

Curriculum Vitae

Ryan Smith, Ph.D.

Research Associate Professor

Laureate Institute for Brain Research

Contact Information

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Research Interests/Goals

I am interested in the neural, cognitive, and computational basis of interactions between **interoception**, **emotion**, and **decision-making**. One line of my research aims to understand how individuals perceive internal signals from their body, such as respiration and heartbeat perception, and how this may be altered in individuals with affective and substance use disorders. A complementary line of my research aims to understand how interoceptive/emotional states influence **prospective planning**, **information-seeking**, and underlying neurocomputational mechanisms. Using a range of **cognitive computational models** (e.g., Bayesian models of perception, reinforcement learning and active inference models of decision-making, sequential sampling models of reaction times) and **neural measures** (fMRI, EEG, ECG, pupillometry), this second line of research characterizes how emotions influence proximal vs. distal planning processes and the trade-off between exploration and exploitation. By investigating how these mechanisms may be affected within clinical populations (transdiagnostically), I further utilize these approaches to identify underlying sources of maladaptive behavior—with the hope of identifying clinically useful predictors and novel treatment targets.

Education

2012 – 2015, University of Arizona, Tucson, AZ

Major: Psychology (Cognition & Neural Systems Program)

Minor: Philosophy

Degree: PhD

Advisor: Richard Lane

Dissertation title: Disambiguating the roles of select medial prefrontal subregions in conscious and unconscious emotional processing

2014 – 2015 University of Arizona Tucson, AZ

Major: Philosophy

Degree: MA

Advisor: Jenann Ismael

2010 – 2012, University of Arizona, Tucson, AZ

Major: Neuroscience

Degree: MS

Advisor: Richard Lane

Thesis title: Antidepressant effects of sertraline associated with volume increases in dorsolateral prefrontal cortex

2007 – 2010, Arizona State University , Phoenix, AZ

Major: Psychology

Degree: BS, Summa Cum Laude

Employment

2022 – Present, University of Tulsa, Tulsa, OK

Research Associate Professor

2022 – Present, Laureate Institute for Brain Research, Tulsa, OK

Principal Investigator

2019 – 2021, Laureate Institute for Brain Research, Tulsa, OK

Associate Investigator

2018 – 2019, University College London, London, UK

Visiting Fellow

Lab of Dr. Karl Friston

2016 – 2018, Pima Community College, Tucson, AZ
Adjunct Teaching Faculty

2015 – 2018, University of Arizona, Tucson, AZ
College of Medicine, Department of Psychiatry
Postdoctoral Fellow
Lab of Dr. W.D. “Scott” Killgore

2012 – 2015, University of Arizona, Tucson, AZ
Psychology Graduate Program
Graduate Research/Teaching Assistant

2010 – 2012, University of Arizona, Tucson, AZ
Neurosciences Graduate Program
Graduate Research Assistant

2009 – 2010, Barrow Neurological Institute, Phoenix, AZ
Neuropsychology/ Neuroimaging Lab
Researcher Assistant
Lab of Dr. Leslie Baxter

2007 – 2008, Barrow Neurological Institute, Phoenix, AZ
Neuro-Oncology Lab
Researcher Assistant
Lab of Dr. Adrienne Scheck

