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# Development and Engineering of Dopamine Neurons

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# Development And Engineering Of Dopamine Neurons

**Kursad Turksen**



## **Development And Engineering Of Dopamine Neurons:**

*Development and Engineering of Dopamine Neurons* Jeroen Pasterkamp, Marten P. Smidt, J. Peter H. Burbach, 2009-12-16  
The neurotransmitter dopamine has just celebrated its 50th birthday. The discovery of dopamine as a neuronal entity in the late 1950s and the notion that it serves in neurotransmission has been a milestone in the field of neuroscience research. This milestone marked the beginning of an era that explored the brain as an integrated collection of neuronal systems that one could distinguish on basis of neurotransmitter identities and importantly in which one started to be able to pinpoint the seat of brain disease. The mesodiencephalic dopaminergic mDA system previously designated as midbrain dopaminergic system has received much attention since its discovery. The initial identification of dopamine as a neurotransmitter in the central nervous system CNS and its relevance to psychiatric and neurological disorders have stimulated a plethora of neurochemical, pharmacological and genetic studies into the function of dopamine neurons and their projections. In the last decade studies on gene expression and development have further increased the knowledge of this neuronal population and have unmasked a new level of complexity. The start of the molecular dissection of the mDA system has been marked by the cloning and characterization of Nurr1 and Pitx3. These transcription factors were shown to have a critical function during mDA development. These initial studies have been followed by the identification of many other proteins which have a crucial function in the creation of a dopamine neuron permissive region induction of precursors induction of terminal differentiation and finally maintenance of the mDA neuronal pool.

*The Handbook of Dopamine* Stephanie J. Cragg, Mark Walton, 2025-07-04  
The Handbook of Dopamine captures current understanding of dopamine biology in the brain including anatomical organization of dopamine neurons their molecular and genetic diversity synaptic and circuit connectivity receptor function and signalling through to diverse roles in behaviors and finally dysfunction in disease. This volume compiles a comprehensive set of perspectives from a large number of leading scientists working in dopamine research. The volume describes the current state of the field summarizing knowledge that has been transformed in the last decade through the advent and application of sophisticated new technologies. Offers up to date review of dopamine biology across fields. Explores the function and regulation of dopamine neurons in healthy behavior and also dysfunction in disease. Includes historical and future perspectives in the field of dopamine research.

*Birth, Life and Death of Dopaminergic Neurons in the Substantia Nigra* Giuseppe di Giovanni, Vincenzo Di Matteo, Ennio Esposito, 2009-09-02  
This book provides a unique and timely multidisciplinary synthesis of our current knowledge of the anatomy pharmacology physiology and pathology of the substantia nigra pars compacta SNc dopaminergic neurons. The single chapters written by top scientists in their fields explore the life cycle of dopaminergic neurons from their birth to death the cause of Parkinson's disease the second most common and disabling condition in the elderly population. Nevertheless the intracellular cascade of events leading to dopamine cell death is still unknown and consequently treatment is symptomatic rather than preventive. The mechanisms by

which alterations cause neuronal death new therapeutic approaches and the latest evidence of a possible de novo neurogenesis in the SNc are reviewed and singled out in different chapters This book bridges basic science and clinical practice and will prepare the reader for the next few years which will surely be eventful in terms of the progress of dopamine research The Neurobiology of Olfaction Anna Menini,2009-11-24 Comprehensive Overview of Advances in Olfaction The common belief is that human smell perception is much reduced compared with other mammals so that whatever abilities are uncovered and investigated in animal research would have little significance for humans However new evidence from a variety of sources indicates this traditional view is likely Adaptive Function and Brain Evolution Agustín González,Fernando Martinez-Garcia,Luis Puelles,Hans J Ten Donkelaar,2014-10-27 The brain of each animal shows specific traits that reflect its phylogenetic history and its particular lifestyle Therefore comparing brains is not just a mere intellectual exercise but it helps understanding how the brain allows adaptive behavioural strategies to face an ever changing world and how this complex organ has evolved during phylogeny giving rise to complex mental processes in humans and other animals These questions attracted scientists since the times of Santiago Ramon y Cajal one of the founders of comparative neurobiology In the last decade this discipline has undergone a true revolution due to the analysis of expression patterns of morphogenetic genes in embryos of different animals The papers of this e book are good examples of modern comparative neurobiology which mainly focuses on the following four Grand Questions a How are different brains built during ontogeny b What is the anatomical organization of mature brains and how can they be compared c How do brains work to accomplish their function of ensuring survival and ultimately reproductive success d How have brains evolved during phylogeny The title of this e book Adaptive Function and Brain Evolution stresses the importance of comparative studies to understand brain function and the reverse of considering brain function to properly understand brain evolution These issues should be taken into account when using animals in the research of mental function and dysfunction and are fundamental to understand the origins of the human mind **Origins of Human Neuropathology: The Significance of Teneurins and Latrophilins**

