Tomas Björklund
Molecular Neuromodulation
MultiPark: Multidisciplinary research on neurodegenerative diseases
LTH Profile Area: Engineering Health
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Research

Are you intrigued by the brain and its complexity, as well as by new technologies and the amazing developments in biotechnology? Then my research group may be for you. My team and I are at the forefront of biotechnology and molecular biology, aiming to treat disorders of the human brain. Our main focus is on developing advanced therapeutical medical products (ATMPs), such as cell and gene therapy for Parkinson's disease. We are also working to treat one of the most devastating disorders of the human brain: glioblastomas, or brain tumors. The team combines in silico modeling using advanced machine learning and AI with molecular biology to tailor synthetic vectors to accurately target the cells that need treatment. This will enable us to find treatments and, in the long term, to develop cures for very complex disorders. To ensure that the treatments we develop are feasible to bring to the clinic, we are using human model systems to develop and validate our new therapies. These include stem cell-based organoids, 3D organoids grown in vitro derived from patient tumors, as well as primary tumors from patients. By combining these cell systems with spatial sequencing, we can map and model exactly where the new viruses go and how they act in the human brain.

About me as an individual
I see myself as both a researcher and an inventor. I love to invent new tools and come up with new ideas that will give us completely new possibilities, making things possible that were previously seen as nearly impossible. We take available techniques and change them all the time to achieve something completely new. In my research group, we work very closely together. Everyone is part of the team and has close proximity to me. I have an open-door policy where we meet every day and work closely on projects. I'm driven by curiosity and will never stop wanting to learn new things. I have a passion for medicine, molecular biology, mathematics, machine learning, and the computation of large data. I'm a visual person who works a lot with pictures and how we can interpret them to learn the underlying biology. We depend on what's called computer vision to perform our spatial sequencing and to interpret how our new viruses work. We build new instruments and new microscopes as well. So, in my research group, there's space for all kinds of researchers. Medical doctors, biologists, and engineers are all very welcome.

Qualifications

Neurobiology, Docent, Faculty of Medicine
Award Date: 2016 Aug 12

Neurobiology, PhD in Medical Science, Gene therapy by enzyme replacement for Parkinson’s disease – Optimization of con- tinuous DOPA delivery and development of a candidate vector for clinical application, Faculty of Medicine
2004 Sept 1 → 2009 Dec 4
Award Date: 2009 Dec 4

Employment

Research team manager, Professor
Molecular Neuromodulation
Lund University
Lund, Sweden
2011 Jul 1 → present

Member of Strategic Research Area
MultiPark: Multidisciplinary research on neurodegenerative diseases

Lund University
Lund, Sweden
2011 Jan 1 → present

Profile area member
LTH Profile Area: Engineering Health
Lund University
Sweden
2022 Jun 28 → present

Research outputs

Construct optimization for AAV-mediated human α-syn overexpression, and validation across research settings: Development of a shared tool for the research community
Pardo, J., Mudannayake, J., Bernal-Conde, L. D., Sandoval, I. M., Dong, R. B., Avallone, M., Marmion, D. J., Gralen, A., Waite, L., Heuer, A., Davidsson, M., Polinski, N. K., Björklund, T. & Manfredsson, F. P., 2026 Aug, In: Journal of Parkinson's Disease. 16, 5, p. 877-894 18 p.

Administration of a barcoded AAV capsid library to the putamen of non-human primates identifies variants with efficient retrograde transport
Dzhashiashvili, Y., McBride, J. L., Fabyanic, E., Huang, X., Kelly, B. M., Walton-Gibbs, G. D., Vemireddi, V., Wicks, J., Nayal, M., Hippen, A. A., Yu, Z., Raman, P., Ramsburg, E., Davidsson, M., Engel, E. A. & Björklund, T., 2026, In: Molecular Therapy. 34, 3, p. 1794-1812

GDNF overexpression in astrocytes enhances branching and partially preserves hippocampal function in an Alzheimer's rat model
Vidal Escobedo, A. A., Peralta, F., Morel, G. R., Avallone, M., Björklund, T., Reggiani, P. C. & Pardo, J., 2025 Jun 2, In: Scientific Reports. 15, 1, p. 1-16 19284.

