ERA-NET Neuron

NEWSLETTER 32

Austria | Belgium | Canada | Finland | France | Germany | Israel | Italy | Latvia | Netherlands | Norway | Poland | Portugal | Romania | Slovakia | Spain | Switzerland | Turkey | United Kingdom

News From NEURON Cofund

NEURON 2019 Call: Excellent Paper in Neuroscience Award (EPNA)

Are you a first author of a scientific article in the field of neuroscience published between 1.1-31.12.2018?

You may be eligible to participate with a chance to win 3000€ and an opportunity to speak at the 2020 FENS Forum!

Deadline: October 1st, 2019

https://www.neuron-eranet.eu/_media/epna_2019_call.pdf

Looking forward to the

Midterm Symposium of JTC2017 Calls on:

Synaptic Dysfunction & Ethical, Legal, and Social Aspects (ELSA) of Neuroscience

September 18th, Lisbon

From the desk of the coordinator | August 2019

Marlies Dorlöchter

This late summer issue of the NEURON newsletter covers the latest scientific symposium on sensory organs which was held on May 15th in Riga, Latvia. The symposium was chaired by Etienne Hirsch and Bernard Poulain. They invited seven renowned researchers from five countries to present their views on the topic as you can read in the contributions of some of them in this issue. The audience comprised representatives of the funding organizations, members of the NEURON Scientific Advisory Board, and invited patient representatives from Retina International and Christian Blind Mission International.

The EPNA 2018 was awarded to Dr. Tobias Kaufmann at the NEURON MidTerm Symposium of the Joint Transnational Call 2016, on January 22nd 2019 in Bonn, Germany. In this issue he shares his views on science and career options in an interview on page 13.

Funded by the European Commission

More information can be found on our website
http://www.neuron-eranet.eu/
era-net neuron

Produced by CSO-MOH, IL

The EPNA 2019 Call was published in August on NEURON's website and facebook page. The call is targeted to early-career researches (ECR). First-author ECRs of a research article published in an international peer review journal with a high impact factor are eligible to apply. The topic of the article must be clearly relevant to disease related neuroscience and the work must be done in an ERA-NET NEURON partner country. The awardee receives a prize of 3,000 €, as well as an invitation and travel support to present the paper in a special lecture at the FENS FORUM 2020 in Glasgow, Scotland.

September 18th, 2019 will see NEURON's MidTerm symposium of the JTCs 2017 'Synaptic Dysfunction'& 'Ethical, Legal, and Social Aspects (ELSA) of Neuroscience'. The meeting takes place back-to-back with the 5th International Conference on Neuroethics (ICONES) on September 16-17th. Twelve transnational consortia on synaptic dysfunction and three transnational consortia on ELSA research projects will present and discuss their work, and we look forward to a most interesting event.

Also upcoming is the Cajal-course 'Advanced Techniques for Synapse Biology' from October 13th to November 1st, 2019, in Bordeaux at the Neurocampus. Within the partnership with the Cajal Advanced Neuroscience Training Programme, NEURON offers stipends for the registration fee for principal investigators that have been selected among applicants and are partners in a NEURON funded project. The advanced course will allow students to integrate the basic techniques in molecular and cellular neurobiology with advanced state-of-the art molecular, imaging and functional methodologies, through direct hands-on experiments using a variety of models. The course director is Patrik Verstreken of KU Leuven, Belgium.

Not least, a new twitter account was opened for Neuron!
Interested parties are invited to follow and tweet https://twitter.com/EraNeuron

Sincerely yours,

Marlies Dorlöchter.

