Matthijs (Matt) van der Meer

Assistant Professor
Department of Psychological & Brain Sciences

Dartmouth College
3 Maynard Street
Hanover, NH 03755, USA

Office phone: (603) 646 0610
Lab website: www.vandermeerlab.org
E-mail: mvdm at dartmouth dot edu

Professional appointments

Assistant Professor — Jan 2015-
Department of Psychological and Brain Sciences, Dartmouth College

Assistant Professor and Canada Research Chair — Sept 2010-Dec 2014
Department of Biology, University of Waterloo

Post-doctoral associate — 2007-2010
Department of Neuroscience, University of Minnesota
Mentor: A. David Redish

Education

Ph.D. in Neuroinformatics — 2003-2007
Neuroinformatics Doctoral Training Centre, University of Edinburgh, UK
Thesis title: "Neural compass or epiphenomenon? Experimental and theoretical investigations into the rodent head-direction system".
Advisors: Mark van Rossum, Emma Wood; Examiners: Neil Burgess (University College London), Mayank Dutia (Edinburgh)

Neural Systems & Behavior summer course — 2005
Marine Biological Laboratory, Woods Hole, USA

M.Sc. in Neuroinformatics *(with distinction)* — 2002-2003
Neuroinformatics Doctoral Training Centre, University of Edinburgh

M.Sc. in Informatics *(with distinction)* — 2001-2002
School of Informatics, University of Edinburgh

Exchange trimester — 2000
University of California, San Diego, USA
Focus: Artificial Intelligence, Cognitive Science

B.Sc. in Science *(cum laude*) — 1998-2001
University College Utrecht, the Netherlands

Publications

34. Crego AC, Carmichael JE, van der Meer MA, Smith KS (submitted) The dorsolateral striatum regulates habits by way of performance vigor when actions are initiated. *bioRxiv*, doi: 10.1101/426031

33. Carey AA, Tanaka Y, van der Meer MA (*revision submitted*) Reward revaluation biases hippocampal sequence content away from the preferred outcome. *bioRxiv*, doi: 10.1101/300251

32. Gmaz JM, Carmichael JE, van der Meer MA (2018) Persistent coding of outcome-predictive cue features in the rat nucleus accumbens. *eLife* 7:e37275

31. Carmichael JE, Gmaz JM, van der Meer MA (2017) Gamma oscillations in the rat ventral striatum originate in the piriform cortex. *Journal of Neuroscience* 37(33):7962-7974
*Highlighted in eNeuro editorial, Dec 2017

30. Riaz S, Schumacher A, Sivagurunathan S, van der Meer MA, Ito R (2017) Ventral, but not dorsal hippocampus inactivation impairs reward context memory expression and retrieval. *Hippocampus* 27(7):822-836

29. Butler WN, Smith KS, van der Meer MA, Taube JS (2017) The head direction signal plays a functional role as a neural compass during navigation. *Current Biology* 27(9):1259-1267

28. Pezzulo G, Kemere C, van der Meer MA (2017) Internally generated hippocampal sequences as a vantage point to probe future-oriented forms of cognition. *Annals of the New York Academy of Sciences* 1396: 144-165

27. van der Meer MA, Carey AA, Tanaka Y (2017) Optimizing for generalization in the decoding of internally generated activity in the hippocampus. *Hippocampus* 27(5):580-595

26. Hassani SA, Oemisch M, Balcarras M, Westendorff S, Ardid S, van der Meer MA, Tiesinga P, Womelsdorf T (2017) Alpha-2A noradrenergic agonist Guanfacine improves reinforcement learning during feature-based reversal performance: A nonhuman primate case study. *Scientific Reports* 7:40606

25. Catanese J, Carmichael JE, van der Meer MA (2016) Low and high gamma oscillations deviate in opposite directions from zero phase synchrony in the limbic corticostriatal loop. *Journal of Neurophysiology* 116(1): 5-17