**Interaction** David A. Lovejoy,Antony A. Boucard,Richard P. Tucker,2020-07-22 We are delighted to introduce this new special issue on The Origins of Neuropathology The Roles of Teneurins and Latrophilins Although the title may seem particularly bold and indeed perhaps presumptuous we the editors think our title well warranted based on the findings and interpretation provided by a dedicated group of researchers who have developed this field over the last 25 years In this publication we introduce the readers to researchers whom have pioneered this field and those whom have played an essential role in developing this research direction Now together their combined work have elucidated a novel ligand-receptor network that evolved during the earliest period of animal evolution and has fostered a new insight into the ancient evolutionary organization of the central nervous system CNS Specifically this work offers a new understanding of several aspects of neuropathology including degenerative psychiatric and mood disorders and furthermore illuminates a fundamental role that

teneurins and latrophilins play in cell to cell metabolism that may be associated with various forms of cancer both within and outside of the brain In 1994 the laboratories of Professors Ron Wides in Israel and Ruth Chiquet Ehrismann working in Switzerland independently reported the existence of a novel transmembrane protein and its gene in *Drosophila* A complex gene protein its closest homologue was that of the tenascins The gene was named either odd or *odz* or tenascin major ten m by these researchers Subsequent studies indicated that the gene was highly expressed in the brains of vertebrates and the term teneurin was coined to reflect both its relationship with tenascins and with the CNS Around the same time as these studies a novel G protein coupled receptor was identified by Yuri Ushkaryov and his team in the United Kingdom in fact the latrophilins then named CIRL calcium independent receptor for a latrotoxin was first identified by the group of Petrenko at NYU Medical Center in New York USA which was subsequently established as a cognate receptor for the teneurins This receptor was later termed as the latrophilins and more recently Adhesion receptor G protein coupled receptor family L or ADGRL In Part 1 of this publication the early history on the origin and discovery of teneurins has been described by Stefan Baumgartner and Ron Wides Ron Wides and Richard Tucker Recent structural studies by Verity Jackson and her colleagues as well as Demet Arae and Jingxian Li have provided molecular models to understand how teneurins are ensconced in the plasma membrane and play a role in synaptic interaction In addition their work integrates the molecular mechanisms with the early evolution of both teneurins and latrophilins In Part 2 four studies build upon the evolutionary development of teneurins by examining its role in nematodes by Ulrike Topf and Krzysztof Drabikowski a model of teneurin action in the *Drosophila* nervous system by Alison DePew and associates and two studies on fish Angela Cheung and her colleagues describe the neurological function and expression in zebrafish whereas Ross Reid and his coworkers have described novel actions of the teneurins with respect to metabolism in fish Part 3 of this publication is focused on the latrophilins and is led off by Yuri Ushkaryov and his team describing the discovery structure and function of the latrophilins This work is followed by a review by Ana Moreno Salinas and colleagues in Antony Boucard s laboratory describing the structure of the latrophilins and its interaction with associated transmembrane proteins with respect to adhesion neuronal function and pathology The following paper by Torsten Sch nberg and Simone Pr mel links the previous papers with a comparison of teneurin and latrophilin interactions in invertebrates and vertebrates Finally in this section Peter Burbach and Dimphna Meijer provide an interesting overview of the relationship of teneurins and latrophilins with respect to other proteins described in these other papers Together these studies provide a novel understanding of how the teneurins and latrophilins interact in a complex set of associated proteins The next section Part 4 of the publication focuses on the development and maintenance of the CNS in mammals Here Catherine Leamey and Atomu Sawatari lead off with a discussion of the role of teneurin associated neuro circuit formation using knockout studies in mice A detailed review by Luciane Sita and her colleagues in the Bittencourt laboratory frames this and previous studies in a comparative neuroanatomical background and in addition provides a