NEURON Symposium on SENSORY ORGAN DISORDERS

May 2019, Riga

We were honoured to have seven renowned researchers in the field of sensory organs disorders present their research, as well as their insights and thoughts on the current state of the sensory disorders field, its challenges and knowledge gaps. Serge Picaud from the Vision Institute in Paris spoke of the state of the art and current challenges in vision. Brigitte Malgrange from University Liège, Belgium, presented the state of the art and challenges in audition (hearing). Andrew J. Bremner from the University of London exposed us to senses other than hearing and vision and their related disorders. Andrej Kral from Hannover Medical School spoke on the interaction between sensory organs and the central nervous system, as examplified by the bionic ear. Tobias Moser from University Medical Center Göttingen, focused in his talk on neuroprosthesis for sensory restoration as a means for sensory disability restoration. Francine Behar-Cohen from INSERM, covered the topic of cellular and molecular mechanisms for disability rehabilitation, mainly in the eye, and Diego Santana-Hernández, from CBM International, talked about the social aspects and health economics related to sensory disorders. The symposium ended with a panel discussion, which included engaged patient representatives, Christina Fasser from Retina International and Diego Santana-Hernández from CBM International and members of the Neuron Scientific Advisory Board. The discussion focused on the main gaps existing in the sensory organs disorders research and the topics that should to be included in Neuron's next Joint Transnational Call funding scheme. An elaborate report of the symposium and its outcomes, prepared by INSERM, can be found here.

We hereby present contributions from four of our distinguished guests.

Opening of the Sensory Organs Disorders Symposium by the organizers, Etienne Hirsch and Bernard Poulain

Sensory disorders discussion panel led by Marlies Dorlöchter, including representatives from European patient organizations

Francine Behar-Cohen

DISABILITY REHABILITATION: MOLECULAR AND CELL THERAPIES

Prof. Francine Behar-Cohen

Ophtalmopole, Cochin Hospital AP-HP, Paris

Director Physiopathology of ocular diseases: Therapeutic innovations, INSERM UMR 1138 Centre de Recherche des Cordeliers , Paris, France

Common challenges faced by visual and hearing systems, in particular the prevention and targeting of environmental risk factors

The visual and hearing systems share common properties: they're both in contact with the outside environment, they are both small organs, complex, compartmentalized, comprising of neuronal tissue and fluidic environment, and these local micro-environments are more or less privileged immunologically. Both organs are protected by barriers and the systemic routes are not optimal, making systemic drug delivery to these organs a major problem. But compared to the brain, there is a direct access allowing for local delivery. Both the eye and the ear are exposed to environmental burden (light, noise, particles, allergens) and in these organs there are diseases associated with pathological ageing, genetic diseases, but also complex, multifactorial diseases. The main difference between the visual and hearing system is the complexity of the visual signal and the difficulty to develop a visual aid, such as cochlear implants in hearing loss. Also, good animal models are difficult to find for visual pathophysiology, due to the differences in the retina structure among species: macula (the rodents have none), in vasculature (it is different in the rabbit, rodents and in human) or in immunity (different in any animal, including between non-human and human primates). Nevertheless, the eye can benefit of much more developed local delivery of drugs.

Regarding the causes of blindness, cataract is prevalent in the world, especially in developing countries, whereas age-related macular degeneration (AMD) and retinal disease are the most frequent diseases in Western societies, representing up to 50% causes of blindness. Regarding retinal disease, AMD is the main cause of blindness, followed by diabetic retinopathy and glaucoma, and in 2040 the number of individuals in Europe with early AMD is predicted to reach 20 million and for late AMD, around 5 million, thus representing an important health problem. And although the number of patients with visual impairment due to diabetes is not going to increase in proportion, the number of diabetic patients itself is going to significantly increase all over the world, and also in Europe, so it will increase the overall number of diabetic retinopathies.

Often neglected, myopia is becoming a major problem for young individuals. Already very prevalent in Asia, where in some countries like in Korea, it reaches 94% of the whole population, it is also increasing in Europe and presently, we witness for the first time, a higher number of myopic than non-myopic individuals. In 2050, 50% of world population will be myopic. Myopia is associated with macular complications, called myopic maculopathy, leading to blindness and such myopic-related blindness is predicted to soon affect almost 20 million people worldwide. Therefore, many efforts are done to identify factors responsible of this ocular axial length change. One of the major factors having been recognized is the lighting environment, which plays an important role: doing the same activity but being outside decreases the evolution and the onset of myopia for children. At a time when new lighting systems (i.e. LEDs) modify our daily environment, spectral composition of the light and the circadian rhythm are modified, playing a role in the occurrence and progression of myopia.

