

CURRICULUM VITAE AND LIST OF PUBLICATIONS (121)

/May, 2022

CURRICULUM VITAE

Name: Mathias Hallberg
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EDUCATION

- Student Diploma	Engineering Program 3 year, Lund	1987-1990
- Military Service (fallskärmsjägarutb)	Swedish Army's Parachute Ranger School	1991-1992
- Teacher Training Program, (60 hp) and	Institute of Education in Malmö	
Master of Science, Biology/Chem (240 hp)	Lund University	1999
- Doctor of Pharmacy (PhD, Pharmacology)	Uppsala University	2005
- Assistant Professor (Docent, Pharmacology)	Uppsala University	2007
- Ämneslärarexamen (BScEd), Chem/Biology	Uppsala University	2009
- Teacher certification (lärarlegitimation)	Swedish National Agency for Education	2015

APPOINTMENTS

- Employment Gambro Ltd (20 months)	Lund	1990-1994
- Doctoral Studentship	Uppsala University	2000-2005
- Director of Studies (studierektor)	Uppsala University	2005-2020
- Project Leader, Researcher	Uppsala University	2005-2010
- Associate Professor (universitetslektor)	Uppsala University	2010-2016
- Professor (molekylär beroendeforskning)	Uppsala University	2016-
- Dean, Faculty of Pharmacy	Uppsala University	2020-

TEACHING AND PEDAGOGICAL EXPERIENCE

- Supervisor, PhD candidate Sara Florén Lind	2021-
- Supervisor, PhD candidate Frida Stam	2019-
- Supervisor, PhD candidate Sofia Zelleröth	2016-
- Deputy Supervisor, PhD candidate Esther Olaniran	2020-
- Supervisor, PhD Erik Nylander	2014-2019
- Supervisor, PhD Alfhild Grönbladh	2008-2013
- Supervisor, PhD Jenny Johansson	2007-2013
- Deputy Supervisor, PhD Erika Brolin	2010-2017
- Deputy Supervisor, PhD Anna Jonsson	2009-2015
- Deputy Supervisor, PhD Malik Mumtaz Taqi	2007-2011
- Deputy Supervisor, PhD Uwe Rossbach	2005-2010
- Deputy Supervisor, PhD Kristina Magnusson	2005-2009
- Deputy Supervisor, PhD Milad Botros	2006-2008
- Lecturer, Course Leader and Examiner for "Drug Development and Drug Usage, 7.5 hp" every semester. In total > 3500 Pharmacy students attended	2005- 2020
- Lecturer, Course Leader and Examiner for "Drugs in Society", 5.5 hp" every semester	2020- 2021

- Lecturer, Course Leader and Examiner for "Basic Pharmaceutical Science and Professional Development, 3.5 hp" every semester: 90 students/semester 2017- 2021
- Lecturer and Course Co-Leader (with Professor Erik Nylander) for the Course "Drugs and Dependence, Advanced Course C, 7,5 hp": 30-50 students/semester 2015- present
- Lecturer, Course Leader and Examiner for the Advanced course "Neuropharmacology, 7,5 hp": 25-50 students/semester 2018- 2021
- Lecturer, Course Leader and Examiner for the Course "Drugs, Doping and Gambling Addiction, 5 hp", Summer course Uppsala University, Campus Gotland: 15-20 students/year 2018- present
- Lecturer, Course Leader and Examiner for the Course "Drugs: Use, Abuse and Dependence, 10.5 hp", Social Care Program: 25-30 students/year 2006-2008
- Lecturer and Course Leader for the Course "Theory of Dependence, Prevention and Therapy; Focus on Abuse of Cannabis, 5 p": 20 students/course 2005-2009
- Lecturer, Course Co-Leader and Examiner for the Course "Drug-assisted Treatment of Drug Abuse and Dependence, 10 p". Number of students: 12 2006
- Supervisor for the Problem-Based Learning (PBL) in the course "Drug Development and Drug Usage, 5 p". Total number of groups: 16 (8-10 students/group) 1999-2004
- Supervisor for In-depth Research Projects in Pharmacology, 15 hp (C-level) and 30 hp (D-level). Number of students: 15 2000-

Educational activities outside Uppsala University:

1-3 Days courses:

- Chairman/Moderator and Lecturer in Short Courses (mainly on narcotics and drug abuse) organized by Uppsala University Education and arranged all over Sweden. Number of participants: 50-300 / course. Total number of Courses > 20

Examples of other lectures outside Uppsala University:

Lectures at several foreign Universities; On a regular basis at St. George's Hospital Medical School, University of London. Presentations at Läkarstämman, Svenska Läkaresällskapet, Svenska Föreningen för Alkohol och Drogforskning (SAD) and at Nätverk mot Anabola Steroider; Lectures at The Swedish Prosecution Authority (regularly) and at Rosenbad, Stockholm; Hearings Rosenbad; Anti Doping Denmark's research seminars, Copenhagen; Numerous lectures at public schools and for the public. Lectures for Utbildningsradion/ Kunskapskanalen (SVT). Lecturer and Chairman annually at seminars in Almedalen, Gotland 2018-

ORGANIZATION OF CONFERENCES

- Member of the organizing committee *European Opioid Conference* 2002 in Uppsala. 2001-2002
- Swedish Coordinator for the *European Opioid Conference* (EOC) 2005-2015
- Local host and member of the organizing committee *Nordisk AAS konferens* 2007 in Uppsala 2006-2007
- Member organizing committee *International Narcotics Research Conference* in Malmö 2009-2010
- Member organizing committee *4th Nordic Conference on Abuse of Anabolic Steroids and Anti-Doping Work* 2013 in Stockholm 2012-2013
- Organizer and Chairman of the international conference; *IRAP 2015 – The second Symposium on IRAP/PLAP/oxytocinase and angiotensin IV*, 13-15 Sept, 2015, in Uppsala 2015
- Organizer and Chairman of several national U-FOLD conferences on drug abuse and addiction 2018-

RESEARCH ACTIVITIES OUTSIDE UPPSALA UNIVERSITY

Research scientist at Vicore Pharma Ltd / New York Medical School, with Prof Eric Simon (6 months)

