internationally well-known Nordic audiology. The combination of conferences, annual meetings with interesting symposia, and focused studies should attract even more professionals, the hard of hearing, and industrial representatives to take an active part. We could thereby intensify and further develop the audiological discipline worldwide!

In all, it has been a great pleasure to work for NAS throughout the years.

Technical Development: the Nordic Perspective

Hearing Aid technology revisited

Ture Dammann Andersen, Denmark

An important date in Hearing Aid (HA) technology development is 1996. In particular, 1996 was the year the first full digital HA was introduced by Widex (the Senso) and by Oticon (the DigiFocus). Over the next few years, all major HA manufacturers introduced full digital HAs, and now analogue as well as (the hybrid version) digital controlled analogue HA are history.

Is digital HA technology truly a major breakthrough seen from the HA users' point of view? In many ways, yes indeed, but there is still a long way to go for HA technology to be able to compensate for the reduced streaming experienced by most people with hearing impairment (the cocktail party effect).

It could be interesting to look back just a few more years to the 1980s and the beginning of the 1990s. The technology was analogue and the amplification rationale was linear. The linear fitting rationale NAL (later NAL-RP) was introduced - and among quite many more rationales also the DSL for fitting children. The only way to use these rationales was to make verification by performing real ear (RE) measurements - often REIG. It is interesting to note that at that time, a proper fitting always included an RE measurement, a verification now often skipped!

Based on audiological research, more detailed knowledge of the physiology and neurophysiology of the auditory system evolved, i.e., demonstrating that prestin-based electromotility is required for cochlear amplification¹, the outer hair cell (OHC) motor function produces nonlinear compression in the cochlea, while OHC malfunction accounts

for many of the perception defects in cochlear impairments⁷, recruitment of loudness is related to the loss of OHC amplification^{2,3}, etc. Combined with more advanced HA technology, this led to the introduction of nonlinear amplification strategies.

The basic intention for using nonlinear amplification was to make the HA perform compression of the input dynamic range. This makes the HA output dynamic range small and hopefully equalizes the reduced dynamic range experienced by people with cochlear impairment. The reduced dynamic range is related to only a slight increase in the uncomfortable level (UCL) seen at even a quite increased threshold level⁵ combined with the pathological steep loudness function related to malfunction of the OHC. This is one of the many examples of how HA manufacturers have managed to use audiological research when designing new HA technology.

Nonlinear amplification strategies could be more easily implemented in HA due to the development of digitally controlled analogue HAs - an HA design not that far away from the digital HA currently used regarding at least some of the sound handling capabilities. After some confusing years spent having to program a computer for every mark, the HA industry developed (fortunately) standardized hardware and software platforms (HI-PRO and NOAH) to serve as a common interface. Nevertheless, RE measurements were used as an important verification strategy.

Directional microphones were now introduced in the more high-level HAs. Therefore, in the first part of the 1990s, before digital HA technology evolved, the HA treatment of hearing disability was at a level that was not that low compared to that performed currently. For an overview, see⁶. Interestingly, if one makes an RE measurement in an anechoic room using a speech signal of 65 dB SPL, the gain measured at 65 dB SPL input with many full digital HAs (fitted with the manufacturer's strategy) will often be rather close to that proposed by the linear NAL-RP strategy.

In many listening situations, the now fully digital HA often performs much better. This is because the HA can handle digital speech signal details that are not possible with an analogue signal.

The ability to control the phase of the signal currently exists in real time, which has made it possible to design quite effective anti-feedback systems. The scope of using phase control is that the anti-feedback system now does not have to reduce the gain in the whole frequency range of a HA channel or introduce a narrower bandstop filter; both features reduce the audibility of speech cues. This is a feature where HA manufacturers are in conquest, making systems more effective. Phase control has thus increased the fitting range of “open fitting” HAs by lowering the risk of feedback.

Noise cancellation algorithms are likewise new features in digital HA, often using amplitude modulation detection to state if the input signal in each HA channel is a human voice or “something else”. If the latter is the case, the gain in the HA channel will be reduced. One problem regarding the efficiency of such an algorithm is that the input signal is often a combination of speech cues and noise. In certain background noise types (such as steady low-frequency machine noise), such an algorithm can increase the signal-to-noise ratio (SNR).

Another way of increasing the SNR in the output of the HA is by using directional microphones, a feature now seen in all digital BTE HAs. The HA user is supposed to direct the head towards the person speaking because the microphone algorithm defines the sound source in front to be the source of interest. In more advanced microphone algorithms, the directional system is designed as an adaptive directional microphone. In each HA channel, the algorithm can state if there is a noise source (away from the front direction), and then in the frequency interval of the noise source (in that particular HA channel), the microphone directivity is changed to have minimum sensitivity in the direction of the noise source. In free field-like situations, this can indeed increase the SNR by as much as 4 to 5 dB (increasing speech perception by 40 to 50%). The clinical everyday problem here is that the HA user quite often must communicate

in a more diffuse field-like situation. Here, the directional microphone system will be unable to increase the SNR.

Wind noise cancellation algorithms have now too been introduced in most HAs.