Likewise, in hearing loss, there are frequent but actionable risk factors that can be controlled (such as noise). Accessible preventive strategies might be more cost-effective than complex replacement and treatment strategies, which remain necessary. So both visual and hearing diseases affect large populations, are multifactorial and involve complex genetic predispositions, ageing and environmental factors (noise, light, food, pollution, allergens, toxic agents, stress, shift work). There is, therefore, a crucial need to act on their "exposome", to control causative or aggravative factors. Indeed, only a limited number of diseases are simply explained monogenetically: they are rare diseases, affecting small number of patients, although they can be models for more frequent ones.

Major recent advances in visual rehabilitation

First of all, the most striking advances come from microsurgery. These advances made possible other therapeutic innovations, like the development of local therapies to treat common retinal diseases, gene therapy and cell therapy, which all need complex surgical procedures. Indeed, eye surgery improved, with miniaturization, simplification, better visualization, and collaboration with industry and doctors. For example, cataract surgery has the highest rate of success amongst all performed surgeries in humans. The other major advance has been the revolution in imaging technologies. This is probably the reason why in the eye so many therapies were developed: because we can see what we are doing, we can evaluate and quantify the effects of our treatments. Should neuroprotective or preventive treatments become available, there is a dire need to be able to evaluate progression of the disease and the effect of treatments and validate correlations between imaging and functional endpoints for clinical trials, or else it will not be possible to test and evaluate therapies in humans. Therefore, many efforts focus on improving imagery at the level of the cells. More generally, in multifactorial

diseases, it is difficult to find one simple etiological treatment. There are three main mechanisms leading to loss of sight: macular edema, cell death, abnormal healing (glial and vascular proliferation). Inflammation and oxidative stress are in the center of all these processes. Macular edema, the accumulation of fluid in the macula, leading to visual distortion and scotoma, is occurring in almost all retinal diseases, such as diabetic retinopathy, wet AMD, vein occlusion, even in retinitis pigmentosa where macular edema develops at the last stage (Daruich et al, Prog Retin Eye Res, 2017). Currently, macular edema is the one and only sign and symptom that is accessible to treatments. Anti-VEGF proteins or glucocorticoids injected repeatedly in the vitreous, are not curative of the disease but they reduce edema and have changed the fate of disease in millions of individuals.

Local intraocular injections of anti-VEGF therapeutic proteins or glucocorticoids have revolutionized the management of macular edema in various retinal diseases, but it's still not perfect, as not all patients respond to the treatment, and important gaps remain to be solved. Indeed, results are much worse in real life studies as compared to randomized controlled trials, and this might be due to under-treatment as well as the need for having the drug in the eye permanently, which urge to find methods to achieve sustained and controlled intraocular delivery of the drugs. Another problem lies in the fact that there are no biomarkers to select patients amenable to specific treatments. So there is a high cost for the health system and insufficient benefits for patients. There is therefore a need for personalized medicine, to identify those biological and imaging factors that could tell which patient will benefit from one treatment or another.

Finding other drugs that target the other blinding mechanisms, such as fibroglial scarring and retinal cells death is another major challenge. Whilst many drugs, targeting oxidative stress and various mechanisms of cell death have shown efficacy in animal models, none of them have yet reached the clinical stage.

