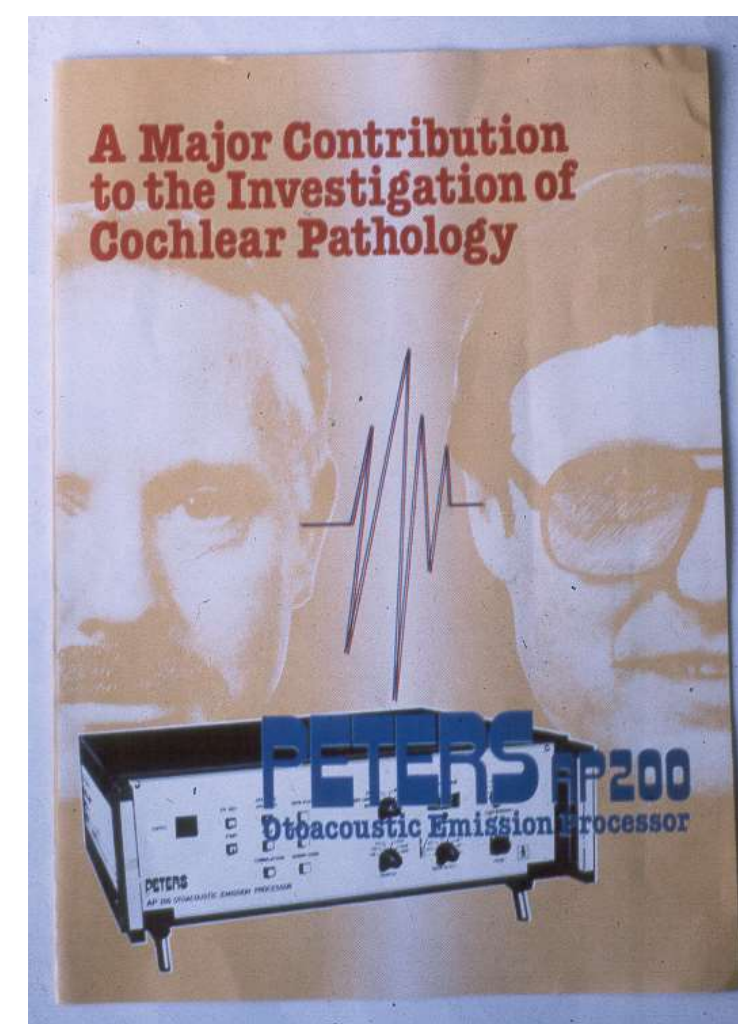


OAEs in audiology - how did it all start?

THE FIRST OAE INSTRUMENTS



1979 The first clinical OAE instrument the 'Cochlear Sounder' was a one-off portable battery powered device built by Ru Chum in Dr Kemp's laboratory in 1979. Without a computer, it used a 'delay line' signal averager to collect TEOAEs, and a miniature oscilloscope to display the OAE waveform in real time. It was demonstrated to the major instrument manufacturers -but none wanted to take up the idea.



1985 Research continued in the lab on DPOAEs. Eventually in a British audiometer manufacture (Peters Ltd) built and launched the AP200 commercial TEOAE instrument (left). It used computer technology but had no display. Before you could see the test result you needed to print a report which took several minutes. Only 5 were sold. It was not a success.



1987 Frustrated by the lack of interest within the instrument industry Dr Kemp decided to develop an OAE instrument to facilitate clinical research in other hospitals and research labs

Peter Bray in Dr Kemp's lab designed and built the first PC based OAE instrument, with Dave Brass and Siobhan Ryan. It was known as the **ILO88** named after the research institute's name and the year. It was first used on newborns. In 1988 it became a commercial product with the formation of **Otdynamics Ltd**.

USA's PIONEERS OF UNIVERSAL NEWBORN HEARING SCREENING



The Rhode Island Hearing Assessment Project PI's reviewed all available instruments for suitability. They found no ABR system available at that time anywhere near robust and fast enough for intensive use in universal newborn hearing screening.

Learning of the work in Europe showing that OAEs were fast and effective with newborns- they adopted the **ILO88** TEOAE as their screener. Careful training, record keeping and management helped make the Rhode Island project a success - proving that universal newborn hearing screening was feasible. This success fed into an NIH Consensus Conference in 1993 which recommended the provision of newborn screening (by OAE or ABR) for all infants. This finally triggered the involvement of major audiology companies in OAE device development.

Audiologist Susan Norton who had been involved with laboratory OAE research throughout the 1980 stepped up to lead education and training initiatives for newborn screening with OAEs. She gained funding for a multi center trial to measure the effectiveness of both ABR and OAE screening methods. UNHS is now the standard of care.