There seems to be a general consensus that most cochlear hearing impairments should be treated with nonlinear HA amplification strategies. Nonlinear amplification strategies have indeed proven to be better than linear strategies for “the majority” of HA users with cochlear impairment in many listening situations. Souza 2009 provided an overview⁴ summarizing that nonlinear amplification for the majority of HA users provides a) better audibility of low-level speech, b) better speech discrimination in situations without background noise, c) better speech discrimination in noise depending on the type of background noise, d) better comfort of loud speech and e) better pleasantness.

For HA users with very severe hearing impairment (thresholds at 80 dB HL or worse), there is not much consensus regarding the amplification strategy. Some HA manufacturers use a linear or only slight nonlinear amplification strategy in their superpower BTE models.

Using a nonlinear amplification strategy in HA, one has to define the speed of the compressor. The controversy between the two schools, fast versus slow, still exists. Edgar Vilchur argued for fast compression (short attack and short release time) because this would increase the audibility of weak speech cues. Reinier Plomp argued for slow compression because this would preserve the modulation depth in speech sounds. When designing a HA, one has to choose between these two strategies. What will the hearing impaired benefit most from: preserving the modulation depth equal to preserving the envelope in the speech signal (slow compressor) or preserving most of the audibility of details in the temporal fine structure in the speech signal (fast compressor). In the digital area, HA manufacturers have also been divided between these two schools. In 1996, Widex chose the slow compressor, while all other manufacturers chose the fast compressor. Over some years, most manufacturers have changed

to slow compressor design when input in microphones is a speech signal. Interestingly, Widex has now changed to a moderate fast compressor design for moderate impairments. Research has no definite conclusion. There is a rather high amount of information in envelope modulation⁹,¹⁰. Nevertheless, temporal fine structure information is important for the hearing impaired¹¹. Therefore, this seems to be a never-ending question.

From a pathophysiological point of view, it seems logical that a hearing impairment due to purely OHC malfunction and impairments with OHC malfunction as a part of the cochlear pathology will be compensated to a major degree with nonlinear amplification. Here, we are at a point where we might ask if hearing impairments exist solely due to malfunctions in inner hair cells, ribbon synapses and/or neuropathy in spiral ganglion neurons. In 1996, Liberman and his group demonstrated synaptopathy and auditory neuropathy in test animals and lately in humans¹². Liberman 2016⁸ states: Recent work suggests that hair cells are not the most vulnerable elements in the inner ear; rather, synapses between hair cells and cochlear nerve terminals degenerate first in the ageing or noise-exposed ear. At present, this author is not aware of any research regarding loudness function in “pure synaptopathy” patients. Should such patients who seem to be experiencing hearing disability be fitted with nonlinear amplification HA? We need more research for proper HA design in such patients.

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Technical Development, Nordic Perspective – Electrophysiology

Bue Kristensen, Denmark

The area of audiology is by its nature a quite conservative field – for good reasons. First, most of the basic insights and procedures of diagnosis and rehabilitation have matured over long time spans, both in research and in clinical application. Second, the number of active researchers in the field is small. Third, and perhaps most importantly, the newer rehabilitation procedures of cochlear implantation or bone anchored hearing devices that are radical surgical procedures were simple trial and error approaches that are not a suitable path to follow in attempts to introduce new technologies. This well-placed conservatism in a generally mature field means that fewer new developments happen, and when we limit the geography of focus to the Nordic Countries, and we limit the time span of interest to a couple of decades, then one could expect hardly anything of interest would be worth mentioning. However, the good news is that for electrophysiology, new things are actually happening, particularly so, here in our little cozy and creative part of the world.

Therefore, let us get started on a high note and enjoy the fact that a broad Scandinavian collaboration was participating in a prestigious publication in 2018 in Nature Communications. The article by Nuttall et al, “A mechano-electrical mechanism for detection of sound envelopes in the hearing organ”, describes the use of electrophysiological measurements of the human inner ear to reveal the fact that the dominant method for detection of envelopes of sounds already occurs at the level of hair cells due to distortion introduced by mechano-electrical transduction channels. This is of course fascinating, and the collaborating Scandinavian authors come from places well known for interesting research activities: Linköping University, Interacoustics Research Unit, Copenhagen University Hospital and Eriksholm Research Centre.

Needless to say, basic research such as this is not something that has any consequences in the clinic at this time, but such types of broadening of our understanding are important for moving our field forward in general.

Let us, however, move to something that relates more to current clinical practice.

Currently, the main application for auditory electrophysiology is newborn hearing screening and subsequent diagnostic follow-up, including threshold assessment. In this area, our field of audiology has undergone important changes, and it is nice to see how newborn hearing screening now seems to be generally implemented not only in Scandinavia but also globally.

In addition, looking at technologies used for newborn hearing screening, the two different modern test methods – OAE and ABR – seem to have found their respective application areas to make best use of their individual characteristics.

For some years, OAE was clearly the most popular technology for hearing screening due to its fast test procedure and low price. However, driven by an increasing clinical interest in identifying auditory neuropathy and the economic efficiency associated with having a lower number of

false referrals from screening programmes, screening ABR has gained renewed interest, and as both the acoustic stimuli and the statistical response detectors of automated ABR have improved considerably to the benefit of reduced test time, many screening programmes currently use either a combination of OAE and screening ABR or screening ABR exclusively. Technological electrophysiological advancements in this area are also helping to improve speed and accuracy in clinical follow-up sessions, where estimation of hearing acuity and decisions for rehabilitation strategy are made. Therefore, let us take a brief look at the development and status of these new technologies.