How to improve models and their translationability

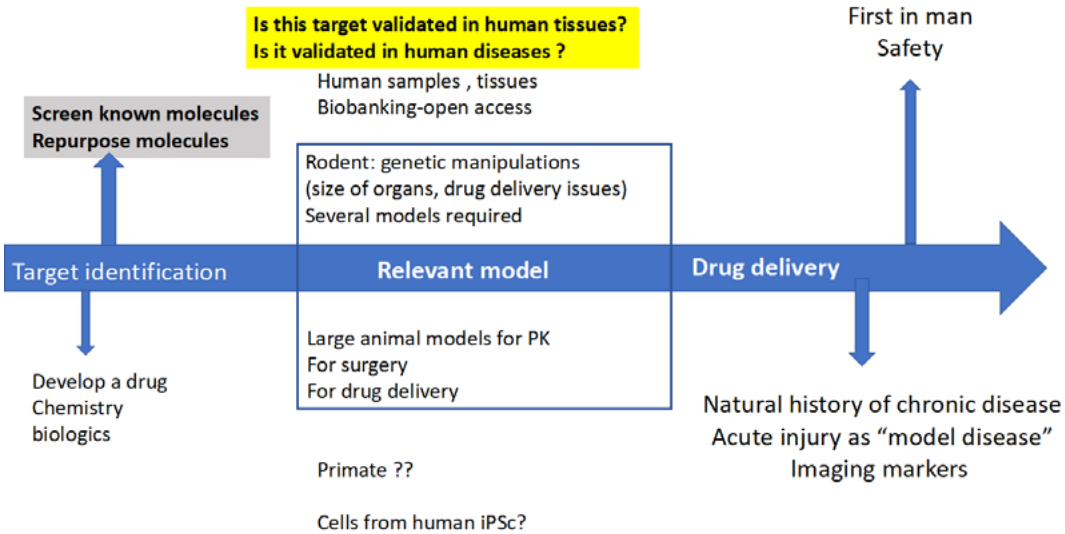
Numerous drugs are efficient in models but there has been no translation in humans yet. It is therefore important to re-think drug development strategies. Target identification and development of a drug require intensive chemistry and biological research that might take twenty years. On the other hand, it is possible to test molecules that are already known, in order to repurpose them. In either case, the major bottleneck is whether these targets are validated in human tissues and human disease. And this needs to be known quickly for any drug development because if there is no validation in human, this drug development in animals becomes pointless and needs to be stopped. Validation in humans requires performant and open

biobanking, with human samples of ocular tissues.

Regarding the currently available models, rodents are used because they are easily available, cheap and can be genetically manipulated but they are very small, with a small eye in the range of the millimeter, on which it is difficult to perform surgery. Moreover, it is difficult to know if the drug is achieving its target within such a model. Larger animal models, like non-human primates, might be better for pharmacokinetic studies, surgery and drug delivery but they still present problems for translationability: although primates have a macula, it is different from the human one and the immune systems are different in primates and humans. Another solution would be to use cells from human iPSCs. Overall, there is a need for collaborative work to define different types of models that could answer different types of questions and validate these models. Drug delivery remains a major issue, both in humans and in animals. And first-in-man safety trials as well as validation of the efficacy of treatments in humans are direly needed. Therefore, a better understanding of the disease's natural history and imaging markers are crucial. Working with agencies so that they accept these imaging markers as validating markers and not just wait for functional efficacy is thus an important step to take. Therefore, screening small molecules, repurposing known drugs, reformulation for ocular / ear delivery, and methods to evaluate the effects in relevant models (animal but also cellular) are recommended.

Different available therapies: viral and non-viral gene therapy, and stem cell therapy

Gene therapy is particularly adapted for retinitis pigmentosa, affecting 1.5 million patients worldwide, and a major cause of total blindness. But there are numerous genes leading to retinitis pigmentosa, some affecting also the cilia, leading to retinal dystrophy and deafness as well, and many efforts are directed towards identification of unknown genes. Viral vectors are probably good candidates to deliver these genes, in the case of a target cell where gene replacement and augmentation are required. They



have been so far injected sub-retinally, in many clinical trials, amongst which, two are promising. First, the Luxturna treatment, FDA-approved, which provides a functional RPE 65 gene in congenital Leber amaurosis. It leads to an increase in the navigational ability in dim light conditions only in half of the patients, and improvements might not persist long-term, while two patients experienced permanent vision loss. It could treat about 60,000 patients in the world, probably two thousand in Europe, but the price is very high. The other clinical trial using viral vectors is the phase 2 trial for choroideremia (CHM), an X-linked chorioretinal dystrophy characterized by progressive degeneration of the choroid, retinal pigment epithelium and retina-mutation in REP1 gene. It seems that visual acuity in the 14 treated eyes was increased as compared to the controls, in a cohort of predominantly late-stage choroideremia patients in whom rapid visual acuity loss would ordinarily be predicted. But a phase 3 trial is needed to confirm these results.