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Fiorenzano, A., Storm, P., Sozzi, E., Bruzelius, A., Corsi, S., Kajtez, J., Mudannayake, J., Nelander, J., Mattsson, B., Åkerblom, M., Björklund, T., Björklund, A. & Parmar, M., 2024 Nov 19, In: Proceedings of the National Academy of Sciences of the United States of America. 121, 47, p. 1-12 e2410331121.

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Preventive cognitive protection based on AAV9 overexpression of IGF1 in hippocampal astrocytes
Peralta, F., Escobedo, A. A. V., Hanotte, J. L., Avallone, M., Björklund, T., Reggiani, P. C. & Pardo, J., 2024 Oct, In: Neurobiology of Disease. 200, 106612.

Identification and validation of novel engineered AAV capsid variants targeting human glia
Giacomoni, J., Åkerblom, M., Habekost, M., Fiorenzano, A., Kajtez, J., Davidsson, M., Parmar, M. & Björklund, T., 2024, In: Frontiers in Neuroscience. 18, 1435212.

Visualizing Arc protein dynamics and localization in the mammalian brain using AAV-mediated in situ gene labeling
Avallone, M., Pardo, J., Mergiya, T. F., Rajova, J., Räsänen, A., Davidsson, M., Åkerblom, M., Quintino, L., Kumar, D., Bramham, C. R. & Björklund, T., 2023 Jun 15, In: Frontiers in Molecular Neuroscience. 16, 1140785.

Deconvolution of spatial sequencing provides accurate characterization of hESC-derived DA transplants in vivo.
Rájová, J., Davidsson, M., Avallone, M., Hartnor, M., Aldrin-Kirk, P., Cardoso, T., Nolbrant, S., Mollbrink, A., Storm, P., Heuer, A., Parmar, M. & Björklund, T., 2023 Jun 8, In: Molecular Therapy - Methods and Clinical Development. 29, p. 381-394

Mutant huntingtin expression in the hypothalamus promotes ventral striatal neuropathology
Soylu Kucharz, R., Adlesic, N., Davidsson, M., Björklund, T., Björkqvist, M. & Petersén, Å., 2023 Mar 4, bioRxiv.

A novel two-factor monosynaptic TRIO tracing method for assessment of circuit integration of hESC-derived dopamine transplants
Aldrin-Kirk, P., Åkerblom, M., Cardoso, T., Nolbrant, S., Adler, A. F., Liu, X., Heuer, A., Davidsson, M., Parmar, M. & Björklund, T., 2022 Jan 11, In: Stem Cell Reports. 17, 1, p. 159-172 14 p.

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Svanbergsson, A., Ek, F., Martinsson, I., Rodo, J., Liu, D., Brandi, E., Haikal, C., Torres-Garcia, L., Li, W., Gouras, G., Olsson, R., Björklund, T. & Li, J.-Y., 2021, In: Neurotherapeutics. 18, 3, p. 1692-1709

Next-Generation Gene Therapy for Parkinson's Disease Using Engineered Viral Vectors
Björklund, T. & Davidsson, M., 2021, In: Journal of Parkinson's Disease. 11, s2, p. S209-S217

AAV Production Everywhere: A Simple, Fast, and Reliable Protocol for In-house AAV Vector Production Based on Chloroform Extraction
Negrini, M., Wang, G., Heuer, A., Björklund, T. & Davidsson, M., 2020, In: Current Protocols in Neuroscience. 93, 1, p. e103

A systematic capsid evolution approach performed in vivo for the design of AAV vectors with tailored properties and tropism
Davidsson, M., Wang, G., Aldrin-Kirk, P., Cardoso, T., Nolbrant, S., Hartnor, M., Mudannayake, J., Parmar, M. & Björklund, T., 2019 Dec 26, In: Proceedings of the National Academy of Sciences of the United States of America. 116, 52 , p. 27053-27062 10 p.