EXTERNAL GRANTS

Research grants and economic support *e.g.* from The Swedish Brain Foundation, the Beijer Foundation and the DDD platform of SciLifeLab/UU Innovation ca. 15 MSEK 2014-

AWARDS AND HONORS

- The Benzelius Award from the Royal Society of Sciences, Uppsala 2007
 - The Special Award for “Studentbemötande” from the Pharmacy Student Union 2008
 - The Oscar Prize from Uppsala University 2009
 - Commencement Speech as best teacher at the Social Care program, Faculty of Social Sciences 2011
 - The Special Award for “Studentbemötande” from the Pharmacy Student Union 2013
 - The Best Teacher Award 2013, from Uppsala University (Pedagogiska priset 2013) 2013
 - Awarded a Beijer Scholarship 2014
 - Promoted to Excellent teacher, from Uppsala University (Excellentlärare) 2016
 - Prize for Best Lecture 2017 (shared with Anna Sarkadi), Science Festival (SciFest,), Uppsala 2017
 - Awarded “Attractive Innovation Project Prize 2021” (shared with Mats Larhed) from UU Innovation 2022

- U-FOLD (chairman) awarded the “Nordic Drugs Grand Prize 2021” 2021

- Member of the Royal Society of Sciences, Uppsala 2019-
 - Member of the Royal Society of Arts and Sciences, Uppsala 2020-

COMMISSIONS OF TRUST AND MISCELLANEOUS

- Member of the Board of the Department of Pharmaceutical Biosciences 2007-2012
 - Member (deputy) of the Board of the Department of Pharmaceutical Biosciences 2013-2015
 - Member of the Department Board for Ethnicity and Equal opportunities 2013-2015
 - Member of Lärarutredningen, Uppsala University 2015-2016
 - Member (deputy) of the Board for Education (GRUFF), Faculty of Pharmacy 2008-2011
 - Member of the Board for Education (GRUFF), Faculty of Pharmacy 2011-2014
 - Vice Chairman of the Student Recruitment Committee, Faculty of Pharmacy 2012-2017
 - Member of the Local Committee, at The Biomedical Centre (BMC) 2016-2018
 - Member of the Reference group for the Language Workshop, Uppsala University 2009-2019
 - Vice Chairman of the Board for Education (GRUFF), Faculty of Pharmacy 2014-2020
 - Chairman of the Student Recruitment Committee, Faculty of Pharmacy 2018-2020
 - Member of the Board of Svenska Föreningen för Alkohol och Drogforskning (SAD) 2019-2020
 - Chairman National University Coordination Node (UU) for Education, Learning and Research (ULF) 2018-2020
 - Chairman of the National Research Evaluation Committee for ULF Grant 2019-2020
 - Member of the Board of Sveriges Landsråd för Alkohol och Narkotikafrågor (SLAN) 2019-2021
 - Member Steering Committee for e-learning, Uppsala University 2017-2022
 - Member of the Steering Committee for the Language Workshop, Uppsala University 2019-
 - Chairman/coordinator U-FOLD, Forum för läkemedels- och drogberoende, Uppsala University 2018-
 - Deputy Chairman, Department of Pharmaceutical Biosciences, Faculty of Pharmacy 2020
 - Member of the Board of the Disciplinary Domain of Medicine and Pharmacy, Uppsala University 2020-

- Faculty PhD Thesis Opponent, most recently May 2021 (Annica Börjesson, KI), Member of Evaluation Boards of Master and PhD Thesis 2008-

Participation in panel discussions;

- Member of numerous panel discussions in Sweden and US on doping issues, illegal drugs and addiction; *eg.* at the National Institute on Drug Abuse in Washington DC 2013-

BRIEF DESCRIPTION OF RESEARCH PROGRAM

Program title: *The impact of addictive drugs on cognition; memory and learning and efforts to identify unique cognitive enhancers, analgesics and anti-fibrotic agents.* The program comprises three parts; A, B and C. Part B and C are drug discovery projects.

Part A. Focus on the impact of addictive drugs (anabolic androgenic steroids, opioids, GHB *etc.*), but also hormones (growth hormone *etc.*), on important biochemical and physiological processes that are associated with drug dependence, behaviour and cognition. The effects on *e.g.* learning and memory in experimental models are examined.

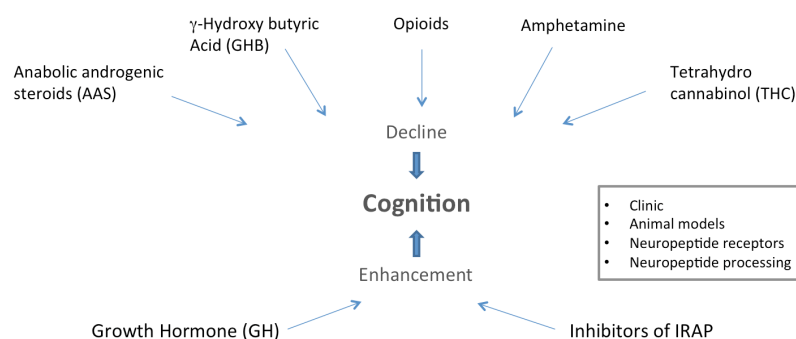


Figure 1: Several abused drugs affect cognitive functions. Growth hormone and inhibitors of IRAP enhance cognitive functions, *vide infra*. For a review on GH; Nyberg F, Hallberg M. Growth hormone and cognitive function. *Nature Rev Endocrinology*. **2013**, 9: 357-365.

Part B. Abuse of addictive drugs like opioids results often in cognitive decline. This subproject has a focus on cognitive enhancers, *i.e.* growth hormone and in particular inhibitors of insulin-regulated aminopeptidase (IRAP). Angiotensin IV (Ang IV), a metabolite from the hypertensive angiotensin II, acts as an IRAP inhibitor and improves memory after *i.c.v.* injection in rats. In 2005, MH started a new program aimed at discovering orally active drug-like cognitive enhancers by utilizing Ang IV as the structural starting point in design processes.