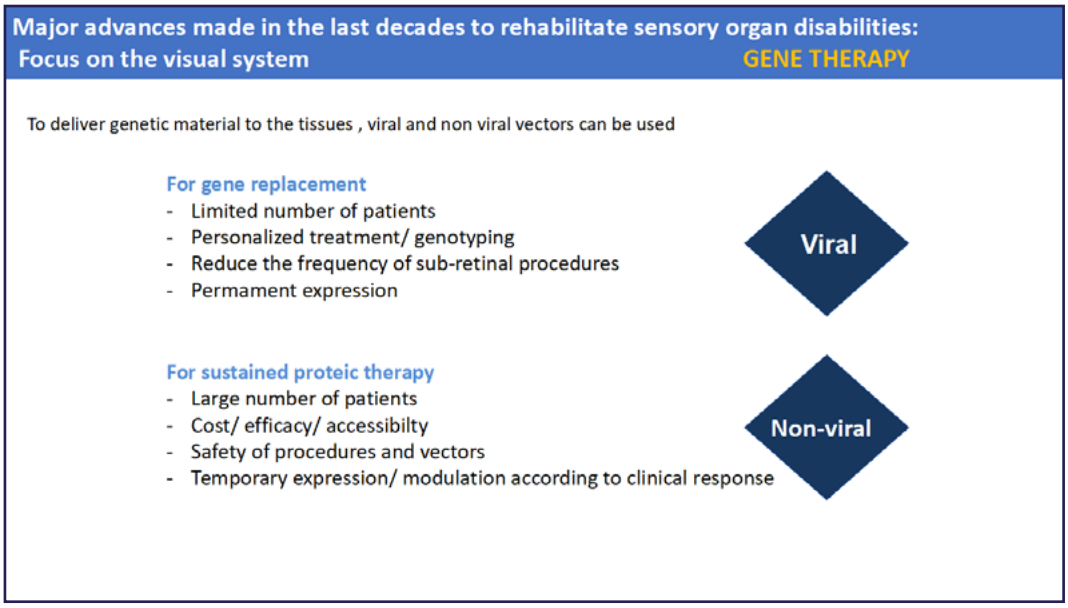
There are, however, important gaps that still need to be overcome: subretinal injection remains at high risks and low reproducibility, it is difficult to evaluate pharmacokinetics and pharmacodynamics, the delivery of vectors and their production needs to be improved and has a high cost, and it is limited to small number of patients with this specific genotype. Also, efficacy so far has been limited and the duration of efficacy is not known. Therefore, it is not adapted for large number of patients and for the production of secreted proteins.

Gene editing is a recent topic of research, at its early stage, and will not be addressed in this summary.

A sustained production of secreted therapeutic proteins, for instance anti-VEGF, as a result of gene therapy is not the optimal option. Indeed, it is not recommended to have a permanent definitive expression of anti-VEGF forever in the eye, and there is a need to be able to evaluate the dose and have an efficient exit strategy. In addition, the cost of 5 million patients receiving subretinal injections of viral vectors itself is redhibitory.

Non-viral vectors appear as an interesting possibility for a large number of patients, with better cost, efficacy and accessibility, better safety of procedures, and the possibility of a temporary expression modulation according to clinical response. For instance, electroporation of plasmids in the ciliary muscle turns it into a biofactory, producing therapeutic proteins for a long term in the eye. This has already been used to target TNF to decrease inflammation. The device is a combination therapy of a coupled electric system with plasmid – combination therapy (Eyevensys). Preliminary results are encouraging. They should be confirmed in larger trials. Non-viral vectors are a good strategy, considering the number of patients that there are to treat.

Regarding cell therapy, a good example is the surgery of the corneal endothelium graft. When the cornea is blurred because of a pathological endothelium, which does not regenerate, this 20 microns thick layer of endothelium can be removed and replaced with the apposition of the endothelial from a dead donor, without any suture nor immunosuppression, thus taking advantage of the immune privilege of the eye. It is more complicated for retinal diseases, however. Removing dead tissues is a first step, then there is the possibility of introducing embryonic stem cells, cells differentiated from pluripotent stem cells, that can either be free, on a material or on a biologic membrane. Some under-retinal injections of free cells from human embryonic stem cells have been performed, but they were not completely conclusive and will not be discussed here.