Approximately twenty years ago, Torsten Dau (since 2003 at DTU) and colleagues published an article that started the new interest in acoustic chirp stimuli for auditory electrophysiology. Ten years earlier, Lütkenhöner et al. investigated the possibility of compensating for the frequency-specific cochlear travel time by applying an acoustic broad band chirp stimulus in which lower frequencies were presented earlier than higher frequencies. The aim of such stimulation was to generate a synchronous neural output from the cochlea since all stimuli frequently elicit a neural response at the same time. Dau et al. then elaborated this concept further and demonstrated that acoustic chirp stimuli with a simple delay function motivated by cochlear modelling indeed increased the amplitude of human ABRs. These findings challenged the generally accepted hypothesis at the time that ABRs were primarily elicited due to the onset or offset of the stimuli – characteristics that are evident in the click stimulus. Four years later, Fobel and Dau demonstrated how different chirps constructed with different delay models within their band widths of stimulation produced different wave V amplitudes of the ABR. Following these original scientific contributions proving the concept of chirps as a possible way to increase ABR amplitudes, Claus Elberling and colleagues started a series of investigations and publications to develop optimum chirps for various clinical use scenarios.

In 2006 and 2007, Elberling and his German research colleagues E. Stürzebecher and M. Cebulla published various aspects of applying chirp-based stimuli to ASSRs.

In 2008, the first article (together with Manny Don) described the central principles of the specific delay model that defined what became the clinically popular CE-Chirp stimulus family. Many professionals in our field might intuitively expect the “CE” to be related to the CE-marking that we see all over at this day and age. That is not so, though. The name CE-Chirps is used in recognition of Claus Elberling, who has been orchestrating and managing the research leading to this stimulus family with all the underlying details of calibration, technical aspects, academic and clinical documentation and so forth. It should also be mentioned that Claus Elberling was awarded the British Institute of Acoustics’ Rayleigh medal, which was presented to him at the Dansk Teknisk Audiologisk Selskab’s (DTAS) conference weekend in September 2019. Dr. Elberling’s keynote lecture including a layout of this path of research is available here (<https://www.youtube.com/watch?v=yZ9XPSNIFGI&t=560s>) including a fascinating look into some of the things that have happened in auditory research in this past generation.

Another area of important clinical relevance that has benefitted from new research in the past 20 years is the use of the ASSR for threshold estimation. The idea behind ASSR for audiogram estimation is intriguing, as it attempts to increase efficiency by testing several frequencies at the same time and additionally has the presence or absence of a response determined by statistical response detectors rather than the classic eyeballing of ABR waveforms with all the subjective aspects involved in that.

The last 20 years of research in this area have been in fine-tuning of the original concepts, not so much in radical new technologies.

First, as we all know, the stimuli of the classic ASSR technologies are simple amplitude-modulated pure tones at the audiometric octave frequencies and are typically modified slightly by, e.g., adding an FM modulation to them to increase stimulation to a slightly larger section of the basilar membrane on either side of the audiometric frequency of interest. A major boost to the effectiveness of this classic ASSR has been

replacing acoustic stimuli with octave-wide narrow band versions of CE-Chirps, thus obtaining larger electrophysiological responses.

Second, the original statistical response detectors were not very advanced, so combined with the relatively small responses elicited, it was difficult to obtain valid responses close to the threshold, and the test time was generally long. Stürzebecher, Cebulla and specialists from Interacoustics in Denmark have over the years developed and optimized an advanced detector that looks at response components not only at the fundamental stimulation rate frequency as used in original ASSR detection but also looks at response components that are generated by the auditory system at higher harmonics of the stimulation rate.

The combined benefits of the new stimuli and the new detectors are such that ASSRs in many Scandinavian clinics have become the threshold test of choice over ABRs. A considerable amount of clinical documentation to support the use of this new technology in various clinical populations has emerged globally in recent years, and in this context, it is worth mentioning publications by Franck Michel, Århus University Hospital, that describe an efficient clinical ASSR procedure developed and used in Århus. Such documentation on procedures is important, as technology by itself does not ensure optimal clinical outcomes, particularly since best clinical practices must be applied and results must be evaluated in the context of related published clinical evidence.

In the area of balance testing involving electrophysiology, oVEMP has become a popular test of the utricle in the last decade or so. The response is most effectively and comfortably elicited by bone conduction, and much research has been carried out using a mini-shaker from Brüel & Kjær, a company that still stands out as a jewel in the field of sound and vibration. The mini-shaker, however, is suitable for research only, and new technologies developed at Chalmers University, Göteborg by Bo Håkansson, should prove to be a clinically viable replacement. Bo Håkansson invented a balanced armature vibration motor technology that is very suitable for improving the performance of bone conductors such as the classic RadioEar B-71. In cooperation with the Danish speci-

alist Ortofon, known for decades for their extremely popular pick-ups for playing vinyl records, Håkansson together with RadioEar developed the bone conductor B-81. Compared to B-71, B-81 not only exhibits much less distortion but is also capable of stimulating much higher levels of vibration. This can be beneficial not only in detecting large air-bone gaps in normal audiometry but also in providing the high level of vibratory force needed for the oVEMP test. An added benefit for clinicians is also the fact that B-81 has reduced its electromagnetic radiation and thus provides less electromagnetically induced artefacts when used, e.g., bone-conducted ABR.