Part C. This subproject is derived from our findings in the tachykinin and renin-angiotensin systems (RAS). Opioids, although superior analgesics are severely addictive. Our objective is to discover new unique classes of analgesics devoid of the addictive properties of morphine and related opioids. Nonpeptides mimicking the antinociceptive substance P metabolite SP (1-7) and nonpeptides acting as angiotensin II AT2 receptor (AT2R) antagonists are made and characterized as potential analgesics. Project support from SciLifeLab DDD. At present, major focus on AT2R agonists for CV indications and as potential anti-inflammatory and anti-fibrotic agents. A close collaboration with the Department of Medicinal Chemistry (Larhed and Sandström) at the Faculty of Pharmacy is established.

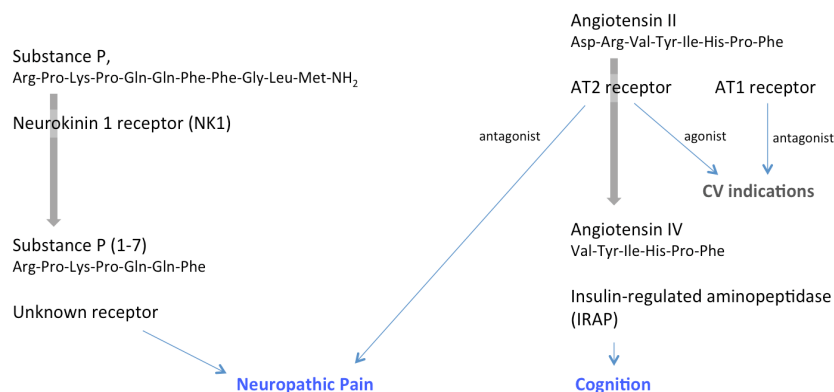


Figure 2: The two grey bold arrows represent degradation of parent peptides to bioactive fragments. For the first two reports from our group on efforts to make drug-like substance P (1-7) and angiotensin IV peptidomimetics, see ref 24 and ref 15, respectively. For a review on proteolytic degradation of neuropeptides, see ref 62: Hallberg M. *Med Res Rev*. **2015**, 35: 464-519.

LIST OF PUBLICATIONS (121)

106 Articles in peer-reviewed international journals, 5 book chapters and 10 other publications.

Articles

1. Johansson P, Hallberg M, Kindlundh A, Nyberg F. The effect on opioid peptides in the rat brain, after chronic treatment with the anabolic androgenic steroid, nandrolone decanoate. *Brain Res Bull.* 51 (2000) 413-418.
2. Hallberg M, Johansson P, Kindlundh A, Nyberg F. Anabolic-androgenic steroids affects the content of substance P and substance P₁₋₇ in the rat brain. *Peptides.* 21 (2000) 845-852.
3. Kindlundh AM, Bergstrom M, Monazzam A, Hallberg M, Blomqvist G, Langstrom B, Nyberg F. Dopaminergic effects after chronic treatment with nandrolone visualized in rat brain by positron emission tomography. *Prog Neuropsychopharmacol Biol Psychiatry.* 26 (2002) 1303-8.
4. Hallberg M, Nyberg F. Neuropeptide conversion to bioactive fragments - an important pathway in neuromodulation. *Curr Protein Pept Sci.* 4 (2003) 31-44.
5. Marinova Z, Yakovleva T, Melzig MF, Hallberg M, Nylander I, Ray K, Rodgers DW, Hauser KF, Ekstrom TJ, Bakalkin G. A novel soluble protein factor with non-opioid dynorphin A-binding activity. *Biochem Biophys Res Commun.* 321 (2004) 202-9.
6. Hallberg M, Thunell E, Kindlundh AMS, Nyberg F. Anabolic androgenic steroids: A gateway to drug addiction and aggressive behavior? *Methods Find Exp Clin Pharmacol.* 26 (2004) 33-37.
7. Zhou Q, Kindlundh AM, Hallberg M, Nyberg F. The substance P (SP) heptapeptide fragment SP1-7 alters the density of dopamine receptors in rat brain mesocorticolimbic structures during morphine withdrawal. *Peptides.* 25 (2004) 1951-7.
8. Hallberg M, Kindlundh AM, Nyberg F. The impact of chronic nandrolone decanoate administration on the NK1 receptor density in rat brain as determined by autoradiography. *Peptides.* 26 (2005) 1228-34.
9. Steensland P, Hallberg M, Kindlundh A, Fahlke C, Nyberg F. Amphetamine-induced aggression is enhanced in rats pre-treated with the anabolic androgenic steroid nandrolone decanoate. *Steroids.* 70 (2005) 199-204.
10. Hallberg M, Magnusson K, Kindlundh AMS, Steensland P, Nyberg F. The effect of anabolic androgenic steroids on calcitonin gene-related peptide (CGRP) levels in the rat brain. *PharmacologyOnline.* 1 (2005) 178-196.
11. Marinova Z, Vukojevic V, Surcheva S, Yakovleva T, Cebers G, Pasikova N, Usynin I, Hugonin L, Fang W, Hallberg M, Hirschberg D, Bergman T, Langel U, Hauser KF, Pramanik A, Aldrich JV, Graslund A, Terenius L, Bakalkin G. Translocation of dynorphin neuropeptides across the plasma membrane: A putative mechanism of signal transmission. *J Biol Chem.* 280 (2005) 26360-26370.
12. Lindblom J, Petrovska R, Hallberg M, Magnusson K, Nyberg F, Uhlén S. Nandrolone treatment decreases the alpha1B-adrenoceptor mRNA level in rat kidney, but not the density of alpha1B-adrenoceptors in cultured MDCK-D1 kidney cells. *Eur J Pharmacol.* 527 (2005) 157-162.
13. Magnusson K, Hallberg M, Kindlundh Hogberg AM, Nyberg F. Administration of the anabolic androgenic steroid nandrolone decanoate affects substance P endopeptidase-like activity in the rat brain. *Peptides.* 27 (2006) 114-121.