24. Malhotra S, Cross RW, Zhang A, van der Meer MA (2015) Ventral striatal gamma oscillations are highly variable from trial to trial, dominated by behavioral state, and only weakly influenced by outcome value. *European Journal of Neuroscience* 42(10): 2818–2832

23. Pezzulo G, van der Meer MA, Lansink CS, Pennartz CMA (2014) Internally generated sequences in learning and executing goal-directed behavior. *Trends in Cognitive Sciences* 18(12): 647-657

22. van der Meer MA, Ito R, Lansink CS, Pennartz CMA (2014) Hippocampal projections to the ventral striatum: from spatial memory to motivated behavior. *Invited Contribution for "Space, Time & Memory in the Hippocampal Formation" (Knierim JJ and Derdikman D, eds.), Springer*.

21. Caze R, van der Meer MA (2013) Adaptive properties of differential learning rates for positive and negative outcomes. *Biological Cybernetics* 107(6): 711-719

20. Catanese J, van der Meer MA (2013) A network state linking motivation and action in the nucleus accumbens (Invited *Preview* of McGinty et al.) *Neuron* 78(5): 753-754

19. Ogawa M, van der Meer MA, Esber GR, Cerri DH, Stalnaker TA, Schoenbaum G (2013) Risk-responsive orbitofrontal neurons signal acquired salience. *Neuron* 77(2): 251-8

18. van der Meer MA, Kurth-Nelson Z, Redish AD (2012) Information processing in decision-making systems. *The Neuroscientist* 18 (4): 342-359

17. Gupta AS, van der Meer MA, Touretzky DS, Redish AD (2012) Segmentation of spatial experience by hippocampal theta sequences. *Nature Neuroscience* 15: 1032-1039

16. Malhotra S, Cross RW, van der Meer MA (2012) Theta phase precession beyond the hippocampus. *Reviews in the Neurosciences* 23(1): 39-65

15. van der Meer MA, Redish AD (2011) Ventral striatum: a critical look at models of learning and evaluation. *Current Opinion in Neurobiology* 21(3): 387-92

14. van der Meer MA, Redish AD (2011) Theta phase precession in rat ventral striatum links place and reward information. *Journal of Neuroscience* 31(8): 2843-2854

13. van der Meer MA, Johnson A, Schmitzer-Torbert NC, Redish AD (2010) Triple dissociation of information processing in dorsal striatum, ventral striatum, and hippocampus on a learned spatial decision task. *Neuron* 67(1): 25-32

12. van der Meer MA, Kalenscher T, Lansink CS, Pennartz CMA, Berke JD, Redish AD (2010) Integrating early results on ventral striatal gamma oscillations in the rat. *Frontiers in Neuroscience* 15(4): 300

11. van der Meer MA, Redish AD (2010) Expectancies in decision making, reinforcement learning, and ventral striatum. *Frontiers in Neuroscience* 15(4): 6

10. Gupta AS, van der Meer MA, Touretzky DS, Redish AD (2010) Hippocampal replay is not a simple function of experience. *Neuron* 65(5): 695-705
*Spotlighted in a Preview by Derdikman and Moser, *Neuron* 65(5):582-584
*Evaluated "Must Read" on *Faculty of 1000*, www.f1000.com

9. van der Meer MA, Richmond Z, Braga RM, Wood ER, Dudchenko PA (2010) Evidence for the use of an internal sense of direction in homing. *Behavioral Neuroscience* 124(1): 164-169

8. Pennartz CMA, Berke JD, Graybiel AM, Ito R, Lansink CS, van der Meer MA, Redish AD, Smith K, Voorn P (2009) Corticostriatal interactions during learning, memory processing and decision-making. *Journal of Neuroscience* 29: 12831-12838

7. van der Meer MA, Redish AD (2009b) Low and high gamma oscillations in rat ventral striatum have distinct relationships to behavior, reward, and spiking activity on a learned spatial decision task. *Frontiers in Integrative Neuroscience* 3(9): doi:10.3389/neuro.07.009.2009
*Selected for *Focused Review* in *Frontiers in Neuroscience.*

6. van der Meer MA, Redish AD (2009a) Covert expectation-of-reward in rat ventral striatum at decision points. *Frontiers in Integrative Neuroscience* 3(1): doi:10.3389/neuro.07.001.2009.
*Selected for *Focused Review* in *Frontiers in Neuroscience*.

