

Description of research and training

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Description of Research

Title:

Development of inner ear and brain – the role of Netrin1 and Gata transcription factors.

Netrins comprise a conserved family of laminin-related secreted molecules with members originally implicated in axon guidance and neuronal migration. Netrin1 deficiency in mouse brain causes defects in axon guidance and cell migration during embryonic development. We have shown that Netrin1 is also required for the development of the inner ear and more recently in olfactory bulb morphogenesis. We demonstrated a novel function for Netrin1 in forebrain as a factor that enables the olfactory bulb neuronal and oligodendroglial precursors to leave their place of birth in the ventricular zone and to efficiently enter the rostral migratory stream to migrate to the olfactory bulb. Furthermore, we have shown that Netrin1 is important for the formation of the corpus callosum, the largest commissural tract in mammalian brain which acts to coordinate information between the two cerebral hemispheres.

The zinc-finger containing transcription factors Gata2 and Gata3 in vertebrates belong to the six-member Gata-family that are essential regulators in the development of various organs. Both Gata2 and Gata3 have important roles during mouse inner ear and brain development. We have shown that both Gata factors are required for inner ear morphogenesis and Gata3 also for the differentiation of the sensory hair cells of the mouse cochlea. With genetically modified mouse and chicken embryos as models we have also shown that Gata2 is important for neuronal fate specification in the midbrain. The gamma-aminobutyric acid-secreting (GABAergic) neurons in the midbrain are clinically relevant since they contribute to fear, anxiety, and addiction regulation. The molecular mechanisms regulating the GABAergic neuronal development, however, are largely unknown. We characterized Gata2 as a critical determinant of the GABAergic neuronal fate in the midbrain. In *Gata2*-deficient mouse midbrain, GABAergic neurons were not produced, instead the *Gata2*-mutant cells acquired a glutamatergic neuronal phenotype. Gain-of-function experiments in chicken also revealed that Gata2 was sufficient to induce GABAergic differentiation in the midbrain. Further studies involve the characterization of the genes regulated by Gata factors especially in midbrain as well as the origin and regulation of the development of other midbrain neuronal populations such as dopaminergic, serotonergic and glutamatergic neurons.

Description of training/teaching

Education in University Pedagogy

Yliopistopedagogiikka I, 10 op, University of Helsinki 2008

Opettajasta oppimisen ohjaajaksi, 2 op, Faculty of Veterinary Medicine, 2013:

Tiedekuntaan räätälöity koulutus koostuu kolmesta lähiopetuspäivästä ja pienimuotoisesta omaan opetukseen liittyvästä sovellustehtävästä. Lähipäivien teemat ovat

12.4.2013 Opettajan vuorovaikutustaidot ja osallistamisen taito

6.5.2013 Opiskelijan osallistamisen ydinelementit

30.5.2013 Tutkiva oppiminen ja yhteisöllisyys opetuksessa

Tavoite:

Täydennyskoulutuksessa Helsingin yliopiston eläinlääketieteellisen tiedekunnan opettajat kehittävät, monipuolistavat ja syventävät rooliaan opiskelijaryhmän vastuuttajana ja ohjaajana. Koulutuksessa opettajat hankkivat työkaluja opiskelijoiden osallistamiseen ja arvioivat ja kehittävät toimintaansa vertaisoppimisen ohjaamisen ja osallistavien menetelmien käytössä.

Teaching experience

2001-2005 Coordinator of training given in Developmental biology by the Institute of Biotechnology, University of Helsinki.

2001-2008 Several lectures annually at the University of Helsinki on subjects such as: Developmental biology, Developmental neuroscience, Stem cells in neuroscience, Stem cells and cloning, Genetically modified animal models, Molecular Neurobiology.

2008- to present University lecturer in Biocemistry, Department of Veterinary Biosciences:

Courses in Finnish approx 70 students annually:

(Eläinlääketieteen kandidaatin tutkinnon aineopintoja)

90181 Solut ja kudokset, 3 op:

- 2 lectures, exam

90188 Solu- ja molekyylibiologia 4,5 op:

- responsible teacher, planning of the course (kurssin vastuuopettaja)
- 9 lectures, exam
- 3 h group work (2 groups of 35 students)
- 6 h laboratory work (2 groups of 35 students)
- 4 h group work presentations

90183 Solun aineenvaihdunta, 6 op

- 8 lectures, exam
- 15 h group work, responsible teacher (2 groups of 35 students)
- 15 h laboratory work, responsible teacher (2 groups of 35 students)

90805 Anatomia, biokemia ja fysiologia kliinisen työn tukena, 2 op

- responsible for the work of one group (10 students), using problem based learning

Organising scientific meetings as part of training in Developmental Biology:

Co-organiser of an international meeting "Cellular mechanisms of Development" May 8-10, 2003 Helsinki.