14. Botros M, Hallberg M, Johansson T, Zhou Q, Lindeberg G, Frändberg P-A, Tömböly C, Tóth G, Le Grevès P, Nyberg F. Endomorphin-1 and endomorphin-2 differentially interact with specific binding sites for substance P (SP) aminoterminal SP1-7 in the rat spinal cord. *Peptides*. 27 (2006) 753-759.
15. Axén A, Lindeberg G, Demaegdt H, Vauquelin G, Karlén A, Hallberg M. Cyclic insulin-regulated aminopeptidase (IRAP)/AT₄ receptor ligands. *J Pept Sci*. 12 (2006) 705-713.
16. Wu X, Wan Y, Mahalingam A, Plouffe B, Beaudry H, Botros M, Murugaiah A, Karlén A, Hallberg M, Gallo-Payet N, Alterman M. Selective angiotensin II AT₂ receptor agonists: Arylbenzyl imidazole structure activity relationships. *J Med Chem*. 49 (2006) 7160-7168.
17. Bergh A, Nyman G, Roepstorff L, Zhou Q, Hallberg M, Drevemo S, Roethlisberger-Holm K. Defocused CO₂ laser therapy in traumatic arthritis of the metacarpophalangeal joint: a randomised clinical study. *Equine and Comparative Exercise Physiology*. 3 (2006) 169-177.
18. Takahashi K, Hallberg M, Magnusson K, Nyberg F, Watanabe Y, Långström B, Bergström M. Increase in [¹¹C]vorozole binding to aromatase in the hypothalamus in rats treated with anabolic androgenic steroids. *NeuroReport*. 18 (2007) 171-174.
19. Magnusson K, Hallberg M, Bergqvist J, Nyberg F. Enzymatic conversion of dynorphin A in the rat brain is affected by administration of nandrolone decanoate. *Peptides*. 28 (2007) 851-858.
20. Axén A, Andersson H, Lindeberg G, Rönnholm H, Kortessmaa J, Demaegdt H, Vauquelin G, Karlén A, Hallberg M. Small potent ligands to the insulin-regulated aminopeptidase (IRAP)/AT₄ receptor. *J Pept Sci*. 13 (2007) 434-444.
21. Ginya H, Asahina, J, Yoshida M, Asano T, Ikeda H, Hatano YM, Shishido M, Johansson B-M, Zhou Q, Hallberg M, Takahashi M, Nyberg F, Tajima H, Yohda M. Development of Handy Bio-strand and its application to genotyping of OPRM1 (A118G). *Anal Biochem*. 367 (2007) 79-86.
22. Nyberg F, Hallberg M. Peptide Conversion - A potential pathway modulating G-protein signaling. *Current Drug Targets*, 8 (2007) 147-154.
23. Murugaiah AMS, Wallinder C, Mahalingam AK, Wu X, Wan Y, Plouffe B, Botros M, Karlén A, Hallberg M, Gallo-Payet N, Alterman M. Selective angiotensin II AT₂ receptor agonists devoid of the imidazole ring system. *Bioorg Med Chem*. 15 (2007) 7166-7183.
24. Fransson R, Botros M, Nyberg F, Lindeberg G, Sandström A, Hallberg M. Small peptides mimicking substance P (1-7) and encompassing a C-terminal amide functionality. *Neuropeptides*. 42 (2008) 31-37.
25. Yang R, Smolders I, Bundel DD, Fouyn R, Hallberg M, Demaegdt H, Vanderheyden P, Dupont AG. Brain and peripheral angiotensin II type 1 receptors mediate renal vasoconstrictor and blood pressure responses to angiotensin IV in the rat. *J Hypertension*. 26 (2008) 998-1007.
26. Svensson A-L, Bucht N, Hallberg M and Nyberg F. Reversal of opiate-induced apoptosis by human recombinant growth hormone in mice foetus primary hippocampal neuronal cell-cultures. *Proc Natl Acad Sci USA*. 105 (2008) 7304-7308.
27. Botros M, Johansson T, Zhou Q, Lindeberg G, Tömböly C, Tóth G, Le Grevès P, Nyberg F, Hallberg M. Endomorphins interact with the substance P (SP) aminoterminal SP(1-7) binding in the ventral tegmental area of the rat brain. *Peptides*. 29 (2008) 1820-1824.
28. Andersson H, Demaegdt H, Vauquelin G, Lindeberg G, Karlén A, Hallberg M. Ligands to the (IRAP)/AT₄ receptor encompassing a 4-hydroxydiphenylmethane scaffold replacing Tyr². *Bioorg Med Chem*. 16 (2008) 6924-6935.

