

## BIOGRAPHICAL SKETCH

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NAME Leah R. B. Hanson		POSITION TITLE	
eRA COMMONS USER NAME LRHanson		Senior Director, HealthPartners Neuroscience Research	
EDUCATION/TRAINING ( <i>Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.</i> )			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Drake University, Des Moines, IA	B.S.	1994	Biology
University of Minnesota, St. Paul, MN	Ph.D.	2001	Neuroscience
Alzheimer's Research Center, HealthPartners Institute for Education & Research, St. Paul, MN	Postdoctoral	2001-2002	Alzheimer's Disease

### Positions and Employment

2014 – Senior Director, Neuroscience Research, HealthPartners Institute, St. Paul, MN  
2005–13 Director, Alzheimer's Research Center, HealthPartners Institute for Education and Research, St. Paul, MN  
2003–05 Assistant Director, Alzheimer's Research Center, HealthPartners Institute for Education and Research, St. Paul, MN  
2002–03 Research Associate, Alzheimer's Research Center, HealthPartners Institute for Education and Research, St. Paul, MN  
2001–02 Postdoctoral Fellow, Alzheimer's Research Center, HealthPartners Institute for Education and Research, St. Paul, MN  
1994–01 Research Assistant, Fisheries, University of Minnesota, St. Paul, MN  
1994 Undergraduate Research Assistant, Neuroscience, University of Minnesota, Minneapolis, MN  
1993-94 Undergraduate Research Assistant, Psychology, Drake University, Des Moines, IA

### Awards and Honors

2006 Excellence in Research Award, HealthPartners Research Foundation  
2017 HealthPartners President's Team Award

### Peer-reviewed Publications

1. \*Pisansky MT, **Hanson LR**, Gottesman II, Gewirtz JC. Oxytocin enhances observational fear in mice. *Nature Communications Nat Commun.* 2017 Dec 13;8(1):2102. PMID: 29235461
2. \*Fine JM, Forsberg AC, Stroebel BM, Faltsek KA, Verden DR, Hamel KA, Raney EB, Crow JM, Haase LR, Knutzen KE, Kaczmarczek KD, Frey WH, **Hanson LR**. Intranasal deferoxamine affects memory loss, oxidation, and the insulin pathway in the streptozotocin rat model of Alzheimer's disease. *Journal of the Neurological Sciences* 380 (2017) 164–171.
3. \*Tisminetzky M, Bayliss EA, Magaziner JS, Allore HG, Anzuoni K, Boyd CM, Gill TM, Go AS, Greenspan SL, **Hanson LR**, Hornbrook MC, Kitzman DW, Larson EB, Naylor MD, Shirley BE, Tai-Seale M, Teri L, Tinetti ME, Whitson HE, Gurwitz JH. Research Priorities to Advance the Health and Health Care of Older Adults with Multiple Chronic Conditions. *J Am Geriatr Soc.* 2017 Jul;65(7):1549-1553. PMID: 28555750
4. \*Tzabazis A, Kori S, Mechanic J, Miller J, Pascual C, Manering N, Carson D, Klukinov M, Spierings E, Jacobs D, Cuellar J, Frey WH 2nd, **Hanson L**, Angst M, Yeomans DC. Oxytocin and Migraine Headache. *Headache.* 2017 May;57 Suppl 2:64-75. PMID: 28485846

