

## Obituary

### Hendrikus (Diek) Duifhuis 1943–2022

.....



**Hendrikus (Diek) Duifhuis** passed away in July 2022 at the age of 79. Diek was a Fellow of the Acoustical Society of America (ASA). He studied physics at the Technical University in

Eindhoven, The Netherlands. His PhD research was conducted at the Instituut voor Perceptie Onderzoek (IPO), also in Eindhoven, under the supervision of Jan Schouten. Diek's thesis work included psychoacoustics experiments and their theoretical description. In his first publication in *The Journal of the Acoustical Society of America* (1970), he described the effect that when a high harmonic is removed from the spectrum of a periodic pulse, a sine tone is heard to pop out of the perception; the sine tone has the pitch of the high harmonic. This phenomenon is now commonly referred to as the Duifhuis pitch (DP). It was a prelude to his later work that focused on the contribution of inner ear mechanics to perception.

In 1980, Diek moved to the University of Groningen, The Netherlands, to take a position as professor of auditory biophysics. There he started to work on cochlear mechanics. After the discovery of otoacoustic emissions, he specifically focused on active cochlear models. These models consisted of an array of coupled self-sustained active oscillators, such as the Van der Pol oscillator, which could account for both the frequency selectivity of the basilar membrane and its nonlinear properties. Similar models have later been used to describe the active mechanical processes in the ears of various non-mammalian species. Diek also applied these models to describe the specialized properties of the cochlea of the horseshoe bat.

In addition to the theoretical work, a line of experimental research was started to investigate the biophysics of the lateral line organ of fishes. This hair cell sensor is much easier to access for experimental study compared with that in the vertebrate cochlea. This work showed the tight

coupling between the hydrodynamics of the cupula that covers the hair cells and the mechanical properties of the hair cell transduction channels. Later in his career, Diek studied the acoustical properties of MRI scanners, given that the noise produced by these machines interferes with auditory studies.

Diek was very active as lecturer and leader to shape the physics education at the University of Groningen. He added Biophysics of Hearing and Signal Analysis to the curriculum. He was the first director of the Research School for Behavioural and Cognitive Neuroscience (BCN), still one of the cornerstones of research and education in Groningen. Until shortly before his passing away, Diek remained an active participant of the Auditory Research Group at the University Medical Center, inspiring many young scientists.

Diek is survived by his wife Francien, their sons Hans and Peter, and four grandchildren.

#### ***Selected Publications of Hendrikus (Diek) Duifhuis***

- Duifhuis, H. (1970). Audibility of high harmonics in a periodic pulse. *The Journal of the Acoustical Society of America* 48, 888-893.
- Duifhuis, H. (2012). *Cochlear Mechanics. Introduction to a Time Domain Analysis of the Nonlinear Cochlea*. Springer New York, NY.
- van Hengel, P. W. J., Duifhuis, H., and van den Raadt, M. P. M. G. (1996). Spatial periodicity in the cochlea: The result of interaction of spontaneous emissions? *The Journal of the Acoustical Society of America* 99, 3566-3571.
- Wubbels, R. J., Kroese, A. B. A., and Duifhuis, H. (1990). Afferent bursting activity of ruff lateral line induced by background noise stimulation. *Journal of Comparative Physiology A* 166, 585-588.

#### **Written by**

**Pim van Dijk** p.van.dijk@umcg.nl

**Sietse van Netten** s.m.van.netten@rug.nl

**Deniz Baskent** d.baskent@rug.nl

**Hero Wit** h.p.wit@umcg.nl

*University Medical Center Groningen, University of Groningen, The Netherlands*