All of the above is quite different from what used to be ABR's main application years ago, when it was routinely used as the primary screening tool for vestibular schwannomas. Fortunately, high-quality imaging techniques have now been successfully applied to address this clinical need. However, ABR can actually still be an important player in a related area, as hearing preservation surgical techniques have been developed and used clinically, e.g., by Per Cayé-Thomassen at Rigshospitalet in Copenhagen, where monitoring auditory nerve function by ABR during the surgical removal of vestibular schwannomas can help guide the surgeon to maximize the functional preservation of the auditory nerve.

Let us close this overview of the past 20 years of Scandinavian auditory electrophysiology with a glimpse of the possible future of auditory-related electrophysiology as we might see it develop. A broadening of application might actually be emerging, and it seems it has potential in just about any step of the hearing-challenged patient's journey. We have already discussed newborn hearing screening and subsequent clinical hearing assessment to ensure a successfully fitted hearing aid, but for CI candidates, we see interesting applications. There is, for example, an interest in revisiting the assessment for CI candidacy by electrically stimulated ABR to ensure the presence of not only a visible but also a functional auditory nerve prior to CI implantation. Additionally, perisurgical monitoring methods to ensure the least possible damage to the cochlea during CI electrode insertion are fields of research, and once implantation is completed, then using CI-generated electrical stimuli to perform a full

classic far-field ABR assessment might be relevant, as recent publications seem to indicate this to be a better fitting tool than the quick, easy and popular but more cochlear focused measurement of eCAP, in which CI electrodes are used for both electrical stimulation and direct electrophysiological recording.

In regard to hearing aid users, the William Demant Foundation and the family behind WS Audiology have provided a large grant in support of a new Center for Ear-EEG at the Department of Engineering at Aarhus University. Research into ear-EEG is aimed at using electrophysiological measurements of brain activity carried out by the hearing aid during daily use by using electrodes on the hearing aid mould. It is expected that such research can help provide a variety of added benefits to hearing aid users. Furthermore, add to all this the popularity among researchers to use auditory electrophysiology in trying to tease out aspects of hidden hearing loss - aspects that still seem to hide quite well.

Therefore, the future still holds many interesting opportunities for broadening the field of auditory electrophysiology, and it shall indeed be interesting to see how this field looks in another twenty years.

Icelandic Perspective in NAS

Kristbjörg Pálsdóttir, Iceland

The audiological society in Iceland joined NAS in 1995 when it was decided that a congress would be held in Iceland in 1998. After the successful congress in Reykjavik in 1998, it was decided that Iceland should have a board member in NAS and has had one ever since.

This congress in 1998 was vast on an Icelandic scale. It seems to have been an overall good conference experience with 350 attendances, although it was on an island in the middle of the Atlantic Ocean. Ten years later in 2008, right in the economic crash, the next NAS conference was held in Iceland and proved to be a success. There were somewhat fewer participants in the 2018 conference in Reykjavik.

Although Iceland is a quite large island, it is not a large nation. The inhabitants are spread over a large area around the coast, which can be challenging. In 1998, at the first conference, the inhabitants numbered 270 thousand and 350 thousand twenty years later in 2018. The rule of thumb has been through the years that 1/3 of the inhabitants live outside the capital area.

The audiological society in Iceland is quite small. There has not been the same increase in people working in audiology in the last 20 years as the nation has grown and more demands exist in general by society to hear well. An exception exists in regard to ENT doctors specializing in audiology, who have doubled, going from one to two. This is to some extent because audiology is not taught in any university in Iceland and students who might be interested in audiology need to study abroad, which is not unusual for Icelanders. However, for audiology, it is a challenge, since it is quite unknown to the general public.

The fact that the Icelandic audiological society is not connected to the academic society within audiology makes it even more important for

the Icelandic Audiological Society to be in contact with societies such as NAS. By having a board member in NAS and going to NAS congresses, Icelandic audiologists have more chances of becoming informed about what is happening within the field of audiology.

Given the small society, in regard to holding a conference, such as NAS, it has put much work on a few people. However, in a small nation, the connections are shorter. A conference, such as NAS, helps the Icelandic Audiological Society make, and hold on to, contacts within the audiological societies in Scandinavia and even around the world. Additionally, it makes it possible to inform the Icelandic nation about audiology and hearing issues, for example, through the news.

The NAS collaboration has meant a great deal to Iceland and made it easier to be in contact with other members within audiology in other Nordic countries. The conferences that are held every other year give those who are working within audiology an opportunity to meet colleagues in Scandinavia and hear what is happening in academic society. This can be important regarding living on an island and where there is not much turnover in staff, particularly since new staff often comes with new ideas and perspective.