5. \*Belur LR, Temme A, Podetz-Pedersen KM, Riedl M, Vulchanova L, Robinson N, **Hanson LR**, Kozarsky KF, Orchard PJ, Frey WH 2<sup>nd</sup>, Low WC, Mclvor RS. Intranasal AAV Mediated Gene Delivery and Expression of Human Iduronidase in the CNS: A Non-invasive and Effective Approach for Prevention of Neurologic Disease in Mucopolysaccharidosis Type I. *Hum Gene Ther.* 2017 Jul;28(7):576-587. *Hum Gene Ther.* 2017 Jul;28(7):576-587. PMID: 28462595
6. \*Khan RS, Dine K, Bauman B, Lorentsen M, Lin L, Brown H, **Hanson LR**, Svitak AL, Wessel H, Brown L, Shindler KS. Intranasal Delivery of A Novel Amnion Cell Secretome Prevents Neuronal Damage and Preserves Function In A Mouse Multiple Sclerosis Model. *Sci Rep.* 2017 Aug 3; Jan 31;7:41768. PMID: 2813974
7. Dhuria SV, Fine JM, Bingham D, Svitak AL, Burns RB, Baillargeon AM, Panter SS, Kazi AN, Frey WH 2<sup>nd</sup>, **Hanson LR**. Food consumption and activity levels increase in rats following intranasal Hypocretin-1. *Neurosci Lett.* 2016 Aug 3;627:155-9. PMID: 27264485
8. Rosenbloom M, Borson S, Barclay T, **Hanson LR**, Werner A, Stuck L, McCarten J. Routine cognitive screening in a neurology practice: Effect on physician behavior. *Neurol Clin Pract.* 2016 Feb;6(1):16-21. PMID: 26918200
9. Symons FJ, ElGhazi I, Reilly BG, Barney CC, **Hanson L**, Panoskaltzis-Mortari A, Armitage IM, Wilcox GL. Can biomarkers differentiate pain and no pain subgroups of nonverbal children with cerebral palsy? A preliminary investigation based on noninvasive saliva sampling. *Pain Med.* 2015 Feb;16(2):249-56. PMID: 25234580
10. Fine JM, Renner DB, Forsberg AC, Cameron RA, Galick BT, Le C, Conway PM, Stroebel BM, Frey WH 2<sup>nd</sup>, **Hanson LR**. Intranasal deferoxamine engages multiple pathways to decrease memory loss in the APP/PS1 model of amyloid accumulation. *Neurosci Lett.* 2015 Jan 1;584:362-7. PMID: 25445365
11. Rosenbloom MH, Barclay TR, Pyle M, Owens BL, Cagan AB, Anderson CP, Frey WH 2<sup>nd</sup>, **Hanson LR**. A single-dose pilot trial of intranasal rapid-acting insulin in apolipoprotein E4 carriers with mild-moderate Alzheimer's disease. *CNS Drugs.* 2014 Dec;28(12):1185-9. PMID: 25373630
12. Fine JM, Forsberg AC, Renner DB, Falteseck KA, Mohan KG, Wong JC, Arneson LC, Crow JM, Frey WH 2<sup>nd</sup>, **Hanson LR**. Intranasally-administered deferoxamine mitigates toxicity of 6-OHDA in a rat model of Parkinson's disease. *Brain Res.* 2014 Jul 29;1574:96-104. PMID: 25445365
13. **Hanson LR**, Fine JM, Svitak AL, Falteseck KA. Intranasal administration of CNS therapeutics to awake mice. *J Vis Exp.* 2013 Apr 8;(74). PMID:23608783
14. Renner DB, Svitak AL, Gallus NJ, Ericson ME, Frey WH 2<sup>nd</sup>, **Hanson LR**. Intranasal delivery of insulin via the olfactory nerve pathway. *Journal of Pharmacy and Pharmacology* 2012 Dec; 64(12): 1709-1714. Epub 2012 Jul 4. PMID:23146033
15. Whitebird RR, Kreitzer M, Crain AL, Lewis BA, **Hanson LR**, Enstad CJ. Mindfulness-based stress reduction for family caregivers: a randomized controlled trial. *Gerontologist.* 2013 Aug;53(4):676-86. doi: 10.1093/geront/gns126. Epub 2012 Oct 15. PMID: 23070934
16. **Hanson LR**, Fine JM, Renner DB, Svitak AL, Burns RB, Nguyen TM, Tuttle NJ, Marti DL, Panter SS, Frey WH 2<sup>nd</sup>. Intranasal delivery of deferoxamine reduces spatial memory loss in APP/PS1 mice. *Drug Deliv Transl Res.* 2012 Jun;2(3):160-8. doi: 10.1007/s13346-011-0050-2. PMID: 25786865
17. Fine JM, Baillargeon AM, Renner DB, Hoerster NS, Tokarev J, Colton S, Pelleg A, Andrews A, Sparley KA, Krogh KM, Frey WH, **Hanson LR**. Intranasal deferoxamine improves performance in radial arm water maze, stabilizes HIF-1 $\alpha$ , and phosphorylates GSK3 $\beta$  in P301L tau transgenic mice. *Exp Brain Res.* 2012 Jun;219(3):381-90. doi: 10.1007/s00221-012-3101-0. Epub 2012 May 1. PMID: 22547371
18. Wolf DA, **Hanson LR**, Aronovich EL, Nan Z, Low WC, Frey WH 2<sup>nd</sup>, Mclvor RS, Lysosomal enzyme can bypass the blood-brain barrier and reach the CNS following intranasal administration, *Molecular Genetics and Metabolism* 2012 May; 106(1): 131-134. Epub 2012 Feb 10. PMID:22420937.