Publications¹⁻¹⁵¹

Citations: 8,318

h-index (Google Scholar): 48

i10-index: 116

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1. **Smith R**, Smith KA, Biggs CA, Scheck AC. In vitro biological dosimeter modeling of the glioblastoma response to radiation delivered by the Gamma Knife. Laboratory investigation. *J Neurosurg.* 2010;113 Suppl:222-7. Epub 2010/12/09. doi: 10.3171/2010.8.GKS10716. PubMed PMID: 21121805.
2. **Smith R**, Fadok RA, Purcell M, Liu S, Stonnington C, Spetzler RF, Baxter LC. Localizing sadness activation within the subgenual cingulate in individuals: a novel functional MRI paradigm for detecting individual differences in the neural circuitry underlying depression. *Brain Imaging Behav.* 2011;5(3):229-39. Epub 2011/07/02. doi: 10.1007/s11682-011-9127-2. PubMed PMID: 21720734.
3. Lane RD, Weidenbacher H, **Smith R**, Fort C, Thayer JF, Allen JJ. Subgenual anterior cingulate cortex activity covariation with cardiac vagal control is altered in depression. *Journal of affective disorders.* 2013;150(2):565-70. Epub 2013/03/12. doi: 10.1016/j.jad.2013.02.005. PubMed PMID: 23473547.
4. **Smith R**, Chen K, Baxter L, Fort C, Lane RD. Antidepressant effects of sertraline associated with volume increases in dorsolateral prefrontal cortex. *Journal of affective disorders.* 2013;146(3):414-9. Epub 2012/09/29. doi: 10.1016/j.jad.2012.07.029. PubMed PMID: 23017544.
5. **Smith R**. Explanation, understanding, and control. *Synthese.* 2014;191(17):4169-200. doi: 10.1007/s11229-014-0521-3.
6. **Smith R**. Do Brains Have an Arrow of Time? *Philosophy of Science.* 2014;81(2):265-75. doi: 10.1086/675644.
7. **Smith R**, Allen JJ, Thayer JF, Fort C, Lane RD. Increased association over time between regional frontal lobe BOLD change magnitude and cardiac vagal control with sertraline treatment for major depression. *Psychiatry Res.* 2014;224(3):225-33. Epub 2014/10/06. doi: 10.1016/j.psychres.2014.08.015. PubMed PMID: 25282511.
8. **Smith R**, Fass H, Lane RD. Role of medial prefrontal cortex in representing one's own subjective emotional responses: a preliminary study. *Conscious Cogn.* 2014;29:117-30. Epub 2014/10/06. doi: 10.1016/j.concog.2014.08.002. PubMed PMID: 25282525.
9. Lane RD, Weihs KL, Herring A, Hishaw A, **Smith R**. Affective agnosia: Expansion of the alexithymia construct and a new opportunity to integrate and extend Freud's legacy. *Neurosci Biobehav Rev.* 2015;55:594-611. Epub 2015/06/10. doi: 10.1016/j.neubiorev.2015.06.007. PubMed PMID: 26054794.
10. **Smith R**, Allen JJ, Thayer JF, Lane RD. Altered functional connectivity between medial prefrontal cortex and the inferior brainstem in major depression during appraisal of subjective emotional responses: A preliminary study. *Biol Psychol.* 2015;108:13-24. Epub 2015/03/22. doi: 10.1016/j.biopsycho.2015.03.007. PubMed PMID: 25795386.
11. **Smith R**, Braden BB, Chen K, Ponce FA, Lane RD, Baxter LC. The neural basis of attaining conscious awareness of sad mood. *Brain Imaging Behav.* 2015;9(3):574-87. Epub 2014/09/23. doi: 10.1007/s11682-014-9318-8. PubMed PMID: 25234799.
12. **Smith R**, Lane RD. The neural basis of one's own conscious and unconscious emotional states. *Neurosci Biobehav Rev.* 2015;57:1-29. Epub 2015/09/14. doi: 10.1016/j.neubiorev.2015.08.003. PubMed PMID: 26363579.
13. Alkozei A, **Smith R**, Killgore WD. Exposure to blue wavelength light modulates anterior cingulate cortex activation in response to 'uncertain' versus 'certain' anticipation of positive stimuli. *Neurosci Lett.* 2016;616:5-10. Epub 2016/01/26. doi: 10.1016/j.neulet.2016.01.034. PubMed PMID: 26806862.
14. Alkozei A, **Smith R**, Pisner DA, Vanuk JR, Berryhill SM, Fridman A, Shane BR, Knight SA, Killgore WD. Exposure to Blue Light Increases Subsequent Functional Activation of the Prefrontal Cortex During Performance of a Working Memory Task. *Sleep.* 2016;39(9):1671-

