My good fortune to become a syncope doctor

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This personal account describing my good fortune to become a syncope doctor is my contribution to commemorate the 30th anniversary of *Clinical Autonomic Research*.

I was born in 1947 and studied medicine in Amsterdam. After my graduation, I was trained as a general internist (1975–1980) in the old *Binnengasthuis*, the University Hospital in downtown Amsterdam. A.M. van Leeuwen (1923–2013), professor of internal medicine, was my mentor. Van Leeuwen was an eminent clinician and passionate teacher and a role model in the tradition of “the Amsterdam school of internal medicine”. This school goes back to Pieter Klazes Pel (1852–1919), professor of internal medicine in the *Binnengasthuis* from 1883 to 1919 (Fig. 1a). Pel was a charismatic teacher, role model, and leader, who deeply influenced the medical education and training of young physicians in the Netherlands. Pel insisted that students should learn from seeing and talking to patients rather than at a desk listening to lectures. The title of Pel’s inaugural address in 1883 was “On the importance of bedside teaching.” The title of van Leeuwen’s inaugural address almost 90 years later was “The internist and the student”. For van Leeuwen, medical students were “his science citation index” [1]. Van Leeuwen’s mentor was professor J.G.G. Borst (1902–1975). His reputation as a general internist and inspired medical educator was unparalleled. His lectures and bedside teachings in the *Binnengasthuis* attracted the attention of medical students from other universities. He had a great influence on general internal medicine in the Netherlands.

The essential elements of “the Amsterdam school of internal medicine” are (1) evaluation of a patient in his or her social context and thorough medical history and

physical examinations as the starting point; (2) knowledge of pathophysiology is the foundation of internal medicine; (3) In diagnosing, “prefabricated medicine” and practicing medicine “à la mitrailleuse” are out of the question. An all-encompassing, holistic approach to patients and passion for the education of medical students and residents are the hallmark of “the Amsterdam school of internal medicine” [1].

Typical of professor Borst’s research were graphical presentations of very accurate long-term clinical and laboratory observations in individual patients, familiarly known as the “Borst curves”. An example of a Borst curve is the graph dealing with observations over an almost 5-week period of extracellular fluid volume expansion by salt loading and head-up tilt sleeping in a 22-year-old woman with severe orthostatic hypotension due to autonomic failure (Fig. 1c) [2].

My Ph.D. supervisor (1980–1983) was Cornelius Borst (born 1943), one of Professor J.G.G. Borst’s sons. He was a medical physiologist who had studied the mechanisms underlying beat-to-beat heart rate and blood pressure control by the arterial baroreflex. He introduced me to the fun of designing, performing, and analyzing physiological experiments, and writing papers. We analyzed the circulatory response during the first thirty seconds of active standing by performing intra-arterial blood pressure measurements on ourselves [3]. Due to discomfort and the minor risk of trauma, intra-arterial blood pressure measurements can no longer be used routinely in cardiovascular laboratories. In this context, the availability in the 1980s of noninvasive continuous measurement of finger arterial pressure through the inventions of Penaz and Wesseling was an important step forward in the evaluation of autonomic cardiovascular control. Wesseling subsequently developed a computer algorithm that computed stroke volume by pulse-wave analysis. These extraordinary scientific developments enabled clinicians and researchers to study noninvasively beat-to-beat hemodynamics [4]. I had the good fortune to

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Fig. 1 The Amsterdam school of internal medicine. **A.** Clinical class taught by Pieter Klazes Pel (1852–1919) in the *Binnengasthuis* lecture hall ca. 1902. **B.** Van Leeuwen (1923–2013) with residents in the same *Binnengasthuis* lecture hall in 1975. The arrow points at me (W. Wieling). **C.** A typical Borst curve. Diurnal pattern of water and sodium excretion, body weight, and orthostatic tolerance during a 5-week period in a 22-year-old woman with primary autonomic

failure. Her orthostatic tolerance in the early morning improved with a sodium balance of about +230 mmol during the combination of a high salt intake and fludrocortisone 0.2 mg and reached an acceptable level at +300 mmol after the institution of head-up tilt sleeping. Her body weight increased by 2.2 kg. Note the undetectable plasma renin activity

