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The past 20 years have witnessed several major discoveries and innovations in the fields of neuro-ophthalmology and neuro-otology. In this issue of *Current Opinion in Neurology*, the current knowledge and recent results of scientifically and clinically relevant topics will be discussed.

For more than a century, our understanding of vision was that it was mediated via two types of photoreceptors located in the outer retina, rods and cones, each containing specific photopigments (opsins). Recently, a third and novel type of opsin was discovered: melanopsin. In mammals, melanopsin is expressed in specific retinal ganglion cells, located in the inner retina. These intrinsically photosensitive retinal ganglion cells (five subtypes) are not implicated in vision and their axons do not follow the retino-geniculo-calcarine pathways. These ganglion cells are not only important for the pupillary light reflex but are also primordial for regulating the circadian rhythm. Their connections to the posterior thalamus account for photophobia, pain induced by light stimulus. Further, the presence of melanopsin in the inner retina may open up new perspectives for restoring vision in patients blind as a result of an outer retina disease.

Hereditary optic neuropathies have been clinically recognized and characterized for more than a century. From 1978 onwards, researchers have discovered the genetic anomalies responsible for the majority of Leber's hereditary optic neuropathy (LHON) and dominant optic atrophy (DOA). It is only very recently that animal models of both LHON and DOA have been modelled, opening up a new era for investigating potential therapies for these disorders. Also, successful gene therapy was recently reported both *in vitro* and in a mouse model of LHON. This major achievement is important not only for hereditary optic neuropathies but also for the whole field of mitochondrial medicine. Clinical trials with idebenone, a quinone analogue of coenzyme Q-10, have shown some favourable effects in patients affected by either LHON or DOA. An experimental pilot study using α -tocotrienol quinone (EPI-743) in patients with LHON showed promising results. Finally, oestrogens were demonstrated to activate mitochondrial biogenesis and might be the reason why women are relatively protected against developing LHON.

Oculopalatal tremor (OPT) has been a puzzling disorder for more than a century. Although rare, OPT is a disabling condition due to the persistent oscillopsia. The presence of hypertrophied inferior olivary nucleus was associated with the peculiar presentation of OPT, but the mechanisms underlying the development of this delayed movement disorder remained mysterious. Exciting advances in neuroimaging, immunohistochemistry and the development of mathematical models allowed researchers to provide a more precise model for OPT: an inferior olivary nucleus generator/oscillator, whose signal is to be amplified/modulated by the deep cerebellar nuclei.

Saccadic intrusions are common, frequently interrupt fixation and are often symptomatic. Healthy individuals can show a few asymptomatic square wave jerks per minute, their frequency increasing with age or with tobacco smoking. All the other saccadic intrusions are pathological, implying underlying neurological disorders. There are many types of saccadic intrusions, which can be diagnosed by careful clinical examination in most cases, and they can be separated on the basis of the presence or absence of normal intersaccadic latency. Specific treatments have been proposed for specific types of saccadic intrusions.

Over the last 30 years, the diagnosis and treatment of disorders of the peripheral and central vestibular systems and associated dysfunctions of the ocular motor system and the cerebellum have proven to be fruitful scientific and clinical fields. New diseases were discovered such as vestibular paroxysmia, phobic postural vertigo, superior canal dehiscence syndrome (SCDS) as well as the different subtypes of benign paroxysmal positioning vertigo

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(BPPV). Innovative techniques were developed that are now widely used clinically, for instance, techniques to quantify the gain of the vestibulo-ocular reflex (VOR) using combined measurements of eye velocity with video-oculography and head velocity or to evaluate otolith function with cervical vestibular evoked myogenic potentials (cVEMP) for saccular function and ocular VEMP (oVEMP) for utricular function. Clinical trials determined the efficacy of new treatment options such as specific liberatory manoeuvres for the different subtypes of BPPV, corticosteroids for acute vestibular neuritis, betahistine in Menière's disease, carbamazepine for vestibular paroxysmia, aminopyridines for down-beat and upbeat nystagmus and episodic ataxia type 2 or canal plugging in SCDS.

This issue of *Current Opinion in Neurology* highlights the additional developments that have taken place in the last 2 years. A very frequent and clinically relevant subtype of bilateral vestibulopathy was identified and confirmed: cerebellar ataxia, neuropathy, vestibular areflexia syndrome (CANVAS). A systematic bedside examination now makes it possible to differentiate between a central and a peripheral lesion in patients with acute vertigo and dizziness by simply checking for the 'big five': skew deviation, gaze-evoked nystagmus, saccadic smooth pursuit, a normal head-impulse test in a patient with acute nystagmus, and a central fixation nystagmus. The method's sensitivity and specificity exceeds 90%. The evaluation of cVEMPs and

oVEMPs was further perfected, thus increasing their usefulness for peripheral and central vestibular disorders. Finally, the efficacy of the different liberatory manoeuvres in patients with posterior, horizontal or the rare anterior canal BPPV and of vestibular rehabilitation in patients with vestibular deficits is now on solid ground.

Despite this impressive progress, there are still areas with considerable deficits and therefore a continuing need for basic and clinical research in the future. There are two important goals. First, further improved and generally accepted classification criteria for all vestibular disorders should be developed. The Classification Committee of the Bárány Society is currently addressing this problem, and its publications will be coming out soon. Second, we need more state-of-the-art clinical trials to evaluate the efficacy of different treatment strategies, for example, the use of steroids in acute vestibular neuritis, beta-blockers or topiramate in vestibular migraine, betahistine, gentamicine and steroids in Menière's disease or carbamazepine in vestibular paroxysmia. Finally, new treatment options are needed for somatoform phobic postural vertigo.

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Conflicts of interest

No conflicts of interest.