29. Magnusson K, Birgner C, Bergström L, Nyberg F, Hallberg M. Nandrolone decanoate administration affects the density of κ_1 -opioid receptors in the rat brain determined by autoradiography. *Neuropeptides*. 43 (2009) 105-11.
30. Rossbach U, Nilsson A, Fälth M, Kultima K, Zhou Q, Hallberg M, Gordh T, Andrén P, Nyberg F. A quantitative peptidomic analysis of peptides related to the endogenous opioid and tachykinin systems in nucleus accumbens of rats following naloxone-precipitated morphine withdrawal. *J Proteome Res*. 8 (2009) 1091-1098.
31. Hallberg M. Targeting insulin-regulated aminopeptidase/AT4 receptor for cognitive disorders. *Drug News Perspect*. 22 (2009) 133-139.
32. Zhou Q, Carlsson A, Botros M, Fransson R, Sandström A, Gordh T, Hallberg M, Nyberg F. The C-terminal amidated analogue of the Substance P (SP) fragment SP₁₋₇ attenuates the expression of naloxone-precipitated withdrawal in morphine dependent rats. *Peptides*. 30 (2009) 2418-2422.
33. Carlsson A, Ohsawa M, Hallberg M, Nyberg F, Kamei J. Substance P(1-7) induces antihyperalgesia in diabetic mice through a mechanism involving the naloxone sensitive sigma-receptors. *Eur J Pharmacol*. 626 (2010) 250-255.
34. Fransson R, Botros M, Sköld C, Zhou Q, Lindeberg G, Nyberg F, Hallberg M, Sandström A. Discovery of dipeptides as potent ligands of the specific binding site for Substance P 1-7. *J Med Chem*. 53 (2010) 2383-2389.
35. Andersson H, Demaegdt H, Vauquelin G, Lindeberg G, Karlén A, Hallberg M, Erdélyi M, Hallberg A. Disulfide cyclized tripeptide analogues of angiotensin IV as potent and selective inhibitors of insulin-regulated aminopeptidase (IRAP). *J Med Chem*. 53 (2010) 8059-8071.
36. Ohsawa M, Carlsson A, Asato M, Koizumi T, Nakanishi Y, Fransson R, Sandström A, Hallberg M, Nyberg F, Kamei J. The effect of substance P(1-7) amide on nociceptive threshold in diabetic mice. *Peptides*. 32 (2011) 93-98.
37. Nyberg F, Hallberg M. Localization of neuropeptides by radioimmunoassay. *Methods Mol Biol*. 789 (2011) 191-201.
38. Zhou Q, Carlsson A, Hallberg M, Nyberg F. Substance P N-terminal fragment SP(1-7) attenuates chronic morphine tolerance and affects dynorphin B and nociceptin in rats. *Peptides*. 32 (2011) 1661-1665.
39. Andersson H, Demaegdt H, Johnsson A, Vauquelin G, Lindeberg G, Hallberg M, Erdélyi M, Karlén A, Hallberg A. Potent macrocyclic inhibitors of insulin-regulated aminopeptidase (IRAP) by olefin ring-closing metathesis. *J Med Chem*. 54 (2011) 3779-3792.
40. Hallberg M. Impact of anabolic androgenic steroids on neuropeptide systems? *Mini Rev Med Chem*. 11 (2011) 399-408.
41. Ohsawa M, Carlsson A, Asato M, Koizumi T, Nakanishi Y, Fransson R, Sandström A, Hallberg M, Nyberg F, Kamei J. The dipeptide Phe-Phe amide attenuates signs of hyperalgesia, allodynia and nociception in diabetic mice using a mechanism involving the sigma receptor system. *Mol Pain*. 7 (2011) 85.
42. Nyberg F, Hallberg M. Interactions between opioids and anabolic androgenic steroids: Implications for the development of addictive behavior. *Int Rev Neurobiol*. 102 (2012) 189-206.
43. Hallberg M, Nyberg F. Growth hormone receptors in the brain and their potential as therapeutic targets in central nervous system disorders. *The Open Endocrinology Journal*. 6:Suppl 1 (2012) 27-33.

44. Enhamre E, Carlsson A, Grönbladh A, Watanabe H, Hallberg M, Nyberg F. The expression of growth hormone receptor gene transcript in the prefrontal cortex is affected in male mice with diabetes-induced learning impairments. *Neurosci Lett.* 523 (2012) 82-6.
45. Andersson H, Hallberg M. Discovery of inhibitors of insulin-regulated aminopeptidase as cognitive enhancers. *Int J Hypertens.* 2012 (2012) 789671.
46. Grönbladh A, Johansson J, Nyberg F, Hallberg M. Recombinant human growth hormone affects the density and functionality of GABA(B) receptors in the male rat brain. *Neuroendocrinology.* 97 (2013) 203-211
47. Johansson J, Grönbladh A, Nyberg F, Hallberg M. Application of *in vitro* [³⁵S]GTPγ-S autoradiography in studies of growth hormone effects on opioid receptors in the male rat brain. *Brain Res Bull.* 90 (2013) 100-106.
48. Grönbladh A, Johansson J, Nösl A, Nyberg F, Hallberg M. Growth hormone improves spatial memory and reverses certain anabolic androgenic steroid-induced effects in intact rats. *J Endocrinology.* 216 (2013) 31-41.
49. Enhamre-Brolin E, Carlsson A, Hallberg M, Nyberg F. Growth hormone reverses streptozotocin-induced cognitive impairments in male mice. *Behav Brain Res.* 238 (2013) 273-278.
50. Rhodin A, Grönbladh A, Ginya H, Nilsson KW, Rosenblad A, Zhou Q, Enlund M, Hallberg M, Gordh T, Nyberg F. Combined analysis of circulating beta-endorphin with gene polymorphisms in OPRM1, CACNAD2 and ABCB1 reveals correlation with pain, opioid sensitivity and opioid-related side effects. *Molecular Brain.* 2013; 6:8.
51. Fransson R, Sköld C, Kratz J, Svensson R, Artursson P, Nyberg F, Hallberg M, Sandström A. Constrained H-Phe-Phe-NH₂ analogues with high affinity to the substance P 1-7 binding site and with improved metabolic stability and cell permeability. *J Med Chem.* 56 (2013) 4953-4965.
52. Grönbladh A, Johansson J, Bergquist J, Hallberg M. The impact of nandrolone decanoate and growth hormone on plasma steroid levels in rodents. *Steroids.* 78 (2013) 1192-1199.
53. Nyberg F, Hallberg M. Growth hormone and cognitive function. *Nature Rev Endocrinology.* 9 (2013) 357-365.
54. Grönbladh A, Johansson J, Nyberg F, Hallberg M. Administration of growth hormone and nandrolone decanoate alters mRNA expression of the GABA(B) receptor subunits as well as of the GH receptor, IGF-1, and IGF-2 in rat brain. *Growth Horm IGF Res.* 24 (2014) 60-66.
55. Fransson R, Nordvall G, Bylund J, Carlsson-Jonsson A, Kratz J M, Svensson R, Artursson P, Hallberg M, Sandström A. Exploration and pharmacokinetic profiling of phenylalanine based carbamates as novel substance P 1-7 analogues. *ACS Med Chem Lett.* 5 (2014) 1272-1277.
56. Johansson J, Grönbladh A, Hallberg M. Gamma-hydroxybutyrate (GHB) induces cognitive deficits and affects GABA_B and IGF-1 receptors in male rats. *Behav Brain Res.* 269 (2014) 164-174.
57. Borhade S, Rosenström U, Sävmarker J, Lundbäck T, Jenmalm-Jensen A, Sigmundsson K, Axelsson H, Svensson F, Konda V, Sköld C, Larhed M, Hallberg M. Inhibition of insulin-regulated aminopeptidase (IRAP) by arylsulfonamides. *ChemistryOpen.* 3 (2014) 256-263.
58. Guimond M-O, Hallberg M, Gallo-Payet N, Wallinder C. Saralasin and sarile are AT₂ receptor agonists. *ACS Med Chem Lett.* 5 (2014) 1129-1132.