5. Johnson A, van der Meer MA, Redish AD (2008) Integrating hippocampus and striatum in decision-making. *Current Opinion in Neurobiology* 17(6): 692-7

4. van Rossum MC, van der Meer MA, Xiao D, Oram MW (2008) A model for adaptive integration in the visual cortex by depressing recurrent cortical circuits. *Neural Computation* 20(7): 1847-72

3. van der Meer MA, Knierim JJ, Doreswamy Y, Wood ER, van Rossum MC (2007) Anticipation in the rodent head direction cell system can be explained by an interaction of head movements and vestibular firing properties. *Journal of Neurophysiology* 98: 1883-97

2. Ainge JA, van der Meer MA, Langston RF, Wood ER (2007) Exploring the role of context-dependent hippocampal activity in spatial alternation behavior. *Hippocampus* 17(10): 988-1002

1. van der Meer MA, van Atteveldt WH, Coopmans PH, Philip WC (2001) Subject-Object asymmetry in Dutch children′s comprehension of wie-questions. *Linguistics in the Netherlands* 18(1): 167-176

Upcoming & recent conference abstracts

7. Chen H, Manning JR, van der Meer MA (2019) Between-subject prediction reveals a shared representational geometry in the rodent hippocampus. *CoSyNe* 2019.

6. Carmichael JE, Khokhar J, Green AI, van der Meer MA (2016) Unilateral naris occlusion suppresses gamma oscillations in ventral but not dorsal limbic structures in the rat. Society for Neuroscience Annual Meeting, San Diego, CA. Abstract # 543.16.

5. Gmaz J, Carmichael JE, van der Meer MA (2016) Neural coding for distinct sets of reward-predictive cues in the rat ventral striatum. Society for Neuroscience Annual Meeting, San Diego, CA. Abstract #543.05.

4. Irvine EM, van der Meer MA (2016) A novel shortcut task for analyzing hippocampal sequences. Society for Neuroscience Annual Meeting, San Diego, CA. Abstract #263.21

3. Tanaka Y, Carey AA, Ackermann E, Kemere C, Pezzulo G, van der Meer MA (2016) Towards a principled decoding of hippocampal replay. Society for Neuroscience Annual Meeting, San Diego, CA. Abstract #639.01

2. Ackermann E, Maboudi K, Diba K, Pezzulo G, van der Meer MA, Kemere C (2016) Scoring sequences of hippocampal activity using hidden Markov models. Society for Neuroscience Annual Meeting, San Diego, CA. Abstract #639.19

1. Dutta S, Wu C, Liu D, Karlsson M, Frank L, van der Meer MA, Ji D, Kemere C (2016) Low latency, multichannel sharp-wave ripple detection in a low cost, open source platform. Society for Neuroscience Annual Meeting, San Diego, CA. Abstract #639.22

Research Support

(current)

Whitehall Foundation	$225,000	2017-2020 (Sep)

(completed)

Team leader, HFSP Young Investigator Grant Collaboration with Dr. Caleb Kemere and Dr. Giovanni Pezzulo (**$350,000 allocated to each team member*)	$1,050,000*	2014-2018 (Oct)
Templeton Foundation Science of Prospection Award	$140,000	2014-2016
Ontario Early Researcher Award *(*Original award amount; returned because of move to USA)*	$150,000*	2014
Discovery Grant National Science and Engineering Research Council (NSERC)	$160,000	2012-2014
Canada Research Chair (Tier II, NSERC) *(*Used for salary support)*	$500,000*	2011-2014
Canada Foundation for Innovation (CFI) Leaders Opportunity Fund	$50,000	2011
Ontario Research Fund (ORF) Research Infrastructure	$50,000	2012
"VENI" Innovational Research Incentive, Netherlands Organisation for Scientific Research (NWO) ***(***Original award amount; reduced to ~€80,000 following move to Canada)***	€250,000*	2011-2014