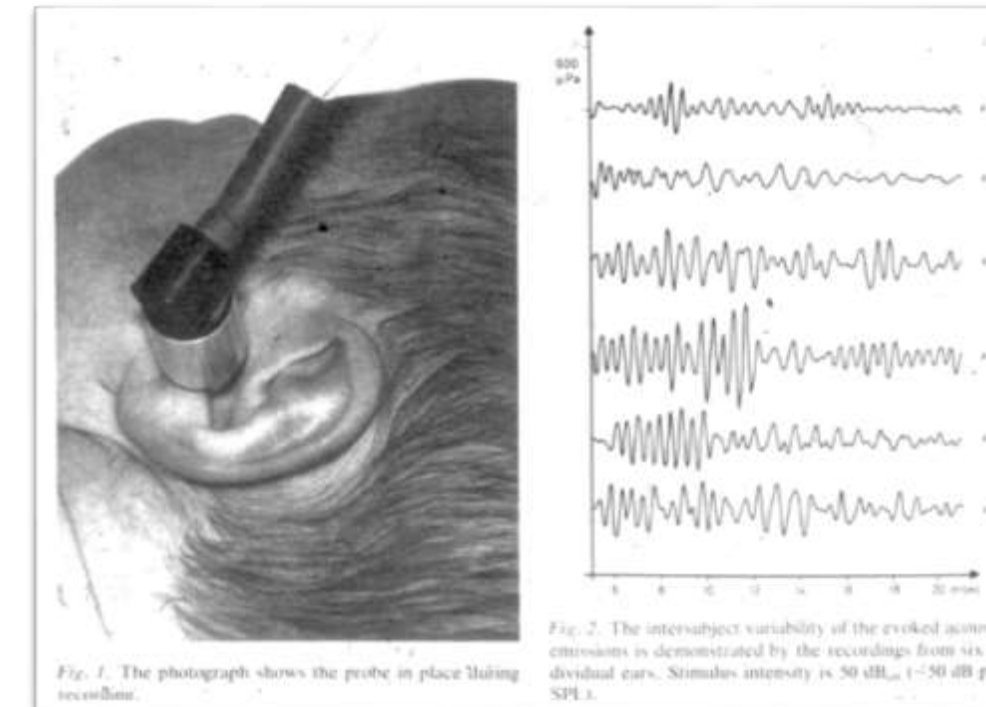
1992-2002 A DECADE OF OAE INSTRUMENT DEVELOPMENT – from large clinical to small screening devices.



EARLY IDEAS ABOUT OAE APPLICATIONS

In 1978 the first applications foreseen for OAEs were the early detection of noise induced or other acquired hearing damage and hearing research. It was never seen as a replacement for audiometry. The application of OAEs to newborn hearing emerged gradually over a decade. At the time neonatal hearing screening was focused on those with known risk factors. Well babies were screened by ineffective behavioural methods, and the average age of detection was 2 ½ years.

OAEs FOR INFANT SCREENING?



OAEs were first recorded from newborns in **1983** by Niels Johnsen, Copenhagen using a TEOAE system he had constructed himself. (left) Remy Pujol's team in Montpellier France also built an OAE system and proved OAEs were fast and effective for newborn screening.