59. Jonsson A, Fransson R, Haramaki Y, Skogh A, Brodin E, Watanabe H, Nordvall G, Hallberg M, Sandström A, Nyberg F. Small constrained SP₁₋₇ analogues bind to a unique site and promote anti-allodynic effects following systemic injection in mice. *Neuroscience* 298 (2015) 112-119.
60. Grönblad A, Hallberg M. GTPγS-autoradiography for studies of opioid receptor functionality. *Methods Mol Biol.* 1230 (2015) 169-176.
61. Wallinder C, Sköld C, Botros M, Guimond M-O, Hallberg M, Gallo-Payet N, Karlén A, Alterman M. Interconversion of functional activity by minor structural iterations in nonpeptide AT₂ receptor ligands. *ACS Med Chem Lett.* 6 (2015) 178-182.
62. Hallberg M. Neuropeptides; metabolism to bioactive fragments and the pharmacology of their receptors. *Med Res Rev.* 35 (2015) 464-519.
63. Kalliomaki M-L, Sandblom G, Hallberg M, Grönbladh A, Gunnarsson U, Gordh T, Ginya H, Nyberg F. Genetic susceptibility to postherpetic pain. The influence of polymorphisms in the Mu opioid receptor, TNF-α, GRIK3, GCH1, BDNF and CACNA2D3 genes. *Scand J Pain.* 12 (2016) 1-6.
64. Diwakarla S, Nylander E, Grönbladh A, Vanga SR, Khan YS, Gutiérrez-de-Terán H, Ng L, Sävmarker J, Lundbäck T, Jenmalm-Jensen A, Andersson H, Engen K, Rosenström U, Larhed M, Åqvist J, Chai SY, Hallberg M. (2016) Binding to and inhibition of insulin-regulated aminopeptidase (IRAP) by macrocyclic disulfides enhance spine density. *Molecular Pharmacol.* 89 (2016) 413-424.
65. Larhed M, Hallberg M, Hallberg A. Nonpeptide AT₂R agonists. *Med Chem Reviews.* 51 (2016) 69-82.
66. Engen K, Rosenström U, Axelsson H, Konda V, Dahllund L, Otrocka M, Sigmundsson K, Nikolaou A, Vauquelin G, Hallberg M, Jenmalm-Jensen A, Lundbäck T, Larhed M. Novel insulin-regulated aminopeptidase inhibitors identified through small molecule screening. *Assay Drug Dev Technol.* 14 (2016) 180-193.
67. Grönbladh A, Nylander E, Hallberg M. The neurobiology and addiction potential of anabolic androgenic steroids and effects of growth hormone. *Brain Res Bull.* 126 (2016) 127-137.
68. Diwakarla S, Nylander E, Grönbladh A, Vanga S, Khan Y, Gutiérrez-de-Terán H, Sävmarker J, Ng L, Pham V, Lundbäck T, Jenmalm-Jensen A, Svensson R, Artursson P, Zellerroth S, Engen K, Rosenström U, Larhed M, Åqvist J, Chai S Y, Hallberg M. Aryl sulfonamide inhibitors of insulin-regulated aminopeptidase enhance spine density in primary hippocampal neuron cultures. *ACS Chem Neurosci.* 7 (2016) 1383-1392.
69. Nylander E, Grönbladh A, Zellerroth S, Diwakarla S, Nyberg F, Hallberg M. Growth hormone is protective against acute methadone-induced toxicity by modulating the NMDA receptor complex. *Neuroscience.* 339 (2016) 538-547.
70. Hallberg M, Sävmarker J, Hallberg A. Angiotensin peptides as AT₂ receptor agonists. *Curr Protein Pept Sci.* 18 (2017) 809-818.
71. Brodin E, Johansson J, Zellerroth S, Diwakarla S, Nyberg F, Grönbladh A, Hallberg M. The mRNA expression of insulin-like growth factor-1 (Igf1) is decreased in the rat frontal cortex following gamma-hydroxybutyrate (GHB) administration. *Neurosci Lett.* 646 (2017) 15-20.
72. Jonsson A, Lind A-L, Hallberg M, Nyberg F, Gordh T. Cerebrospinal fluid levels of substance P (SP) N-terminal fragment SP1-7 in patients with neuropathic pain. *Scand J Pain.* 8 (2017) 51.
73. Skogh A, Lesniak A, Gaugaz FZ, Svensson R, Lindeberg G, Fransson R, Nyberg F, Hallberg M, Sandström A. Importance of N- and C-terminal residues of Substance P 1-7 for alleviating allodynia in mice after peripheral administration. *Eur J Pharm Sci.* 106 (2017) 345-351.