More recently there have been attempts to insert polarized cells on membrane or on biomaterials under the retina with encouraging results that remain to be validated in larger trials. It is important to control the origin of the stem cells, as there have been reports of patients becoming blind after inadequate procedures. Therefore, there is a need to regulate these cells and control their origin and how they are used. Induced pluripotent stem cells (iPSC) can be autologous or not, coming from cells taken from the skin or the blood, dedifferentiated in iPSC and then re-differentiated either in organoids or in cells and then re-implanted as suspensions or again, as scaffolds under the retina.

Gaps and proposed topics to be funded

The following gaps in knowledge need to be overcome:

- Immune response and immunosuppression issues
- The risk of carcinogenesis with the iPSC
- Production, quality control, reproducibility and preservation of viral, non-viral and stem cells
- Long-term survival of cells in a pathologic environment
- Surgical techniques - because we want to intervene earlier, the current high rate of complications cannot be accepted in a patient that is still seeing
- Strategies for late intervention
- Implementation of combination therapies, as they are a good option to work on the micro-environment to allow those cells to survive

The proposed topics to be funded are:

- The role of the environmental burden on sensory organs (light, noise…), to define thresholds and strategies to protect the population
- *In vivo* imaging technology, in the eye and possibly in the ear, at cellular levels, for earlier intervention and testing new drugs; this would help surgery but also follow-up;
- Correlation between imaging and function to define and validate new endpoints for clinical trials (for the moment, only late phase patients are treated)
- Improvement of drug, gene delivery and surgical techniques
- Better understanding of immune responses to therapies
- Standardization of models for translation to human diseases (primates are not going to answer all the questions; there is a need to understand in each animal model what can be gained and share this experience)
- Screening of small molecules and their repurposing for sensory organs with an adapted drug delivery for the eye, requiring a multidisciplinary network

Andrej Kral

INTERACTIONS OF SENSORY ORGANS AND CNS: THE CASE OF THE BIONIC EAR

Prof. Andrej Kral

www.neuroprostheses.com

Cluster of Excellence Hearing4All, Hannover, Germany & Macquarie University, Sydney, Australia

Brain development continues for many years after birth. Much of this development depends on sensory input. We learn to hear, understand and speak the mother language. Hearing loss, one of the three most frequent inborn disorders of humans, interferes with this process. Cochlear implants, the most successful neuroprosthesis, can compensate for profound hearing loss and provide the deafborn children with sufficient hearing to learn a language (review in Kral & O'Donoghue, 2010, New Engl J Med). My lab investigates the neural processes responsible for efficacy of cochlear implants and studies the brain adaptations to early cochlear implantations on animal models.

We are working with a higher mammal model of inborn deafness, the congenitally deaf cat, and test the morphology and function of the brain in hearing animals, congenitally deaf animals, and animals born deaf but equipped with a portable signal processor and a cochlear implant at different ages. Extensive functional deficits in the brain of deaf animals have been demonstrated and could be compensated by an early, but not by late, cochlear implantation. There was excellent correspondence between electroencephalographic findings in cochlear-implanted children with the findings in deaf cats exploring the neuronal mechanisms of developmental plasticity (review in Kral and Sharma, 2012, Trends Neurosci) and critical periods for therapy of deafness with cochlear implants (Kral et al., 2013, Brain, Kral 2013 Neurosci). Furthermore, we observed visual takeover (cross-modal reorganization) of the auditory cortex in deaf animals in higher-order auditory areas (Lomber et al., 2010, Nat Neurosci), whereas it did not interfere with the cochlear implant responses in the reorganized areas (Land et al, 2016, J Neurosci). Serious deficits were observed in congenital deafness in the microarchitecture of the cortical column, a prerequisite for comparing the sensory input with the (top-down) predictions about it (Kral et al., 2019, Ann Rev Neurosci). This is an essential mechanisms controlling adult learning. We observed loss of induced oscillatory responses corresponding to the deficit (Yusuf et al., 2017, Brain). Finally, in children a high variation in cognitive functions is associated with early deafness, indicating consequences also on non-auditory functions (Kral et al., 2016, Lancet Neurol).