80. Epub 2016/06/03. doi: 10.5665/sleep.6090. PubMed PMID: 27253770; PMCID: PMC4989256.
15. Braden BB, Pipe TB, **Smith R**, Glaspy TK, Deatherage BR, Baxter LC. Brain and behavior changes associated with an abbreviated 4-week mindfulness-based stress reduction course in back pain patients. *Brain Behav.* 2016;6(3):e00443. Epub 2016/03/01. doi: 10.1002/brb3.443. PubMed PMID: 26925304; PMCID: PMC4754498.
16. **Smith R**. The relationship between consciousness, understanding, and rationality. *Philosophical Psychology.* 2016;29(7):943-57. doi: 10.1080/09515089.2016.1172700.
17. **Smith R**, Alkozei A, Lane RD, Killgore WDS. Unwanted reminders: The effects of emotional memory suppression on subsequent neuro-cognitive processing. *Conscious Cogn.* 2016;44:103-13. Epub 2016/07/31. doi: 10.1016/j.concog.2016.07.008. PubMed PMID: 27474869.
18. **Smith R**, Allen JJB, Thayer JF, Lane RD. Regional Frontal Lobe Response Magnitudes During Affective Shifting Covary With Resting Heart Rate Variability in Healthy Volunteers. *Journal of Psychophysiology.* 2016;30(4):165-74. doi: 10.1027/0269-8803/a000166.
19. **Smith R**, Baxter LC, Thayer JF, Lane RD. Disentangling introspective and exteroceptive attentional control from emotional appraisal in depression using fMRI: A preliminary study. *Psychiatry Res Neuroimaging.* 2016;248:39-47. Epub 2016/01/26. doi: 10.1016/j.psychres.2016.01.009. PubMed PMID: 26805672.
20. **Smith R**, Lane RD. Unconscious emotion: A cognitive neuroscientific perspective. *Neurosci Biobehav Rev.* 2016;69:216-38. Epub 2016/08/16. doi: 10.1016/j.neubiorev.2016.08.013. PubMed PMID: 27522011.
21. Alkozei A, Killgore WDS, **Smith R**, Dailey NS, Bajaj S, Haack M. Chronic Sleep Restriction Increases Negative Implicit Attitudes Toward Arab Muslims. *Sci Rep.* 2017;7(1):4285. Epub 2017/06/29. doi: 10.1038/s41598-017-04585-w. PubMed PMID: 28655901; PMCID: PMC5487318.
22. Alkozei A, **Smith R**, Dailey NS, Bajaj S, Killgore WDS. Acute exposure to blue wavelength light during memory consolidation improves verbal memory performance. *PLoS One.* 2017;12(9):e0184884. Epub 2017/09/19. doi: 10.1371/journal.pone.0184884. PubMed PMID: 28922397; PMCID: PMC5602660.
23. Alkozei A, **Smith R**, Killgore W. Grateful people are happy and healthy - but why? *Frontiers for Young Minds.* 2017;5:55.
24. Alkozei A, **Smith R**, Killgore WDS. Gratitude and Subjective Wellbeing: A Proposal of Two Causal Frameworks. *Journal of Happiness Studies.* 2017;19(5):1519-42. doi: 10.1007/s10902-017-9870-1.
25. Bajaj S, Vanuk JR, **Smith R**, Dailey NS, Killgore WDS. Blue-Light Therapy following Mild Traumatic Brain Injury: Effects on White Matter Water Diffusion in the Brain. *Front Neurol.* 2017;8:616. Epub 2017/12/08. doi: 10.3389/fneur.2017.00616. PubMed PMID: 29213254; PMCID: PMC5702646.
26. Killgore WDS, **Smith R**, Olson EA, Weber M, Rauch SL, Nickerson LD. Emotional intelligence is associated with connectivity within and between resting state networks. *Soc Cogn Affect Neurosci.* 2017;12(10):1624-36. Epub 2017/10/06. doi: 10.1093/scan/nsx088. PubMed PMID: 28981827; PMCID: PMC5737574.
27. Panksepp J, Lane RD, Solms M, **Smith R**. Reconciling cognitive and affective neuroscience perspectives on the brain basis of emotional experience. *Neurosci Biobehav Rev.* 2017;76(Pt B):187-215. Epub 2016/09/20. doi: 10.1016/j.neubiorev.2016.09.010. PubMed PMID: 27640756.
28. Pisner DA, **Smith R**, Alkozei A, Klimova A, Killgore WD. Highways of the emotional intellect: white matter microstructural correlates of an ability-based measure of emotional