It is quite a coincidence that almost all those who are working within audiology in Iceland have studied at some point in Scandinavia. This makes it easier to be in a society such as NAS, although the general public does not speak the Scandinavian language.

The greatest challenge in Iceland in recent years and upcoming years is attracting educated audiologists to work in Iceland. In spring 2018, audiologists became licenced healthcare professionals. Hopefully, this will help in obtaining more Icelanders to obtain education in audiology. There have been a few Swedish and Norwegian audiologists who have come to Iceland to work for shorter periods. This has made it easier to cut down waiting lists, but it is a vulnerable situation and the language is a barrier to some extent. There is no one to take over when someone goes into retirement. Hopefully, this will change in the coming future, and more Icelanders will be inspired by the great idea of moving abroad to study audiology.

Finnish Perspective on the Last 20 Years of the Nordic Audiological Society

Kerttu Huttunen, Finland

Collaboration and influences

Nordic countries have much in common, one of the most distinctive features of their commonality being health care grounded in certain types of economic and social policies: the Nordic welfare model financed by tax revenues. The structure of audiological care has also been rather similar in Nordic countries. In Finland, hearing care was organized in the 1970s, with its main parts consisting of hearing centres at five university hospitals and hearing units at regional hospitals. This model was adopted from Denmark and Sweden. Additionally, during the years of the NUD (Nordic Staff Training Centre) in Dronningslund, the Danish experience in working with deafblind people has also been an inspiring source of knowledge for many Finnish professionals.

Different professional groups working in the field of audiology are also fairly similar in Nordic countries, although in Denmark, there has been a stronger provision of educational and rehabilitative audiology than perhaps elsewhere, and in Finland, there are too few representatives of technical staff (particularly civil engineers) working with persons with impaired hearing.

The development of the education of the different professionals working in the field of audiology has been one of the main interests and tasks of NAS since its conception. Education has been supported by both the NAS congresses held regularly for almost 60 years, by books published, and, particularly, by publishing scientific journals. The most recent journal, *International Journal of Audiology (IJA)*, is widely available in Finnish secondary and tertiary care hospitals, as it is included in many large scientific journal packages that the university libraries and hospitals subscribe

to. It is important that NAS has a scientifically merited representative in the IJA board, and NAS can, in collaboration with two other societies in the background of the journal, influence the direction towards which the journal is developed. High-quality journals support different professionals within the audiologic field in learning and adopting evidence-based practices.

During the early years of cochlear implantation, it was also possible to obtain information on NAS congresses on the practices and outcomes of implantation in Nordic countries. Since this form of care was new at that time, all information was more than welcome. Because some Finnish patients, mostly children, were operated on in Sweden, for Finns, it was important to be aware of the new developments there.

In the NAS congresses, it has been possible to be in contact with professionals, representatives of patient organizations and hearing instrument manufacturers from other Nordic countries. In the discussions held in NAS congresses, education of hearing care professionals has been a frequent topic. For Finns, the development of the education of audiometricians (audionom in Swedish and audiograf in Norwegian) has been a long-term goal. Sadly and frustratingly, no success has been reached despite frequent attempts (Audionomikoulutuksen kehittäminen -työryhmä, 2013) to negotiate with the Ministry of Education and Culture and Ministry of Social Affairs and Health to have a longer, upgraded and regularly run educational programme for audiometricians at the University of Applied Sciences and to have the profession regulated (that is, to have it as a protected title). In Finland, the basic education required for audiometricians is the education of a nurse, which, according to a survey made in hospitals, does not provide the best possible foundation for a deep understanding of hearing instrument technology (Audionomikoulutuksen kehittäminen -työryhmä, 2013).

Another benefit of having contacts between the Nordic countries in hearing health care is to learn from practices and policy changes in other countries. Information from Sweden, for instance, has been valuable for Finland when developing the hearing aid provision model in a situation

in which the personnel resources of the public sector are no longer sufficient to serve the rapidly increasing number of patients in need of audiological care.

Professional associations and patient organizations in Finland have received valuable back-up from NAS when informing about the ever-increasing needs of audiological care and when lobbying authorities and policy makers to invest more resources in the field. Domestic actors are often not enough in that work, and NAS as a large network is in many cases much stronger. It was therefore very insightful that in 2019, NAS sent out for its member associations and organizations a statement to be delivered via their networks to authorities and policy makers. This statement heavily relied on scientific evidence on the beneficial outcomes of hearing care.

The home ground of Finns

E-Health is strong in Finland, with many clinical practices have already been established. Particularly in sparsely populated areas, distances for many patients are often long to the nearest hospital, providing specialized care. In addition to physical examination performed via remote access, health information can also effectively be disseminated using the Internet. In The Health Village, <https://www.terveyskyla.fi/> (also in Swedish: <https://www.terveyskyla.fi/sv>) The House of Hearing will also appear in the future, with all the information accessible 24/7 for everyone needing it. Additionally, artificial intelligence solutions for health care are currently being developed in collaboration between technology enterprises and hospitals.

The other side of the coin is that medical audiology has limited personnel resources, and possibly because of that, hearing health care concentrates relatively much on technical hearing rehabilitation (provision of hearing aids, for example); much more resources would urgently be needed for adults' rehabilitation in the areas of communication, auditory training, counselling and psychosocial support. NAS, with its congresses, has

spread information from other Nordic countries and their services on hearing tactics (useful communication strategies), for example.