The need for early intervention in congenital deafness results from a multiplicity of developmental mechanisms dependent on sensory input, combining developmental molecular changes in synapses, deficits in their plasticity, reduced informational capacity of the deaf auditory brain, reduced auditory feature sensitivity, cross-modal takeover and deficits in brain mechanisms required for control of learning and behavior.

Supported by Deutsche Forschungsgemeinschaft (Exc 2077 and Kr 3370) and National Science Foundation (USA) in collaboration with BMBF and DLR.

Brigitte Malgrange

STATE OF THE ART AND CHALLENGES IN AUDITION

Prof. Brigitte Malgrange

GIGA-Neurosciences, University of Liège, Belgium

Hearing loss is the most common neurosensory impairment and concerns 360 million people worldwide. For the majority of patients, irreversible deafness results from an alteration of the auditory portion of the inner ear, the so-called sensorineural hearing loss. This type of deafness is mainly due to a loss of hair cells and/or connected spiral ganglion neurons. In addition, deafness – especially in aging – can be related to stria vascularis - the secretory epithelium of the inner ear -damage. Overall, neurosensory deafness appears as the common consequence of many pathological mechanisms that require an equivalent variety of different therapeutic approaches. Up to now, current treatment is limited to hearing aids and cochlear implants but they are far from perfect. No pharmacological treatment has been discovered. Therefore, it is important to overcome the hurdles that are present on the way to novel drug identification for neurosensory deafness.

Diego Santana-Hernández

SOCIAL ASPECTS AND HEALTH ECONOMICS: EAR AND HEARING CARE PERSPECTIVE

Dr. Diego Santana-Hernández

Senior Advisor for Ear and Hearing Care, CBM International

This presentation provided an introduction to the field of Ear and Hearing Care (EHC) and hearing disability; it shared the latest global figures and trends of hearing loss, including current prevalence estimates and projections. Most frequent causes of hearing loss across the life span were detailed, focussing on the importance of early detection, adequate diagnosis and effective interventions through a public health approach, coordinating public and private efforts when appropriate. Reference was made to available international frameworks and planning tools for EHC, produced by WHO and other UN agencies, in partnership with civil society organisations such as CBM International. It also addressed current controversies in the field of EHC, as well as existing gaps in science, medicine and technology.

Attention was given to the importance of breaking the cycle of poverty and disability, and the disparities existing between well-resourced settings compared to communities living in disadvantaged circumstances, both in high income and low- and middle- income countries; particularly to inequities related to financial investment made into public health and research. The personal, familial and societal impact of living with a hearing disability and the challenges derived from lack of accessibility and affordability of hearing services and assistive devices were also addressed.

The essential role of combining public health interventions with service delivery and targeted research was explained, inviting all agencies to contribute towards improving the quality of life of end-users and persons with disability, and to adequately document it. This, by aligning research proposals and work with key drivers identified within already established national health systems and services. The strategy for strengthening Primary Health Care services through research on cost-effectiveness of capacity building in Primary Ear and Hearing Care was shared as an example of how to contribute towards achieving the common goal of Universal Health Coverage, through evidence-based advocacy.

Proposed topics for research related to hearing and audiology where shared from a worldwide perspective. Particular emphasis was made on the need to produce and collect meaningful data about the positive impact of proven successful models; for delivery of hearing care services which are based on implementation science results. Research in the field of EHC plays a vital role in developing evidence-based interventions, in order to identify cost-efficient multidisciplinary strategies to address common challenges, and to make the most of arising opportunities at community, national and international level.

2018 EPNA AWARDEE
Dr. Tobias Kaufmann
Personal Interview

The Excellent Paper in Neuroscience Award (EPNA) intiative was first introduced by Neuron in 2009, in order to support and encourage young scientists in the neuroscience field at the early stage of their career. The winners of the award receive a cash prize as well as an invitation to present their work as special ERA-NET NEURON Young Investigators speakers in an international conference. A fruitful collaboration with the Federation of European Neuroscience Societies (FENS), gives the awardees an opportunity to present their work at the renowned FENS forum.