19. Renner DB, Frey WH 2nd, **Hanson LR**. Intranasal delivery of siRNA to the olfactory bulbs of mice via the olfactory nerve pathway. *Neurosci Lett*. 2012 Apr 4;513(2):193-7. doi: 10.1016/j.neulet.2012.02.037. Epub 2012 Feb 22. PMID: 22387067
20. **Hanson LR**, Fine JM, Hoekman JD, Nguyen TM, Burns RB, Martinez PM, Pohl J, Frey WH 2<sup>nd</sup>, Intranasal delivery of growth/differentiation factor 5 to the central nervous system. *Drug Delivery* 2012 Apr; 19(3): 149-154. Epub 2012 Feb 22. PMID:22353012.
21. Gomez D, Martinez JA, **Hanson LR**, Frey WH 2nd, Toth CC. Intranasal treatment of neurodegenerative diseases and stroke. *Front Biosci (Schol Ed)*. 2012 Jan 1;4:74-89. Review. PMID: 22202044
22. Liu Z, Li, Y, Zhang L, Xin H, Cui Y, **Hanson LR**, Frey WH, Chopp M. Subacute Intranasal Administration of Tissue Plasminogen Activator Increases Functional Recovery and Axonal After Stroke in Rats. *Neurobiology of Disease* 2012;45(2):804-9 (PMC3259280)
23. Whitebird RR, Kreitzer MJ, Lewis BA, **Hanson LR**, Crain AL, Enstad CJ, Mehta A. Recruiting and retaining family caregivers to a randomized controlled trial on mindfulness-based stress reduction. *Contemp Clin Trials*. 2011 Sep;32(5):654-61. Epub 2011 May 12 PMID3148271
24. Francis GJ, Martinez JA, Liu WQ, Zochodne DW, **Hanson LR**, Frey WH 2nd, Toth C. Motor end plate innervation loss in diabetes and the role of insulin. *J Neuropathol Exp Neurol*. 2011 May;70(5):323-39. doi: 10.1097/NEN.0b013e318215669a. PMID: 21487310
25. **Hanson LR**, Hafez D, Svitak AL, Burns RB, Li X, Frey WH 2nd, Marr RA. Intranasal phosphoramidon increases beta-amyloid levels in wild-type and NEP/NEP2-deficient mice. *J Mol Neurosci*. 2011 Mar;43(3):424-7. doi: 10.1007/s12031-010-9460-8. Epub 2010 Oct 13. PMID: 20941644
26. Johnson NJ, **Hanson LR**, Frey WH. Trigeminal pathways deliver a low molecular weight drug from the nose to the brain and orofacial structures. *Mol Pharm*. 2010 Jun 7;7(3):884-93. doi: 10.1021/mp100029t. PMID: 20420446
27. Danielyan L, Klein R, **Hanson LR**, Buadze M, Schwab M, Gleiter CH, Frey WH. Protective effects of intranasal losartan in the APP/PS1 transgenic mouse model of Alzheimer disease. *Rejuvenation Res*. 2010 Apr-Jun;13(2-3):195-201. doi: 10.1089/rej.2009.0944. PMID: 20370487
28. Dhuria SV, **Hanson LR**, Frey WH 2nd. Intranasal delivery to the central nervous system: mechanisms and experimental considerations. *J Pharm Sci*. 2010 Apr;99(4):1654-73. doi: 10.1002/jps.21924. Review. PMID: 19877171
29. Alcalá-Barraza SR, Lee MS, **Hanson LR**, McDonald AA, Frey WH 2nd, McLoon LK. Intranasal delivery of neurotrophic factors BDNF, CNTF, EPO, and NT-4 to the CNS. *J Drug Target*. 2010 Apr;18(3):179-90. doi: 10.3109/10611860903318134. PMID: 19807216
30. **Hanson LR**, Roeytenberg A, Martinez PM, Coppes VG, Sweet DC, Rao RJ, Marti DL, Hoekman JD, Matthews RB, Frey WH 2nd, Panter SS. Intranasal deferoxamine provides increased brain exposure and significant protection in rat ischemic stroke. *Journal of Pharmacology and Experimental Therapeutics*. 2009 Sep; 330(3): 679-686. Epub 2009 Jun 9. PubMed PMID: 2729791.
31. **Hanson LR**, Frey WH 2nd. Intranasal delivery bypasses the blood-brain barrier to target therapeutic agents to the central nervous system and treat neurodegenerative disease. *BMC Neurosci*. 2008 Dec 10;9 Suppl 3:S5. doi: 10.1186/1471-2202-9-S3-S5. Review. PMID: 19091002
32. Dhuria SV, **Hanson LR**, Frey WH 2<sup>nd</sup>. Intranasal drug targeting of hypocretin-1 (orexin-A) to the central nervous system. *J Pharm Sci*. 2009 Jul;98(7):2501-15. doi: 10.1002/jps.21604. PMID: 19025760
33. Dhuria SV, **Hanson LR**, Frey WH 2nd. Novel vasoconstrictor formulation to enhance intranasal targeting of neuropeptide therapeutics to the central nervous system. *Journal of Pharmacology and Experimental Therapeutics*. 2009 Jan; 328(1): 312-20. Epub 2008 Oct 22. PubMed PMID: 18945930.
34. **Hanson LR**, Liu XF, Ross TM, Doppler E, Zimmermann-Meinzingen S, Moessler H, Frey WH 2<sup>nd</sup>. Cerebrolysin Reduces Infarct Volume in a Rat Model of Focal Cerebral Ischemic Damage. *American Journal of Neuroprotection and Neuroregeneration*. 2009 1(1): 60-66. DOI: 10.1166/ajnn.2009.1010.