neuroanatomical rationale for new studies associated with other regions of the CNS Building upon these studies David Hogg and his coworkers include a review on the behavioral actions of the teneurin C terminal associated peptide TCAP in mammals and its potential relationship to brain metabolism and forms of neuropathology Finally in this section a study by Gesttner Tessarin in the Casatti laboratory shows for the first time teneurins may be associated with astrocyte function indicating a novel function for teneurins with respect to some glial based disorders in the brain Finally in our last section we have provided some studies on the potential roles of the teneurins and latrophilins with respect to carcinogenesis Although these studies are somewhat removed from our treatise on the role of teneurins and latrophilins with respect to neuronal development maintenance and pathology they provide interesting observations that may be relevant to some types of CNS pathology Thus Boris Rebolledo Jaramillo and Annemarie Ziegler include a review on the relationship of teneurins to several types of cancers This is followed by a research report by Mia Husi and her colleagues suggesting that the TCAP region of the teneurins could play a role in modulating the adhesion of the cancer like cell line HEK293 and finally Sussy Bastias Candia and associates have provided novel data on the role of teneurin 3 with respect to Wnt signalling and have discussed its potential role in neural development and carcinogenesis Overall we posit that the teneurins and latrophilins played a major role in the early evolution of the nervous system and may underlie the etiology of a number of neurological disorders that are thus far misunderstood Indeed we hope that this publication will stimulate further research into the actions of teneurins and latrophilins and lead to novel approaches of understanding and ultimately treatment

Obituary Ruth Chiquet Ehrismann 1954-2015 A Teneurin Pioneer A major player in the discovery and characterization of teneurins was the Swiss scientist Ruth Chiquet Ehrismann Dr Chiquet Ehrismann had a long standing interest in cell cell and cell extracellular matrix interactions particularly during development and tumorigenesis She earned her Ph D at the ETH Zurich under the mentorship of David C Turner where she performed early work on the cell and heparin binding sites of fibronectin Shortly after joining the Friedrich Miescher Institute in Basel as a junior group leader in 1984 Ruth in collaboration with Eleanor J Mackie and Teruyo Sakakura published a paper in Cell describing an extracellular matrix glycoprotein that she named tenascin A key observation made in this widely cited paper was the presence of tenascin in the extracellular matrix of embryonic tissues and the stroma of breast cancer but its absence from most normal adult tissues We now know that the original tenascin was the founding member of a diverse gene family and that members of this family promote cell motility proliferation and differentiation in a variety of tissue environments both normal and pathological But in the early 1990s it was unclear how tenascins functioned Specifically its receptors and binding partners were not understood Subsequently Ruth engaged in a multi pronged approach to studying tenascin function in an attempt to identify its homologues in Drosophila This work led by her postdoctoral fellow Dr Stefan Baumgartner resulted in the discovery of a novel family of type 2 transmembrane proteins that they named ten a and ten m for tenascin like proteins accessory and major When the homologues of ten a and ten m were found in vertebrates and they