Teaching

PSYC81, Animal Cognition Psychological & Brain Sciences, Dartmouth College	Winter 2018-present
PSYC50, The Rhythmic Brain Psychological & Brain Sciences, Dartmouth College (developed new course with hands-on learning using Emotiv EEG headsets)	Winter 2015-present

PSYC65, Systems Neuroscience with Lab — Fall 2015-present
Psychological & Brain Sciences, Dartmouth College

PSYC179, Analysis of Neural data — Winter 2016
Psychological & Brain Sciences, Dartmouth College

PSYC175, Current Issues in Behavioral Neuroscience — Fall 2016
Psychological & Brain Sciences, Dartmouth College

Co-organizer, Methods in Neuroscience at Dartmouh summer school — 2017-present
https://summer-mind.github.io/

Rodent hippocampus cycle, Neural Systems & Behavior Summer course — 2014-present
Marine Biological Laboratory, Woods Hole, MA
(faculty, with Drs. Rosamund Langston, Emma Wood, Juan-Marcos Alarcon)

BIOL 377, Systems Neuroscience: from neurons to behavior — Winter 2012-2014
Department of Biology, University of Waterloo
(developed new course, including interactive simulations and data exploration assignments)

BIOL 678, Current Topics in Neurophysiology — Fall 2011-present
Department of Biology, University of Waterloo (*co-taught with Dr. David Spafford)

BIOL 680/1, Data Analysis for Neuroscience — Fall 2013-present
Department of Biology, University of Waterloo
(developed new course with hands-on, wiki-based tutorials using lab data)

Course tutor — 2009-2010
Okinawa Computational Neuroscience Course, Okinawa Institute for Science and Technology, Japan (http://www.irp.oist.jp/ocnc/2010/)

Trainees mentored

Post-doctoral:

Julien Catanese, Post-doctoral fellow — 2012-2014
**FYSSEN foundation fellowship award (France)*

Graduate:

Hung-Tu Chen (PhD) — 2018-present

Emily Irvine (PhD) — 2015-present

Eric Carmichael (PhD) — 2013-present

Jimmie Gmaz (PhD) — 2013-present
**NSERC Canada Graduate Scholarship (CGS-D) award recipient*

Youki Tanaka (MSc) — 2015-present

Alyssa Carey, Biology, University of Waterloo (MSc) — 2013-2015

Rob Cross, Biology, University of Waterloo (MSc) 2011-2013

Sushant Malhotra, Systems Design Engineering, Waterloo (MASc) 2011-2013
**NSERC (CGS-M & CGS-D) award recipient*

Yan Wu, Systems Design Engineering, Waterloo (MSc; joint w/C. Eliasmith) 2010-2012

Undergraduate:

2 Senior thesis students 2016-present

at Waterloo:

7 full-time/single-term research assistants (NSERC USRA awards) 2011-2014

11 Honours thesis students (BIOL 499) 2011-2014

Invited talks, workshops (2012-present)