Language issues

The historical roots of Finnish education and practice in medicine are in Central Europe. Up to World War II, clinical medicine strongly leaned on the Central European research tradition, and Finnish medical doctors were often at least partly trained in German-speaking countries (Saxén, 2000). Nordic, especially Swedish, contacts in medicine were important for Finns, particularly in the late 1940s and early 1950s, together with North American influences starting to grow strongly in the 1950s.

The same strong roots and a long-standing tradition to study in Central Europe applies even for teachers, and Central European Phoniatics formed the foundation of the early days of speech and language therapy in Finland. However, in the field of pedagogics related to children with impaired hearing, contacts of especially Finland and Sweden have existed since the 19th century. In the early 1960s, immediately after the founding of NAS, all Nordic countries were enthusiastic about the possibility of attending NAS congresses/courses and using the printed materials of the congresses as audiological literature to develop the practices of the multi-professional field and as teaching materials in the education of new professionals (Ingberg, 2002).

In different functions of the Nordic Audiological Society, representatives of practically all Nordic countries except Finland can use their native language. Of them, Swedish, Danish and Norwegian populations are usually mutually understandable. With its population of only approximately 5% of the inhabitants speaking Finland-Swedish as their native language, Finland is much different from other Nordic countries. Today, speakers of languages other than Finnish or Swedish constitute more than 7% of the population, so they already outnumber the Swedish-speaking part of the population of Finland. Additionally, the number of students taking the Swedish test as the second national language in the Matriculation Examination of upper secondary school clearly dropped after the

decision to no longer have Swedish as the compulsory part of it. This will, in the future, diminish the share of the Finnish-speaking population to study and master Swedish at a more advanced level. Finns study many foreign languages, with school English being the strongest language; it is the most popular language subject from the early school years.

All factors mentioned above cause rather large challenges for Finns to participate in, for example, NAS congresses and annual general meetings, and consequently, the number of Finns has indeed usually been rather modest in NAS meetings. For instance, out of the approximately 500 participants of the NAS congress in 2008, only approximately 30 participants (6%) were from Finland. As an exception, English has been the language of two NAS congresses, one concentrating on paediatric audiology (organized in Copenhagen in 2000 with the theme “Communication 2000”) and one on the elderly (The 1st International Congress on Geriatric/Gerontologic Audiology organized in Stockholm in 2004 with the theme of “Hearing in the Elderly”).

Since the meeting held in Turku, Finland, in 1986, NAS tried to encourage, at least for some time, the participation of Finns by starting to offer simultaneous interpretation of presentations in NAS congresses into Finnish (Ingberg & Jauhiainen, 2000). In recent years, at least part of the presentations in NAS congresses held in Nordic languages have usually been translated into English. This practice of NAS has aimed to help the international keynote or invited speakers to follow the programme of the congresses, but Finns have also benefitted from it. In the next NAS congress in Odense, Denmark, for example, although the conference language is primarily Scandinavian, in addition to presentations in Danish, Swedish and Norwegian, abstracts and presentations in English are accepted, and simultaneous translation of presentations into English is available.

When NAS congresses and seminars related to NAS annual general meetings have been organized in Finland, English has been used as the working language for a relatively long time now. This is in line with the

practice of all Nordic medical societies in Otorhinolaryngology, which today have English as the working language in their meetings.

Future studies will show whether the ever-expanding use of English in science, culture and everyday life in Western societies will also have more influence on the language(s) used in meetings organized by NAS.

Acknowledgment

Warm thanks are due to Docent Kentala and audiometrician Tarja Wäre for information and fruitful discussions during the preparation of this text.

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Nordic Textbook in Audiology - A Multi-professional and Cultural Challenge

Stig Arlinger, Sweden

The five Nordic countries – Denmark, Finland, Iceland, Norway and Sweden – have a relatively long history of cooperation in audiology, gradually increasing from the 1950s. The Nordic Society of Audiology (Nordiska Audiologiska Sällskapet, NAS) was founded in 1960 as an umbrella organization where all the different professional organizations within audiology in the Nordic countries joined as members. The way audiology was organized varied somewhat between the countries, but in particular in Denmark, Norway and Sweden, a multi-professional approach was a basic concept when hearing health care was established within the public health systems. The complexity of audiology requires joint competence within medicine, technology and behavioural sciences to provide the best possible services to hearing impaired citizens regarding diagnostics, surgery, medication, hearing aids and other kinds of support.

One function that NAS established quite early was the organization of Nordic conferences in audiology, held every second year and rotating between the five member countries. At the NAS conference in Copenhagen 2000, a proposal was made to initiate a project with the aim of producing a common Nordic textbook in audiology.

Earlier, several textbooks in audiology were published in Sweden. In 1975, Gunnar Lidén, an audiological physician and professor in Gothenburg, Sweden, published a textbook with the title “Audiologi” with cooperation from three other professionals within the field. This book provided broad coverage of the topic and was used for many years as a textbook by most professional groups in Swedish audiology. A second revised edition was published in 1985.