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Espa, E., Clemensson, E. K. H., Luk, K. C., Heuer, A., Björklund, T. & Cenci, M. A., 2019, In: Movement Disorders. 34, 11 , p. 1699-1710

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Rosenblad, C., Li, Q., Pioli, E. Y., Dovero, S., Antunes, A. S. L. M., Agúndez, L., Bardelli, M., Linden, R. M., Henckaerts, E., Björklund, A., Bezard, E. & Björklund, T., 2019, In: Brain : a journal of neurology. p. 2402-2416

A novel adeno-associated virus capsid with enhanced neurotropism corrects a lysosomal transmembrane enzyme deficiency
Tordo, J., O'Leary, C., Antunes, A. S. L. M., Palomar, N., Aldrin-Kirk, P., Basche, M., Bennett, A., D'Souza, Z., Gleitz, H., Godwin, A., Holley, R. J., Parker, H., Liao, A. Y., Rouse, P., Youshani, A. S., Dridi, L., Martins, C., Levade, T., Stacey, K. B. & Davis, D. M. & 11 others, Dyer, A., Clément, N., Björklund, T., Ali, R. R., Agbandje-McKenna, M., Rahim, A. A., Pshezhetsky, A., Waddington, S. N., Linden, R. M., Bigger, B. W. & Henckaerts, E., 2018 Jul 1, In: Brain. 141, 7, p. 2014-2031 18 p.

Molecular barcoding of viral vectors enables mapping and optimization of mRNA trans-splicing
Davidsson, M., Díaz-Fernández, P., Torroba, M., Schwich, O. D., Aldrin-Kirk, P., Quintino, L., Heuer, A., Wang, G., Lundberg, C. & Björklund, T., 2018 May 1, In: RNA. 24, 5, p. 673-687 15 p.

Chemogenetic modulation of cholinergic interneurons reveals their regulating role on the direct and indirect output pathways from the striatum
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Repairing the brain: Gene therapy
Björklund, T., 2018, In: Journal of Parkinson's Disease. 8, s1, p. S123-S130

A novel process of viral vector barcoding and library preparation enables high-diversity library generation and recombination-free paired-end sequencing
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Identification of multiple QTLs linked to neuropathology in the engrailed-1 heterozygous mouse model of Parkinson's disease
Kurowska, Z., Jewett, M., Brattås, P. L., Jimenez, I., Kenéz, X., Björklund, T., Nordström, U., Brundin, P. & Swanberg, M., 2016 Aug 23, In: Scientific Reports. 6, 31701.

DREADD Modulation of Transplanted DA Neurons Reveals a Novel Parkinsonian Dyskinesia Mechanism Mediated by the Serotonin 5-HT6 Receptor
Aldrin-Kirk, P., Heuer, A., Wang, G., Mattsson, B., Lundblad, M., Parmar, M. & Björklund, T., 2016 Jun 1, In: Neuron. 90, 5 , p. 955-968 14 p.

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Kristiansen, T. A., Jaensson Gyllenbäck, E., Zriwil, A., Björklund, T., Daniel, J. A., Sitnicka, E., Soneji, S., Bryder, D. & Yuan, J., 2016, In: Immunity. 45, 2, p. 346-357 12 p.

Expression of Multiple Functional RNAs or Proteins from One Viral Vector.
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Direct evidence of Parkinson pathology spread from the gastrointestinal tract to the brain in rats.
Holmqvist, S., Chutna, O., Bousset, L., Aldrin-Kirk, P., Li, W., Björklund, T., Wang, Z.-Y., Roybon, L., Melki, R. & Li, J.-Y., 2014, In: Acta Neuropathologica. 128, 6, p. 805-820

Novel AAV-Based Rat Model of Forebrain Synucleinopathy Shows Extensive Pathologies and Progressive Loss of Cholinergic Interneurons.
Aldrin-Kirk, P., Davidsson, M., Holmqvist, S., Li, J.-Y. & Björklund, T., 2014, In: PLoS ONE. 9, 7, e100869.

A novel α-synuclein-GFP mouse model displays progressive motor impairment, olfactory dysfunction and accumulation of α-synuclein-GFP.
Hansen, C., Björklund, T., Petit, G., Lundblad, M., Murmu, R., Brundin, P. & Li, J.-Y., 2013, In: Neurobiology of Disease. 56C, April,30, p. 145-155

Continuous DOPA synthesis from a single AAV: dosing and efficacy in models of Parkinson's disease.
Cederfjäll, E., Nilsson, N., Sahin, G., Chu, Y., Nikitidou, E., Björklund, T., Kordower, J. H. & Kirik, D., 2013, In: Scientific Reports. 3, 2157.