74. Skogh A, Lesniak A, Gaugaz FZ, Svensson R, Lindeberg G, Fransson R, Nyberg F, Hallberg M, Sandström A. Impact of N-methylation of the Substance P 1-7 amide on anti-allodynic effect in mice after peripheral administration. *Eur J Pharm Sci.* 109 (2017) 533-540.
75. Hallberg M, Sumners C, Steckelings UM, Hallberg A. Small-molecule AT₂ receptor agonists. *Med Res Rev.* 38 (2018) 602-624.
76. Wannberg J, Isaksson R, Bremberg U, Backlund M, Sävmarker J, Hallberg M, Larhed M. A convenient transesterification method for synthesis of AT₂ receptor ligands with improved stability in human liver microsomes. *Bioorg Med Chem Lett.* 28 (2018) 519-522.
77. Brolin E, Zellerroth S, Jonsson A, Hallberg M, Grönbladh A, Nyberg F. Chronic administration of morphine using mini-osmotic pumps affects spatial memory in the male rat. *Pharmacol Biochem Behav.* 167 (2018) 1-8.
78. Vanga SR, Sävmarker J, Ng L, Larhed M, Hallberg M, Åqvist J, Hallberg A, Chai SY, Gutierrez-de-Teran H. Structural basis of inhibition of human insulin-regulated aminopeptidase (IRAP) by aryl sulfonamides. *ACS Omega.* 3 (2018) 4509-4521.
79. Skogh A, Lesniak A, Sköld C, Karlgren M, Gaugaz FZ, Svensson R, Diwakarla S, Jonsson A, Fransson R, Nyberg F, Hallberg M, Sandström A. An imidazole based H-Phe-Phe-NH₂ peptidomimetic with anti-allodynic effect in spared nerve injury mice and without neurotoxic liability. *Bioorg Med Chem Lett.* 28 (2018) 2446-2450.
80. Hallberg M, Sandström A. From the anti-nociceptive substance P metabolite substance P (1-7) to small peptidemimetics. *Curr Protein Pept Sci.* 19 (2018) 1038-1048.
81. Nylander E, Zellerroth S, Nyberg F, Grönbladh A, Hallberg M. The protective and restorative effects of growth hormone and insulin-like growth factor-1 on methadone-induced toxicity in vitro. *Int J Mol Sci.* 19 (2018) Article 3627.
82. Zellerroth S, Nylander E, Nyberg F, Grönbladh A, Hallberg M. Toxic impact of anabolic androgenic steroids in primary rat cortical cell cultures. *Neuroscience.* 397 (2019) 172-183.
83. Isaksson R, Lindman J, Wannberg J, Sallander J, Backlund M, Baraldi D, Widdop R, Hallberg M, Åqvist J, Gutiérrez-de-Terán H, Gising J, Larhed M. A series of analogues to the AT₂R prototype antagonist C38 allows fine tuning of the previously reported antagonist binding mode. *ChemistryOpen.* 8 (2019) 114-125.
84. Wallinder C, Sköld C, Sundholm S, Guimond M-O, Yahiaoui S, Lindeberg G, Gallo-Payet N, Hallberg M, Alterman M. High affinity rigidified AT₂ receptor ligands with indane scaffolds. *Med Chem Comm.* 10 (2019) 2146-2160.
85. Seyer B, Diwakarla S, Burns P, Hallberg A, Grönbladh A, Hallberg M, Chai SY. Insulin-regulated aminopeptidase inhibitor-mediated increases in dendritic spine density are facilitated by glucose uptake. *J Neurochemistry.* 153 (2020) 485-494.
86. Barlow N, Reddy Vanga S, Sävmarker J, Sandström A, Burns P, Hallberg A, Gutiérrez-de-Terán H, Hallberg M, Larhed M, Chai SY, Thompson PE. Macrocyclic peptidomimetics as inhibitors of insulin-regulated aminopeptidase (IRAP). *RSC Med Chem.* 11 (2020) 234-244.
87. Isaksson R, Casselbrant A, Elebring E, Hallberg M, Larhed M, Fändriks L. (2020) Direct stimulation of angiotensin II type 2 receptor reduces nitric oxide production in lipopolysaccharide treated mouse macrophages. *Eur J Pharmacol.* 868 (2020) Article 172855.

88. Nylander E, Zelleröth S, Stam F, Grönbladh A, Nyberg F, Hallberg M. Growth hormone increases dendritic spine formation in primary hippocampal cell cultures. *Growth Hormone and IGF-1 research*. 50 (2020) 42-47.
89. Balgoma D, Grönbladh A, Zelleröth S, Hallberg M, Pettersson C, Hedeland M. Anabolic androgenic steroids exert a selective remodeling of the plasma lipidome that mirrors the decrease of the de novo lipogenesis in the liver. *Metabolomics*. 16 (2020) Article 12.
90. Engen K, Reddy Vanga S, Lundbäck T, Agalo F, Konda V, Jenmalm Jensen A, Gutiérrez-de-Terán H, Hallberg M, Larhed M, Rosenström U. Synthesis, evaluation and proposed binding pose of substituted spiro-oxindole dihydroquinazolinones as IRAP inhibitors. *ChemistryOpen*, 9 (2020) 325-337.
91. Vasile S, Hallberg A, Sallander J, Hallberg M, Åqvist J, Gutiérrez-de-Terán H. Evolution of angiotensin peptides and peptidomimetics as AT2 receptor agonists. *Biomolecules*. 10 (2020) Article 649.
92. Mpakali A, Saridakis E, Giastas P, Maben Z, Stern LJ, Larhed M, Hallberg M, Stratikos E. Structural basis of inhibition of insulin-regulated aminopeptidase by a macrocyclic peptidic inhibitor. *ACS Med Chem Lett*. 11 (2020) 1429-1434.
93. Watanabe H, Nosova O, Sarkisyan D, Storm Andersen M, Zhang M, Rorick-Kehn L, Clausen F, Gawel K, Kehr J, Hallberg M, Schouenborg J, Marklund N, Bakalkin G. Ipsilesional vs contralesional postural deficits induced by unilateral brain trauma: a side reversal by opioid mechanism. *Brain Communications*. 2 (2020) 2, Article 208.
94. Hallberg M, Larhed M. From angiotensin IV to small peptidemimetics inhibiting insulin-regulated aminopeptidase (IRAP). *Front Pharmacol*. 11 (2020) Article 590855.
95. Wannberg J, Gising J, Lindman J, Salander J, Gutiérrez-de-Terán H, Ablahad H, Hamid S, Grönbladh A, Spizzo I, Gaspari TA, Widdop R, Hallberg A, Backlund M, Leśniak A, Hallberg M, Larhed M. N-(Methyloxycarbonyl)thiophene sulfonamides as high affinity AT2 receptor ligands. *Bioorg Med Chem*. 29 (2021) 115859
96. Nyman J, Guo N, Fransson R, Sandström A, Hallberg M, Nyberg F, Yu L. The amino-terminal heptapeptide of the alginate substance P provides analgesic effect in relieving chronic neuropathic pain. *Eur J Pharmacol*. 892 (2021) Article 173820.
97. Watanabe H, Nosova O, Sarkisyan D, Andersen M, Carvalho L, Galatenko V, Bazov I, Lukoyanov N, Maia G, Hallberg M, Zhang M, Schouenborg J, Bakalkin G. Left-right side-specific neuropeptide mechanism mediates contralateral responses to a unilateral brain injury. *eNeuro* 2021; 8(3) ENEURO. 0548-20.2021 1-19
98. Bakalkin G, Nosova O, Sarkisyan D, Hallberg M, Zhang M, Schouenborg J, Marklund N, Watanabe H. Unilateral traumatic brain injury of the left and right hemisphere produces the left hindlimp response in rats. *Exp Brain Res*. 239 (2021) 2221–2232.
99. Grönbladh A, Hallberg M. GTPγS-autoradiography for studies of opioid receptor functionality. *Methods Mol Biol*. 2201 (2021) 109-116.
100. Grönbladh A, Nylander E, Zelleröth S, Hallberg M. Assessing cell viability effects of opioids in primary cortical cells from rat. *Methods Mol Biol*. 2201 (2021) 171-180.
101. Bakalkin G, Kahle A, Sarkisyan D, Watanabe H, Lukoyanov N, Carvalho LS, Galatenko V, Hallberg M, Nosova O. Coordinated expression of the renin-angiotensin genes in the lumbar spinal cord: lateralization and effects of unilateral brain injury. *Eur J Neurosci*. 54(4) (2021) 5560-5573.