Another Swedish publication in audiology with a more limited scope was the result of a project initiated by Swedish professional organizations for audiology assistants and technical audiologists. In cooperation with audiological physicians, a working group was established in 1980. This work led in 1983 to the publication of a “Manual of practical audiometry” – in Swedish “Metodbok i praktisk hörselmätning”. The book contained detailed descriptions of how to perform all the various clinical tests that were known and available at the time. This first textbook was followed by a second book – in Swedish “Handbok i hörselmätning”. Its focus was on the clinical application of the various test methods, how to interpret test results in diagnostic terms, equipment needed, sources of error, test accuracy, etc. Both books were later translated and published in English as “Manual of practical audiometry, Volumes 1 and 2” (Whurr Publishers 1990 and 1991).

The larger project that was initiated by NAS in 2000 had a broader scope. The goal was to make it a joint Nordic project, resulting in a text book to be used in all five countries, albeit in different language versions to make the text as accessible as possible for its readers. Another goal was to cover as much as possible of the whole wide range of facts that make up audiology. For this purpose, a working group was formed, representing all five countries as well as representing technology, medicine and behavioural sciences. The six working group members were Stig Arlinger (Sweden), Gylfi Baldursson (Iceland), Tapani Jauhiainen (Finland), Einar Laukli (Norway), Per Nielsen (Denmark) and Birgit Svendsen (Denmark).

At the first working group (WG) meeting in Stockholm in January 2001, the general layout of the book and the principles for the running of the project were decided. Thirteen separate chapters were identified, and a preliminary number of pages were allotted for each chapter. For each chapter, one of the working group members was to have the main responsibility. This responsibility implied not only contributing to the text but also identifying other specialists to be asked for contributions to the chapter. In the end, a total of 37 specialists provided texts for the book. The chapter sections were written in Swedish, Norwegian, Danish or English. From the very beginning, we expected that the final book

would be published in separate language editions for Nordic countries. This was also the end result with the exception of Iceland. These translations into the various languages were to be handled on an individual basis after agreement with the respective national publishers.

Thirteen main chapters were identified:

- Acoustics
- Psychoacoustics
- Linguistic communication
- The development of the auditory system, genetics
- Anatomy and physiology
- Audiometry
- Hearing impairment
- Medical treatment
- Tinnitus
- Rehabilitation
- Habilitation
- Noise
- International standards

Each chapter ended with a limited list of literature references with relevance to the specific chapter. At the end of the main text, a list of abbreviations and an index list were added.

Each co-author was asked to provide illustrations of their texts. A professional illustrator was then used to finish the figures to provide a relatively homogeneous design.

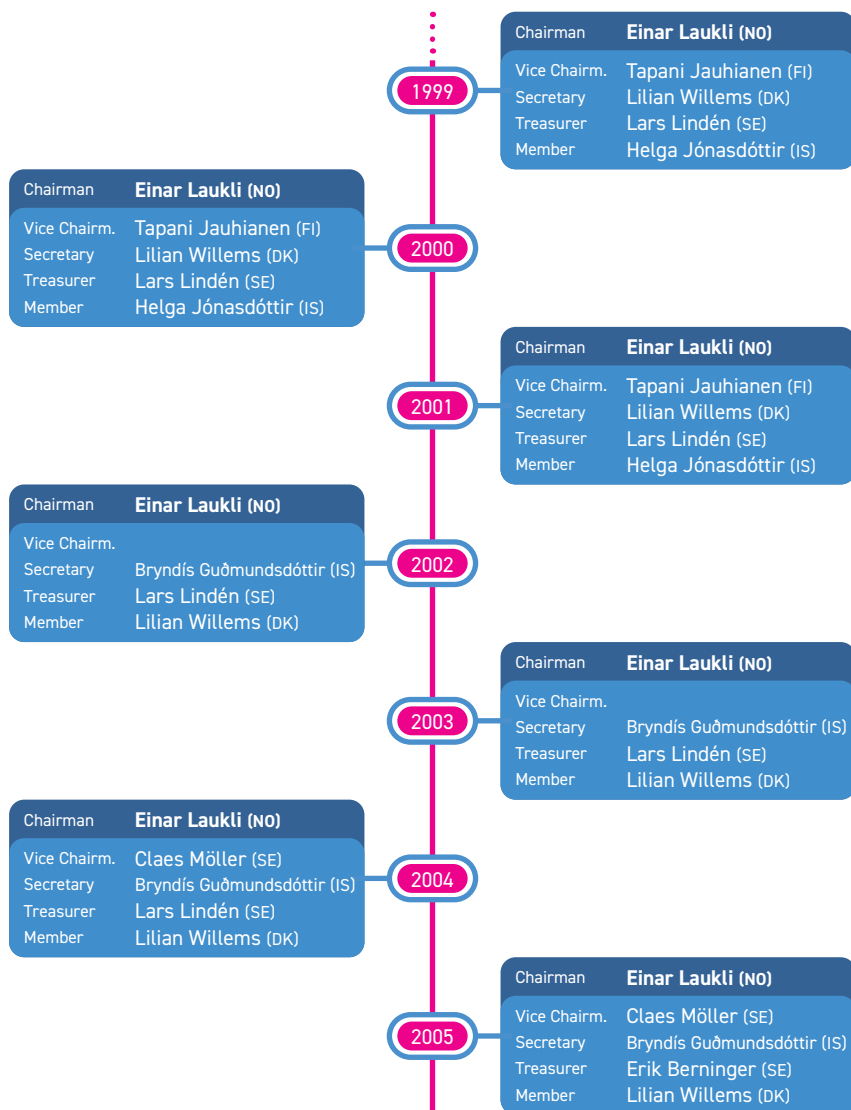
During the period from January 2001 to May 2005, the working group met for eleven intense physical meetings. At each meeting, the contributions received were discussed, usually resulting in asking the authors for some clarifications, additions or other revisions. Occasional reminders about time were also a part of the tasks. In all, close to 20 versions of the