Mark Lutman Adrian Davis Remy Pujol

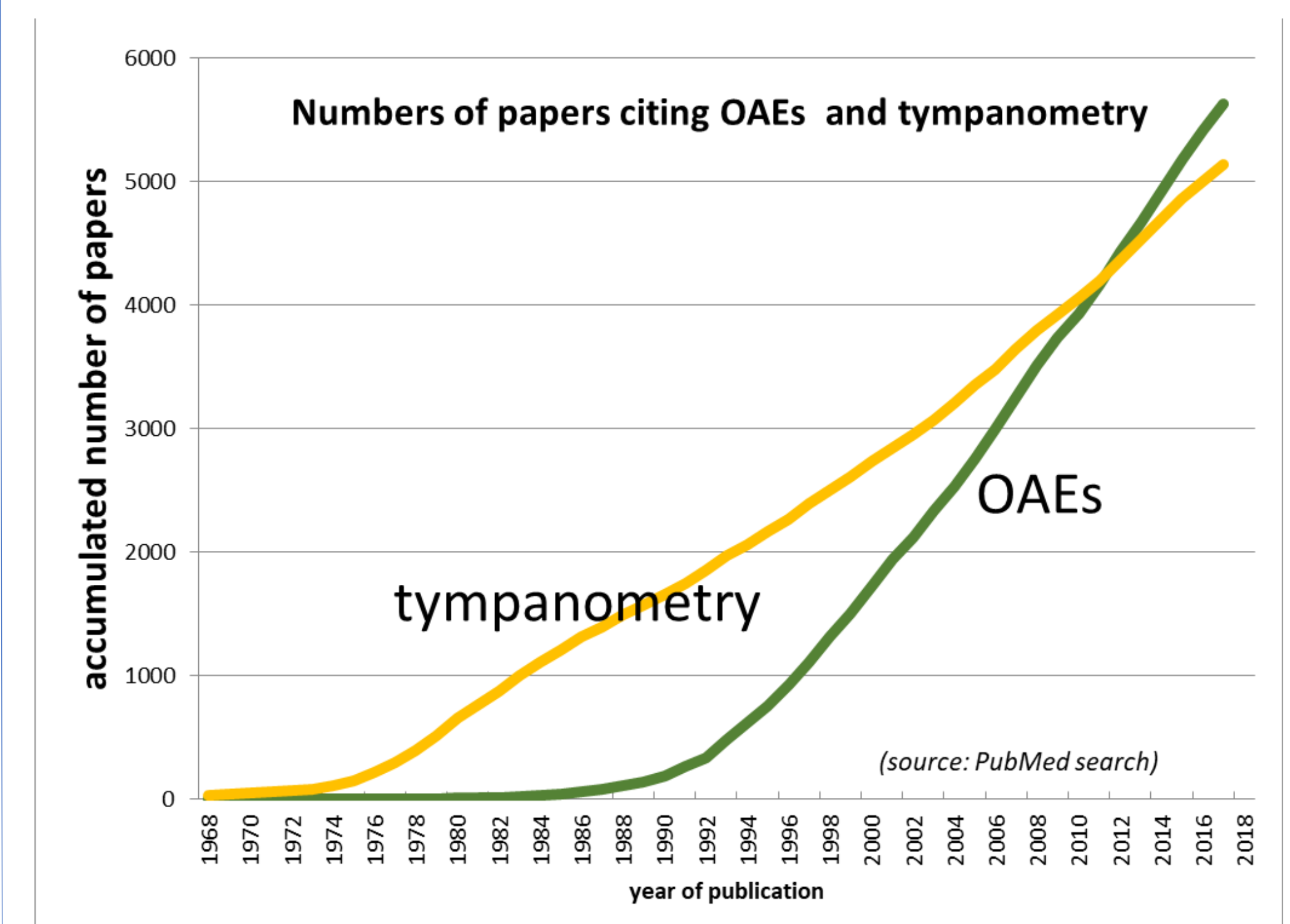
In the UK around **1986** Drs Adrian Davis and Mark Lutman at IHR Nottingham began developing a TEOAE screening instrument they called 'POEMS'. (right)



These 1980s OAE instruments were aimed at the growing need for more efficient detection of congenital hearing loss. But universal newborn screening was considered far too costly and practicable. OAE devices were seen as a way to extend the scope of at-risk screening.



A SLOW START- NOW ROARING AHEAD



The chart shows the accumulation of academic papers referencing **tympanometry** and **OAEs** from 1968 to the present. Poul Madsen introduced the first electronic acoustic impedance meter in 1960 - but take-up was slow. The number of papers citing the technique didn't start rising until about 1976, 16 years later! Papers citing OAEs reached the same level in 1990, 12 years after their discovery. The rise was linked to the release of commercial OAE instruments. Thereafter the rate of publications referencing OAEs has been about 200 per year, double that of tympanometry. These figures reflect research interest more than the level of routine usage.

PIONEERS OF CLINICAL OAE APPLICATIONS



In the USA the clinical application of OAEs evolved out of physiology lab and clinical research which mainly used DPOAEs.

Brenda Lonsbury Martin and Glen Martin's basic and clinical research in Miami through the 1980s proved the sensitivity and reliability of DPOAE to hearing pathology. Their experience provided the specification for the Virtual 330, the first commercial DPOAE instrument released in 1991. The Martins went on to run numerous courses, teaching clinicians about the new technology and encouraging its use. Jont Allen developed a sophisticated laboratory DPOAE system for use in auditory physiology experiments during the 1980s. From 1988 he began to convert it for wider clinical and research use. In 1993 it became the 'CubDis' OAE system and was widely used for research. (Now Mimosa) In 1997 Ted Glattke and Martin Robinette integrated the growing knowledge and clinical experience of OAEs into their book - 'Otoacoustic Emissions- Clinical Applications'.