35. Thorne RG, **Hanson LR**, Ross TM, Tung D, Frey WH 2nd. Delivery of interferon-beta to the monkey nervous system following intranasal administration. *Neuroscience*. 2008 Mar 27; 152(3): 785-97. Epub 2008 Jan 16. PubMed PMID: 18304744.
36. **Hanson LR**, Frey WH 2nd. Intranasal delivery bypasses the blood-brain barrier to target therapeutic agents to the central nervous system and treat neurodegenerative disease. *BMC Neuroscience*. 2008 Dec 10; 9 Suppl 3: S5. Review. PubMed PMID: 19091002.
37. Pulliam L, Sun B, Rempel H, Martinez PM, Hoekman JD, Rao RJ, Frey WH 2nd, **Hanson LR**. Intranasal tat alters gene expression in the mouse brain. *J Neuroimmune Pharmacol*. 2007 Mar;2(1):87-92. Epub 2007 Jan 9. PMID: 18040830
38. **Hanson LR**, Frey WH 2nd. Strategies for intranasal delivery of therapeutics for the prevention and treatment of neuroAIDS. *J Neuroimmune Pharmacol*. 2007 Mar;2(1):81-6. Epub 2006 Sep 15. Review. PMID: 18040829
39. Liu XF, Fawcett JR, **Hanson LR**, Frey WH 2nd. The window of opportunity for treatment of focal cerebral ischemic damage with noninvasive intranasal insulin-like growth factor-I in rats. *J Stroke Cerebrovasc Dis*. 2004 Jan-Feb;13(1):16-23. PMID: 17903945
40. Ross TM, Martinez PM, Renner JC, Thorne RG, **Hanson LR**, Frey WH 2nd. Intranasal administration of interferon beta bypasses the blood-brain barrier to target the central nervous system and cervical lymph nodes: a non-invasive treatment strategy for multiple sclerosis. *J Neuroimmunol*. 2004 Jun;151(1-2):66-77. PMID: 15145605
41. **Hanson LR**, Sorensen PW, Cohen Y. Sex pheromones and amino acids evoke distinctly different spatial patterns of electrical activity in the goldfish olfactory bulb. *Ann N Y Acad Sci*. 1998 Nov 30;855:521-4. PMID: 10049233

## Patents

1. \*U.S. Patent 9,808,509 - Pharmaceutical compositions and methods for enhancing targeting of therapeutic compounds to the central nervous system. November 7, 2017
2. \*U.S. Patent 9,801,835 - Method of pre-treating patients for stroke comprising administering metal chelators to the upper one-third of the nasal cavity. October 31, 2017
3. \*U.S. Patent 9,707,193 - Method of treating cerebral hemorrhage and subarachnoid hemorrhage comprising administering metal chelators to the upper one-third of the nasal cavity. 9,707,193
4. \*U.S. Patent 9,636,313 - Method of treating spinal cord injury comprising administering metal chelators to the upper one-third of the nasal cavity. May 2, 2017
5. \*U.S. Patent 9,636,312 - Method of treating traumatic brain injury/head injury comprising administering metal chelators to the upper one-third of the nasal cavity. May 2, 2017
6. \*U.S. Patent 9,629,819 - Method of treating progressive supranuclear palsy comprising administering metal chelators to the upper one-third of the nasal cavity. April 25, 2017
7. \*U.S. Patent 9,556,260 - Treatment of central nervous system disorders by intranasal administration of immunoglobulin G. January 31, 2017
8. U.S. Patent 9,480,649 - Lipid microparticle growth factor formulations. November 1, 2016
9. U.S. Patent 9,351,927 - Pharmaceutical compositions for treatment of patients with neurodegeneration following ischemic insult. May 31, 2016
10. U.S. Patent 9,345,676 - Method of treating stroke comprising administering metal chelators to the upper one-third of the nasal cavity. May 24, 2016