38. Quantitative Life Sciences seminar series, McGill University 2019
37. Department of Neuroscience, University of Florida 2018
36. CoSyNe workshop, "Model-based cognition: Hierarchical reasoning and sequential planning" 2018
35. Winter Conference on Learning & Memory, Park City, UT 2018
34. Department of Neuroscience, Brown University 2017
33. Department of Psychology, University of Vermont 2017
32. Department of Psychology seminar series, Cornell University 2017
31. Spring Hippocampal Research Conference, Taormina, Italy 2017
30. Division of Neuroscience seminar, University of Dundee, UK 2017
29. Winter Conference on Brain Research (WCBR), Big Sky, Montana (panel co-chair) 2017
28. Donders Institute for Brain, Cognition, and Behavior, Nijmegen, Netherlands 2016
27. Université Pierre et Marie Curie, Paris, France 2016
26. Department of Psychology seminar series, Harvard University 2016
25. 1st Interdisciplinary Navigation Symposium, Bad Gastein, Austria 2016
24. International Neuropsychological Symposium (INS), Baiona, Spain 2016
23. Current Works in Behavior, Genetics, and Neuroscience seminar series, Yale Univ. 2016
22. SUNY Downstate Medical Center seminar series 2016
21. Department of Psychology seminar series, University of Michigan 2015
20. "Memory in action: The role(s) of the hippocampus in decisions for reward," workshop, *CoSyNe* 2015 2015
19. Institut for Theoretische Biologie (ITB) and BCCN, Berlin, Germany 2014
18. Vespucci Institute "Brain and Space" meeting, Lisbon, Portugal 2014
17. Canadian Association for Neuroscience Annual Meeting, Montreal 2014
16. School of Informatics, Edinburgh, UK 2014
15. Psychological and Brain Sciences seminar series, Dartmouth College, NH 2013
14. Psychology & Neuroscience Seminar, Dalhousie University, Halifax, NS 2013
13. Neuroscience and Applied Cognitive Science seminar series, University of Guelph 2013
12. Donders Institute for Brain, Cognition, and Behavior, Nijmegen, Netherlands 2013
11. Neuroscience seminar series, Technion, Haifa, Israel 2013
10. Southern Ontario Neuroscience Association (SONA) annual meeting, Waterloo, ON 2013

9.	Spring Hippocampal Research Conference, Taormina, Italy	2013
8.	Department of Psychology seminar series, McMaster University, Hamilton, ON	2013
7.	FieldTrip workshop, York University, Toronto, ON	2013
6.	Participant, Cognitive Neuroscience workshop, Mathematical Biosciences Institute, Columbus, OH	2012
5.	Douglas Institute for Mental Health, Montréal, QC	2012
4.	Rotman Research Institute/Baycrest Hospital Rounds, Toronto, ON	2012
3.	INCF Canadian Neuroinformatics Workshop, Vancouver, BC	2012
2.	Swammerdam Institute for Life Sciences, University of Amsterdam, Netherlands	2012
1.	Brain and Behaviour Seminar Series, University of Toronto, ON	2012

Service (external)

Panel member, National Science Foundation 2016

Evaluation Committee member, Agence Nationale de Recherche, France 2015-2016

Associate Editor, Circuits/Systems section, *Journal of Neuroscience* 2014-current

Ad hoc manuscript reviewer for *Journal of Neurophysiology, Nature Neuroscience, Frontiers in Neuroscience, Neuron, Behavioral Brain Research, Hippocampus, Neuropharmacology, Biological Psychiatry, Neuroscience, Cerebral Cortex, NeuroSignals, Behavioral Processes, Nature, Journal of Visualized Experiments (JoVE), Journal of Neuroscience, PNAS, Biological Cybernetics, eLife, Neurobiology of Aging, PLoS Computational Biology, Child Development, Behavioral Neuroscience, European Journal of Neuroscience, Philosophical Transactions of the Royal Society B, Journal of Experimental Psychology: Learning, Memory and Cognition, Adaptive Behavior, Current Opinion in Neurobiology*

Ad hoc grant application reviewer for *Natural Sciences and Engineering Research Council (NSERC, Canada), Agence Nationale de Recherche (ANR, France), Wellcome Trust (UK), Netherlands Organisation for Scientific Research (NWO), Human Frontiers Science Project*

External examiner for PhD theses: Department of Psychology, McMaster University (2012); Department of Computer Science, Dalhousie University (2013); Institut for Theoretische Biologie, Humboldt Universitat Berlin, Germany (2014); Department of Psychology, University of Waterloo (2018)