Co-organiser of the Annual Meeting of the Finnish Society of Developmental Biology, November, 2004, Hyytiälä Forestry Field Station, University of Helsinki.

Co-organiser of an international meeting: SIGRID JUSELIUS SYMPOSIUM "Cell Communication in Morphogenesis", June 3 – 6, 2007, Hanasaari, Finland.

Co-organiser of a joint meeting: Finnish German Doctoral Training Network in Developmental Biology (FinGerDevNet) kick-off symposium and Annual Meeting of the Finnish Society of Developmental Biology, November 15-17, 2007, Hyytiälä Forestry Field Station.

Main organiser and Coordinator of the EU Fp6 Marie Curie PhD program DevSignalNet Final Symposium, January 8th, 2010, Helsinki.

Planning of the first year studies for Veterinary students:

Planning of the time-table for the first-year veterinary students

(Lakanatoimikunnan jäsen vuodesta 2010- , vastuualueena ensimmäisen vuoden lakana)

Preparation of major teaching material:

Textbook in developmental biology (in Finnish):

Sariola, H., Frilander, M., Heino, T., Jernvall, J., Partanen, J., Sainio, K., **Salminen, M.**, Thesleff, I. Kehitysbiologia. Solusta yksilöksi. 2003. Kustannus Oy Duodecim, Helsinki.

Completely renewed version:

Sariola, H., Frilander, M., Heino, T., Jernvall, J., Partanen, J., Sainio, K., **Salminen, M.**, Thesleff, I., Wartiovaara, K. 2015. Kehitysbiologia - Solusta yksilöksi. Duodecim.

Supervisory experience

Supervision of 16 Candidate Thesis in Veterinary Sciences 2008- 2015

Supervision of Master's theses:

Tanja Matilainen, University of Helsinki, Dept. of Animal Physiology, Faculty of Biological and Environmental Sciences, 2003.

Janne Hakanen, University of Helsinki, Dept. of Animal Physiology, Faculty of Biological and Environmental Sciences, 2004.

Tanja Wennerström, University of Helsinki, Dept. of Animal Physiology, Faculty of Biological and Environmental Sciences, 2012.

Caisa Inkinen, University of Helsinki, Div. of Animal Physiology, Faculty of Biological and Environmental Sciences, 2016.

Supervision of PhD theses:

Kersti Lilleväli: Gata3 and Gata2 in inner ear development, University of Helsinki and University of Tartu, 2007

Maarja Haugas: GATA factors regulate inner ear development and midbrain neurogenesis, University of Helsinki, Dept. of Veterinary Biosciences, 2012.

Janne Hakanen: Molecular regulation of forebrain development and neural stem/progenitor cells, University of Helsinki, Dept. of Veterinary Biosciences, 2014.

Member of PhD thesis Follow Up Group:

MSc Satu Kuure, 2002-2007, PhD 2007 University of Helsinki.

MSc Pieta Mattila 2002-2007, PhD 2007 University of Helsinki

MSc Katja Piltti, 2002-2009, PhD 2009 University of Helsinki

MSc Heli Pessa, 2001-2010, PhD 2009 University of Helsinki.

MSc Paula Peltopuro, 2008-2012, PhD 2012 University of Helsinki.

MSc Maria Voutilainen, 2009-2015, PhD 2015 University of Helsinki.

Referee of doctoral dissertations

MSc Tuija Mustonen: Ectodermal organ development: Regulation by Notch and Eda pathways, 2004, University of Helsinki.

MSc Maarit Takatalo: Golgi proteomics: Identification of a novel cartilage-specific Golgi protein GoPro49. 2009, University of Helsinki.

MSc Johanna Mantela: Role of cell cycle regulators in development of the inner ear. 2010, University of Helsinki.

MSc Heli Pessa: U12-type spliceosome: localization and effects of splicing efficiency on gene expression. 2010, University of Helsinki.

MSc Ann-Marie Rajalin: The function of NR3B and NR4A orphan nuclear receptors in osteoblasts. 2011, University of Helsinki.

MSc Laura Lahti: FGF signalling in neurogenesis and patterning of the developing midbrain and anterior hindbrain. 2012, University of Helsinki.

MSc Katja Närhi: Canonical Wnt signaling in hair and mammary gland patterning and development. 2012, University of Helsinki.

MSc Linda Jansson: Neural progenitor cell differentiation and migration. 2013, University of Helsinki.

MSc Maria Voutilainen: Molecular regulation of embryonic mammary gland development. 2015, University of Helsinki.

MSc Sanna Toivonen: Derivation of hepatocyte like cells from human pluripotent stem cells. 2015, University of Helsinki.