102. Zellerroth S, Nylander E, Örtenblad A, Stam F, Nyberg F, Grönbladh A, Hallberg M. Structurally different anabolic androgenic steroids reduce neurite outgrowth and neuronal viability in primary rat cortical cell cultures. *J Steroid Biochem Mol Biol.* 210 (2021) Article 105863.
103. Nosova O, Bazov I, Hallberg M, Karpyak V, Bakalkin G. Epigenetic and transcriptional control of opioid gene: In-depth analysis in the human brain. *Molecules* 26 (2021) Article 3458.
104. Nylander E, Zellerroth S, Nyberg F, Grönbladh A, Hallberg M. The effects of morphine, methadone, and fentanyl on mitochondria: A live cell imaging study. *Brain Res Bull.* 171 (2021) 126-134.
105. Gopalan G, Nieto CP, Petersen NN, Hallberg M, Larhed M. Angiotensin II AT2 receptor ligands with phenylthiazole scaffolds. *Bioorg Med Chem.* 65 (2022) 116790.
106. Roy T, Petersen NN, Gopalan G, Gising J, Hallberg M, Larhed M. 2-Alkyl substituted benzimidazoles as a new class of selective AT2 receptor ligands. *Bioorg Med Chem.* 66 (2022) 116804.
107. Zellerroth S, Nylander E, Kjellgren E, Grönbladh A, Hallberg M. Nandrolone decanoate and testosterone undecanoate differently affect stress hormones, neurotransmitter systems, and behavioral profiles in the male rat. *Behav Brain Res.* (2022) *Under revision*

Book chapters

1. Hallberg M, Le Grevès P, Nyberg F. (2005) Neuropeptide processing. In: *Proteases in Biology and Disease*. Volume 3. Eds: Lendeckel U and Hooper N, Springer. Chapter 9, 203-234.
2. Nyberg F, Hallberg M. (2007) Neuropeptides in hyperthermia. In: *Progress in Brain Research*. Volume 162. Ed: Sharma H, Elsevier. Chapter 14, 277-293.
3. Nyberg F, Hallberg M. (2012) Cognition-enhancing peptides and peptidomimetics. In: *Neuropeptides in Neuroprotection and Neurogeneration*. Ed: Nyberg F, CRC Press, New York. Chapter 15, 271-298.
4. Nyberg F, Carlsson A, Hallberg M. (2013) Casomorphins/Hemorphins. In: *Handbook of Biologically Active Peptides*, 2nd Edition. Ed: Kastin AJ, Elsevier, New York. Chapter 211, 1550-1555.
5. Nyberg F, Grönbladh A, Enhamre E, Jonsson A, Johansson J, Hallberg M. (2016) The effect of growth hormone on the brain. In: *Neuroendocrine Disorders in Children*. Eds: Dattani MT, Hindmarsh P, Robinson I, Carr L, Wiley. Chapter 3, 30-41.

Other publications

6. Hallberg M. (2005) Thesis. Anabolic androgenic steroids; Effects on neuropeptide systems in the rat brain. ISBN 91-554-6214-6.
7. Nyberg F, Hallberg A, Hallberg M, Sandström A, Fransson R. Therapeutic methods and compositions employing peptide compounds. *PCT Int. Appl.* (2010), Wo 20100045345A2 20100114.
8. Hallberg M. (2011) Anabola androgena steroider. In: *Beroendemedicin*, Eds; Nylander I and Franck J. Studentlitteratur AB, Lund, Sweden: 233-240.
9. Hallberg M, Nyberg F. Fortfarande oklart om steroider framkallar eget beroende. *Läkartidningen.* 110 (2013) 1736-1739.

10. Hallberg M. (2015) Anabola androgena steroider. In: Beroendemedicin, Second edition. Eds; Nylander I and Franck J. Studentlitteratur AB, Lund, Sweden: 241-248.
11. Lai Z, Grönbladh A, Hallberg M, Nyberg F. Effects of growth hormone on brain function; new routes for the delivery of the hormone into the brain. Peer-reviewed conference contribution. Amino acids. 48 (2016) 633-634.
12. Nyberg F, Hallberg M. Growing knowledge: How growth hormone improves learning. Editorial. Acta Physiol (Oxf). 229 (2020) Article e13474.
13. Hallberg M. (2022) Anabola androgena steroider. In: Beroendemedicin, Third edition. Eds; Nylander I and Franck J. Studentlitteratur AB, Lund, Sweden: xxx-xxx. *In press*.
14. Hoffmann O, Hallberg M. (2022) Opiater och opioider. In: Beroendemedicin, Third edition. Eds; Nylander I and Franck J. Studentlitteratur AB, Lund, Sweden: xxx-xxx. *In press*.
15. Nyberg F, Hallberg M. (2022) Cannabis och cannabinoider. In: Beroendemedicin, Third edition. Eds; Nylander I and Franck J. Studentlitteratur AB, Lund, Sweden: xxx-xxx. *In press*.