were shown to be highly expressed in the nervous system Ruth proposed the name teneurins This name combined the names of the original proteins from *Drosophila* with neurons which appeared to be their most prominent site of expression From that point onward Ruth's research group at the Friedrich Miescher Institute studied two topics the roles of tenascins in cancer and the roles of teneurins in development Using numerous model systems her research included studies of teneurins in arthropods *Drosophila* nematodes *C. elegans* and chordates birds and humans Key firsts that came from Ruth's laboratory include the cloning and sequencing of human teneurins experimental evidence of teneurin processing by furin and the potential nuclear localization of the intracellular domain the ability of teneurins to promote growth cone spreading patterning defects in teneurin knockout animals a description of the ancient origins of teneurins via horizontal gene transfer the complementary expression patterns of different teneurins during development the cytotoxic properties of the teneurin C terminal domain and the presence of homotypic adhesion domains in teneurins Since 1994 Ruth's group published 24 papers on the cloning expression origins and functions of teneurins Contributing to these papers were 15 graduate students and postdoctoral fellows often with the expert technical guidance of Jacqueline Ferralli Marianne Brown Luedi and Doris Martin This work has provided a foundation for a new generation of researchers in the field of teneurins Ruth Chiquet-Ehrismann passed away at her home near Basel on September 4 2015 She is survived by her husband and collaborator Matthias Chiquet three children Daniel Patrice and Fabian and an expanding cohort of grandchildren Richard P Tucker Davis California

**Stem Cells: Current Challenges and New Directions** Kursad Turksen, 2013-09-24 This volume looks at the state of the science in stem cells discusses the current challenges and examines the new directions the field is taking Dr Turksen editor in chief of the journal *Stem Cell Reviews and Reports* has assembled a volume of internationally known scientists who cover topics that are both clinically and research oriented The contents range from sources of stem cells through their physiological role in health and disease therapeutic applications in regenerative medicine and ethics and society An initial overview and a final summary bookend the contents into a cohesive and invaluable volume *Parkinson's Disease* Richard Nass, Serge Przedborski, 2011-04-28 Parkinson's disease is the second most prevalent neurodegenerative disease and is characterized by the irreversible loss of dopamine neurons Despite its high prevalence in society and many decades of research the origin of the pathogenesis and the molecular determinants involved in the disorder has remained elusive Confounding this issue is the lack of experimental models that completely recapitulate the disease state The identification of a number of genes thought to play a role in the cell death and development of both toxin and genetic models to explore the function of the genes both in unaffected and diseased cells are now providing new insights into the molecular basis of the neurodegeneration as well as therapeutic approaches In this reference we will describe the advances and the advantages that various invertebrates cell culture rodents and mammals provide in the identification of the molecular components and mechanisms involved in the cell death and outline the opportunities that these systems provide in drug discovery

Comprehensive and critical assessment of the utility of various model systems to identify the molecular components and pathways involved in Parkinson's disease Describes the power of toxin and genetic models to identify novel therapeutic targets and compounds that can be used in PD Current overviews of current status of PD research and discovery from bench to bedside Provides novel insights and views on where the future of PD research may lead Provides a powerful teaching tool and template to explore the utility of model systems to identify molecular pathways molecular targets and therapeutics that are applicable to a variety of neurological diseases

Dopaminergic Neuron Transplantation in the Weaver Mouse Model of Parkinson's Disease Lazaros C. Triarhou, 2012-12-06 This book is the culmination of fifteen years of research on the transplantation of dopaminergic neurons in the striatum of the weaver mouse wv wv a neurological mutant characterized by genetically determined degeneration of midbrain dopamine neurons This mutant constitutes the only available laboratory model with a chronic disorder that mimics Parkinson's disease Structural and functional aspects of intrastriatal mesencephalic neuron grafting into the weaver model are reviewed including histochemical correlates of graft survival and integration numerical aspects of donor cell survival ultrastructural findings on synaptogenesis neurochemical indices of dopamine uptake and receptor binding gene expression of structural and neurotransmitter receptor related molecules levels of striatal amino acid receptors and behavioural effects of unilateral and bilateral neuronal transplantations

**Parkinson's Disease**, 2004



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### **Development And Engineering Of Dopamine Neurons Introduction**

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