The 2018 EPNA awardee is **Tobias Kaufmann**. Dr. Kaufmann is a neuroscientist at the Norwegian Centre for Mental Disorders Research in Oslo, Norway. In his research, he investigates pathophysiological changes in brain structure and function and their genetic underpinnings in individuals with severe mental illness. He received the award for his publication 'Delayed stabilization and individualization in connectome development are related to psychiatric disorders' publishes in Nature Neuroscience 2017: 20, p. 513–515.

Continue reading to learn more about Tobias and his scientific journey.

1. Please tell us briefly about your research interests.

In my research, I study the brain and its disorders using magnetic resonance imaging. I'm particularly interested in the dynamics across the lifespan - that is, how disorders evolve and how they affect brain structure and function throughout life. To this end, I leverage large resources of brain imaging and genetics data, and search for patterns that are relevant to mental health.

2. Please tell us about your scientific journey to-date.

After completing my studies of Biology with Computer Science as minor at University of Freiburg, I joined the Graduate School of Life Sciences at University of Würzburg. Following graduation in 2013, I joined the Norwegian Centre for Mental Disorders Research – NORMENT – at University of Oslo and soon became interested in lifespan modelling of brain imaging data. In 2017, I was fortunate to secure my own funding in that domain from the Research Council of Norway, and to employ great people to work with. NORMENT is a truly interdisciplinary workplace, and I enjoy how researchers from different disciplines target mental health research together.

3. What made you choose a career in your field?

In academia, you get to work with brilliant people from around the world. I like how discoveries often trigger new questions that shape your own research directions. There is a lot of dynamics behind research that make it a vivid experience.

4. Where do you see your field of research in a few years? What are going to be the major breakthroughs?

Many factors shape our individual risk architecture from genetics to environmental factors, and the timing when changes in neurophysiology occur likely plays a crucial role, especially in development but throughout life. In studying "the average patient" in classical case-control designs much of the heterogeneity between individuals has previously been disregarded. To move on, we need to incorporate a broader set of aspects into the picture and start modelling the within- and between-subject variance both in healthy individuals and those with a disorder. Novel resources like the UK Biobank that make a vast amount of imaging, genetics and behavioral data available to the research community have been a true game changer in recent years. This places us in the unique position to map variations in the healthy brain to genetics, cognition, behavior and environment, and to use the gained insights to improve our understanding of brain disorders.

5. What were the main challenges you had overcome in your career path and how did you overcome them?

I think one of the major challenges that we all face is that thorough research takes time and that we usually have more ideas than we can possibly explore. Fortunately there are support structures in place – like the ERANET – so that we can get more people in and target the research in teams. Also, the open sharing of data really helps in that regard, as we can now reduce the amount of redundant data collections and use the same data to explore different topics.

6. What are your goals for the future and where would you like to see yourself 5 years from now?

Psychiatric disorders such as schizophrenia likely evolve early in life yet they may often go unnoticed until the outbreak of severe symptoms. Our hope is that we can one day identify changes in the brain early so that individuals who are developing a disorder can receive support early on. Given the complexity of these disorders, it is likely a long way to get there. But we are learning a lot about the brain on the way, so that "the journey in itself" is important and interesting.

7. What advice would you give your younger self or young scientists beginning their research career?

There is much to learn from interdisciplinarity. Talk to people who approach your topic from another discipline and see how their perspectives can help your research. Their field-specific terminology or way of thinking may sometimes be difficult to grasp at first trial, but it is worth the effort: The topics we study are usually impossible to tackle from just one angle and by joining forces with other disciplines we can widen our horizons and create something new.

NEURON AT WORK - Riga, May 2019

Dedicated multinational group working on the strategic research agenda of Neuron for the coming years.

A busy Neuron meeting took place in lovely Riga, in May, 2109.

29 representatives from 19 Neuron partner organizations got together in order to jointly work towards pushing forward neuroscience research on an international level.

The meeting included a working group aimed at refreshing the Strategic Research Agenda of Neuron, the symposium on Sensory Organs Disorders mentioned above, a general Neuron meeting and a Call Steering Committee meeting.

Neuron's Sensory Organs Disorders Symposium, Riga 2019