Design of a Single AAV Vector for Coexpression of TH and GCH1 to Establish Continuous DOPA Synthesis in a Rat Model of Parkinson's Disease.
Cederfjäll, E., Sahin, G., Kirik, D. & Björklund, T., 2012, In: Molecular Therapy. 20, 7, p. 1315-1326

Dysregulated dopamine storage increases the vulnerability to alpha-synuclein in nigral neurons
Ulusoy, A., Björklund, T., Buck, K. & Kirik, D., 2012, In: Neurobiology of Disease. 47, 3, p. 367-377

Gene therapy for Parkinson's disease shows promise.
Björklund, A. & Björklund, T., 2011, In: Science Translational Medicine. 3, 79, p. 79ed1

Mutant huntingtin causes metabolic imbalance by disruption of hypothalamic neurocircuits.
Hult Lundh, S., Soylu, R., Björklund, T., Belgardt, B. F., Mauer, J., Brüning, J. C., Kirik, D. & Petersén, Å., 2011, In: Cell Metabolism. 13, 4, p. 428-439

A General Chemical Method to Regulate Protein Stability in the Mammalian Central Nervous System
Iwamoto, M., Björklund, T., Lundberg, C., Kirik, D. & Wandless, T. J., 2010, In: Chemistry and Biology. 17, 9, p. 981-988

Differential Transduction Following Basal Ganglia Administration of Distinct Pseudotyped AAV Capsid Serotypes in Nonhuman Primates
Dodiya, H. B., Björklund, T., Stansell, J. I., Mandel, R. J., Kirik, D. & Kordower, J. H., 2010, In: Molecular Therapy. 18, 3, p. 579-587

Gene therapy for dopamine replacement.
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Gene therapy for Parkinson's disease.
Björklund, T. & Kordower, J. H., 2010, In: Movement Disorders. 25 Suppl 1, p. S161-S173

Optimized adeno-associated viral vector-mediated striatal DOPA delivery restores sensorimotor function and prevents dyskinesias in a model of advanced Parkinson's disease.
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Dose Optimization for Long-term rAAV-mediated RNA Interference in the Nigrostriatal Projection Neurons.
Ulusoy, A., Sahin, G., Björklund, T., Aebischer, P. & Kirik, D., 2009, In: Molecular Therapy. 17, p. 1574-1584

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Gene therapy for dopamine replacement in Parkinson's disease.
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Optimization of continuous in vivo DOPA production and studies on ectopic DA synthesis using rAAV5 vectors in Parkinsonian rats
Björklund, T., Hall, H., Breysse, N., Soneson, C., Carlsson, T., Mandel, R. J., Carta, M. & Kirik, D., 2009, In: Journal of Neurochemistry. 111, 2, p. 355-367

Positron Emission Tomography Imaging Demonstrates Correlation between Behavioral Recovery and Correction of Dopamine Neurotransmission after Gene Therapy
Leriche, L., Björklund, T., Breysse, N., Besret, L., Gregoire, M.-C., Carlsson, T., Dolle, F., Mandel, R. J., Deglon, N., Hantraye, P. & Kirik, D., 2009, In: The Journal of Neuroscience. 29, 5, p. 1544-1553

Scientific rationale for the development of gene therapy strategies for Parkinson's disease.
Björklund, T. & Kirik, D., 2009, In: Biochimica et Biophysica Acta - Molecular Basis of Disease. 1792, 7, p. 703-713

Applications of lentiviral vectors for biology and gene therapy of neurological disorders.
Lundberg, C., Björklund, T., Carlsson, T., Jakobsson, J., Hantraye, P., Déglon, N. & Kirik, D., 2008, In: Current Gene Therapy. 8, 6, p. 461-473

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In vivo gene delivery for development of mammalian models for Parkinson's disease
Ulusoy, A., Björklund, T., Hermening, S. & Kirik, D., 2008, In: Experimental Neurology. 209, 1, p. 89-100

Long-term consequences of human alpha-synuclein overexpression in the primate ventral midbrain.
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Restoration of the striatal dopamine synthesis for Parkinson's disease: viral vector-mediated enzyme replacement strategy.
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Awards

Utveckling av artificiell intelligens för att kartlägga molekylära mekanismer i den mänskliga hjärnan vid Parkinsons sjukdom
Björklund, T. (PI)
The Swedish Parkinson Foundation, Parkinsonfonden: SEK232,500.00
2025/11/05 → 2027/04/30