cooperate with Karel Wesseling in the Academic Medical Centre (AMC) in Amsterdam after my doctorate; the *Binnengasthuis* was merged with the AMC in 1981. The close interactions between Karel Wesseling as a biomedical engineer and myself as a clinician with an interest in physiology resulted in several publications during the 1990s concerning the hemodynamics underlying initial orthostatic hypotension and fainting in young healthy subjects. In collaboration with the physiologist John Karemaker, additional studies in this period focused on afferent baroreflex lesions and the effects of aging on orthostatic adjustments. Together with internist Han van Lieshout, I studied physical counterpressure maneuvers and plasma volume expansion to combat orthostatic hypotension in patients with primary autonomic failure [5]. At present, after decades of studies using measurement of finger arterial pressure and pulse-wave analysis, we have obtained great insight in the hemodynamic mechanisms

underlying a variety of syncope-provoking circumstances in the laboratory [6]. A major breakthrough for understanding syncope under “real-life” circumstances will come with the availability of advanced portable digital devices that can reliably record beat-to-beat ambulatory blood pressure and heart rate noninvasively (e.g. with a wristwatch).

With the above experience as a background, I started the AMC syncope unit in 1998 as a joint project of the departments of internal medicine, cardiology, emergency medicine, neurology, and clinical epidemiology. The syncope unit was located in the cardiology outpatient department. Our AMC syncope unit soon evaluated close to 200 patients per year. We began studies in patients with suspected syncope focusing on epidemiology, diagnosis, and treatment. I had the good fortune this time to collaborate with Patrick Bossuyt and Hans Reitsma from the department of clinical epidemiology in the AMC, world experts in the field of

diagnostic testing [7]. The combination of training in bedside medicine and circulatory physiology, by inspiring mentors and exposure to novel technology and clinical methodology, provided me with an optimal basis to develop syncope expertise. This knowledge was enhanced by my continuous exposure to patients [8].

Due to rapid advances in medical technology, molecular biology, genetics, clinical epidemiology, and evidence-based medicine, as well as wide dissemination of electronic records and rapid turnover of patients, the interest in basic bedside medicine and clinical physiology has decreased. Nevertheless, the core bedside skills of careful history taking and physical examination, the backbone of clinical reasoning, remain vital for the evaluation of transient loss of consciousness (T-LOC) and syncope [9, 10]. The skill in diagnosing an unexplained episode of T-LOC/syncope starts with a meticulous documentation of what happened to deduce what is going on with this patient. The key to a successful syncope history is having sufficient knowledge to ask the right questions and taking enough time to listen to the patient intensely. History building with the patient instead of history taking from the patient is key. The patient needs to feel at ease and to trust the doctor, to reveal all important aspects underlying the episode, particularly the ones with psychosocial triggers [8, 11, 12]. Some vital aspects of the history (which the patient may not consider important) need to be “teased out” by the doctor. This skill requires experience as well as a good interviewing technique. Careful history-taking and physiological reasoning are powerful tools to diagnose T-LOC and syncope. The diagnostic yield of a certain or highly likely diagnosis of T-LOC and syncope with history taking by hospital physicians is at least 60% with an accuracy of about 90%. The diagnostic yield can increase to as much as 85–95% with additional history-taking by a doctor with a special interest in syncope [7, 13, 14]. Additional diagnostic testing increases the certainty of the diagnosis, but it does not contribute to improving patient care [14]. The importance of history-taking and its high diagnostic yield implies that history taking must be allotted time. In complex cases, up to 1 h may be required [12].

A strong formal knowledge structure is needed for a successful interview of a patient with T-LOC and syncope. The Internet can serve as a strong educational tool for students and residents e.g. with a video-library with examples of episodes of reflex syncope. E-learning-based cases (eCases) are a far more effective tool for teaching than learning in a classroom listening to lectures. We have developed *Syncopepedia* (www.syncopepedia.org), a free-access educational website targeted at students, residents, and physicians to learn more about syncope [15]. The website is an initiative of the *Syncopepedia* Foundation, a non-profit organization established in the Netherlands in 2014. The goals of the *Syncopepedia* Foundation are “to improve medical knowledge, especially in the

field of syncope, and to provide access to this knowledge by facilitating publications in digital or other forms, for example by building and maintaining websites”. The goal of the *Syncopepedia* website is to enhance physicians’ knowledge of syncope (or suspected syncope) and to reduce misdiagnosis, unnecessary testing, and multiple specialist consultations.

The direction I chose within my medical career has been determined by my teachers who conveyed their enthusiasm for general internal medicine and clinical physiology upon me. By their knowledge and skill, and in particular by the way they exercised their profession, they served as my role models. What they had in common was the inspiration to pass on experience to the next generation. Over a period of more than 40 years, undergraduates and Ph.D. students played a crucial role in my research projects and building *Syncopepedia*. Their enthusiasm has been my good fortune. I hope I have conveyed the essentials of the Amsterdam school of internal medicine to them.

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Compliance with ethical standards

Conflict of interest None.

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