11. U.S. Patent 9,249,424 - Intranasal delivery of AAV encoding therapeutic enzymes to the central nervous system for the treatment of lysosomal storage diseases. February 2, 2016
12. U.S. Patent 9,216,161 - Methods of treating Huntington's disease comprising administering metal chelators to the upper one-third of the nasal cavity. December 22, 2015
13. U.S. Patent 9,211,273 - Methods of treating neurodegeneration caused by iron accumulation in the brain comprising administering metal chelators to the upper one-third of the nasal cavity. December 15, 2015
14. U.S. Patent 9,211,272 - Method of treating lewy body syndrome comprising administering metal chelators to the upper one-third of the nasal cavity. December 15, 2015
15. U.S. Patent 9,205,066 - Method of treating parkinson's disease comprising administering deferoxamine (DFO) to the upper one-third of the nasal cavity. December 8, 2015
16. U.S. Patent 8,609,088 - Intranasal delivery of therapeutic enzymes to the central nervous system for the treatment of lysosomal storage diseases. December 17, 2013
17. U.S. Patent 8,592,485 - Methods and pharmaceutical compositions for treating the animal central nervous system for psychiatric disorders. November 26, 2013
18. U.S. Patent 8,568,691 - Methods for providing neuroprotection for the animal central nervous system against the effects of ischemia, neurodegeneration, trauma, and metal poisoning. October 29, 2013
19. U.S. Patent 7,989,502 - Intranasal delivery of modafinil. August 2, 2011
20. U.S. Patent 7,776,312 - Method of treating Alzheimer's disease comprising administering deferoxamine (DFO) to the upper one-third of the nasal cavity. August 17, 2010
21. 19. U.S. Patent 7,618,615 - Methods for providing neuroprotection for the animal central nervous system against neurodegeneration caused by ischemia. November 17, 2009

## **2017 Presentations**

1. \* "Outcomes of an Embedded Resource and Education Program for Patients and Families with Memory Loss," poster at Health Care Systems Research Network annual Meeting held March 2017 in San Diego. **Hanson LR**, Forsberg AC, Thomas AJ, Crow JM, Haley-Franklin H, Barclay TR.
2. \* "Clinical Characteristics and Healthcare Utilization of Hmong Patients Presenting with Stroke" poster at American Academy of Neurology annual meeting held April 2017 in Boston. Hussein HM, Kashyap B, Erickson LO, Droegemueller C, **Hanson L**.
3. \* "Analysis of Run Sheets of EMS Serving a Metropolitan Comprehensive Stroke Center" poster at American Academy of Neurology annual meeting held April 2017 in Boston. Hussein H, Kashyap B, Erickson L, Forsberg A, Burnett A, Stanfield S, Wewerka S, Terwilliger A, **Hanson L**.
4. \* "Cognitive Screening Results from the Medicare Annual Wellness Visit in a Primary Care Practice'," poster at Alzheimer's Association International Conference Annual Meeting held July 2017 in London. Rosenbloom MH, Barclay TR, Dorwart A, Erickson LO, Werner AM, Kashyap B, Borson S, **Hanson LR**.
5. \* "Mindfulness for early Alzheimer's Disease: A Pilot Study" poster at Alzheimer's Association International Conference Annual Meeting held July 2017 in London. **Hanson LR**, Barclay M, Kashyap B, Somerville B, Kreitzer MJ, Stuck L, Barclay TR.

## **2017 Community Lectures**

1. \* "Healthy Brain Aging"

- a. \*American Association of University Women, St. Paul Chapter meeting in January 2017.
  - b. \*Minnetonka/Eden Prairie/Hopkins League of Women Voters meeting in September 2017.
2. \*"4 Ways to Improve Your Brain Health" at HealthPartners Neuroscience Center Grand Opening in May 2017.
  3. \* "HealthPartners Center for Memory & Aging Research Update" at the Alzheimer's Fundraising Breakfast in June 2017.