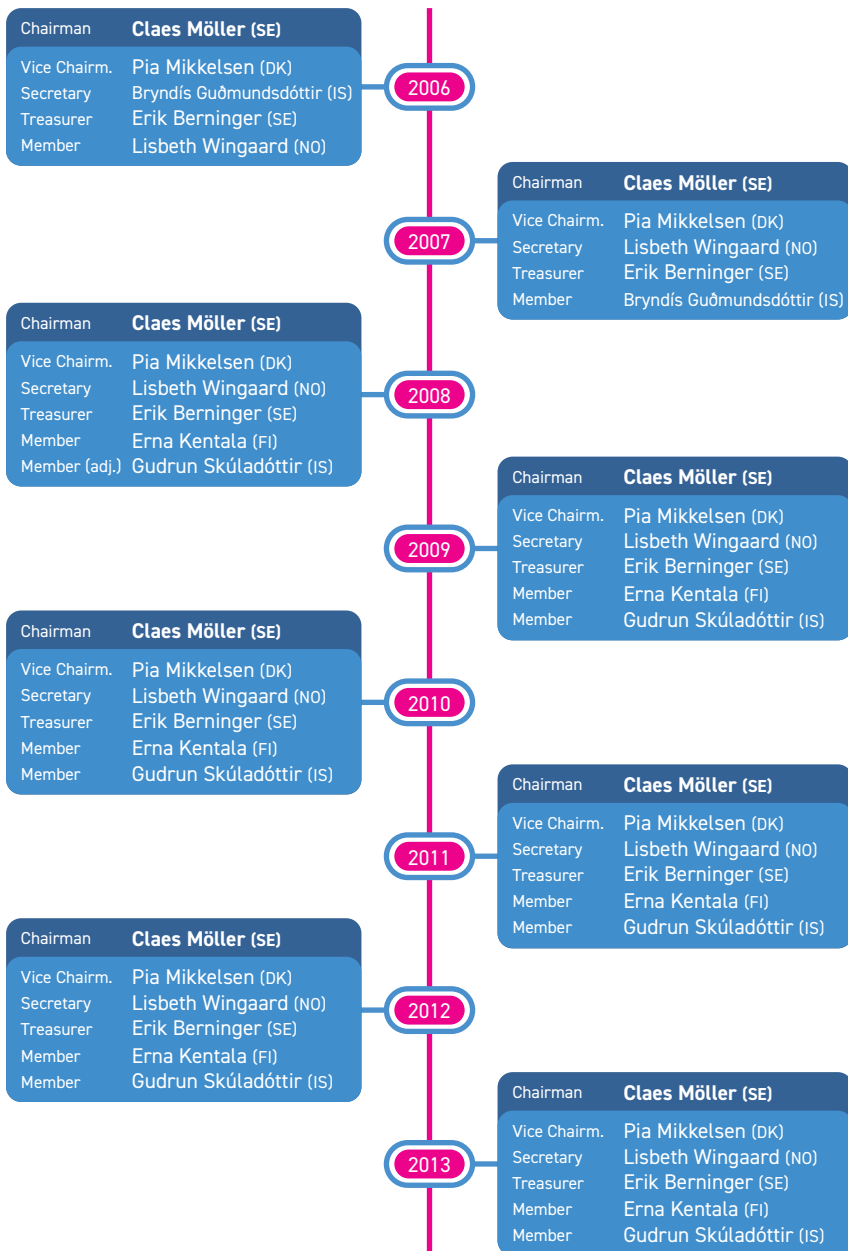
manuscript were produced until the WG agreed to finish the work and proceed with translations and contracts with the national publishers.

The working group was in clear need of financial support for the travel costs to be able to meet face to face in the project. Such support was received from the Nordic Society of Audiology, from the Nordic Council, and from the Oticon Foundation.

In the end, the textbook was published in four different language versions with different national publishers supporting this phase. The Swedish version with 480 pages was published by CA Tegnér AB in Stockholm in 2007 after translations of non-Swedish texts by Stig Arlinger. The Norwegian version with 522 pages also appeared in 2007, published by Fagbokforlaget in Oslo, with translations to Norwegian by Einar Laukli. A version in Finnish with 308 pages was published by Duodecim, Helsinki, in 2008 after translation by Tapani Jauhiainen. Finally, a Danish version with 520 pages appeared in 2016, published by Syddansk Universitetsforlag, Odense, after translation and some revision by Torben Poulsen.

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