- intelligence. *Soc Neurosci*. 2017;12(3):253-67. Epub 2016/04/14. doi: 10.1080/17470919.2016.1176600. PubMed PMID: 27072165.
29. **Smith R**. A neuro-cognitive defense of the unified self. *Conscious Cogn*. 2017;48:21-39. Epub 2016/11/05. doi: 10.1016/j.concog.2016.10.007. PubMed PMID: 27810727.
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31. **Smith R**, Alkozei A, Killgore WDS. How Do Emotions Work? *Frontiers for Young Minds*. 2017;5. doi: 10.3389/frym.2017.00069.
32. **Smith R**, Alkozei A, Killgore WDS. Contributions of self-report and performance-based individual differences measures of social cognitive ability to large-scale neural network functioning. *Brain Imaging Behav*. 2017;11(3):685-97. Epub 2016/03/24. doi: 10.1007/s11682-016-9545-2. PubMed PMID: 27007121.
33. **Smith R**, Lane RD, Alkozei A, Bao J, Smith C, Sanova A, Nettles M, Killgore WDS. Maintaining the feelings of others in working memory is associated with activation of the left anterior insula and left frontal-parietal control network. *Soc Cogn Affect Neurosci*. 2017;12(5):848-60. Epub 2017/02/06. doi: 10.1093/scan/nsx011. PubMed PMID: 28158779; PMCID: PMC5460045.
34. **Smith R**, Thayer JF, Khalsa SS, Lane RD. The hierarchical basis of neurovisceral integration. *Neurosci Biobehav Rev*. 2017;75:274-96. Epub 2017/02/12. doi: 10.1016/j.neubiorev.2017.02.003. PubMed PMID: 28188890.
35. Wright R, Riedel R, Sechrest L, Lane RD, **Smith R**. Sex differences in emotion recognition ability: The mediating role of trait emotional awareness. *Motivation and Emotion*. 2017;42(1):149-60. doi: 10.1007/s11031-017-9648-0.
36. Alkozei A, Haack M, Skalamera J, **Smith R**, Satterfield BC, Raikes AC, Killgore WD. Chronic sleep restriction affects the association between implicit bias and explicit social decision making. *Sleep Health*. 2018;4(5):456-62. Epub 2018/09/23. doi: 10.1016/j.sleh.2018.07.003. PubMed PMID: 30241661.
37. Alkozei A, Killgore WDS, **Smith R**, Dailey NS, Bajaj S, Raikes AC, Haack M. Chronic sleep restriction differentially affects implicit biases toward food among men and women: preliminary evidence. *J Sleep Res*. 2018;27(4):e12629. Epub 2017/11/03. doi: 10.1111/jsr.12629. PubMed PMID: 29094414.
38. Alkozei A, **Smith R**, Killgore WDS. Implicit self-esteem is associated with higher levels of trait gratitude in women but not men. *The Journal of Positive Psychology*. 2018;14(5):587-92. doi: 10.1080/17439760.2018.1497691.
39. Bajaj S, Raikes A, **Smith R**, Dailey NS, Alkozei A, Vanuk JR, Killgore WDS. The Relationship Between General Intelligence and Cortical Structure in Healthy Individuals. *Neuroscience*. 2018;388:36-44. Epub 2018/07/18. doi: 10.1016/j.neuroscience.2018.07.008. PubMed PMID: 30012372.
40. Dailey NS, **Smith R**, Bajaj S, Alkozei A, Gottschlich MK, Raikes AC, Satterfield BC, Killgore WDS. Elevated Aggression and Reduced White Matter Integrity in Mild Traumatic Brain Injury: A DTI Study. *Front Behav Neurosci*. 2018;12:118. Epub 2018/07/18. doi: 10.3389/fnbeh.2018.00118. PubMed PMID: 30013466; PMCID: PMC6036267.
41. Dailey NS, **Smith R**, Vanuk JR, Raikes AC, Killgore WDS. Resting-state functional connectivity as a biomarker of aggression in mild traumatic brain injury. *Neuroreport*. 2018;29(16):1413-7. Epub 2018/09/12. doi: 10.1097/WNR.0000000000001127. PubMed PMID: 30204638.
42. Lane RD, Anderson FS, **Smith R**. Biased competition favoring physical over emotional pain: A possible explanation for the link between early adversity and chronic pain. *Psychosom Med*. 2018;80:880-90.

43. Raikes AC, Bajaj S, Dailey NS, **Smith RS**, Alkozei A, Satterfield BC, Killgore WDS. Diffusion Tensor Imaging (DTI) Correlates of Self-Reported Sleep Quality and Depression Following Mild Traumatic Brain Injury. *Front Neurol.* 2018;9:468. Epub 2018/07/06. doi: 10.3389/fneur.2018.00468. PubMed PMID: 29973910; PMCID: PMC6019466.
44. **Smith R**, Alkozei A, Bao J, Killgore WDS. Successful Goal-Directed Memory Suppression is Associated With Increased Inter-Hemispheric Coordination Between Right and Left Frontoparietal Control Networks. *Psychol Rep.* 2018;121(1):93-111. Epub 2017/08/02. doi: 10.1177/0033294117723018. PubMed PMID: 28762879.
45. **Smith R**, Alkozei A, Killgore WDS. Conflict-related dorsomedial frontal cortex activation during healthy food decisions is associated with increased cravings for high-fat foods. *Brain Imaging Behav.* 2018;12(3):685-96. Epub 2017/04/30. doi: 10.1007/s11682-017-9726-7. PubMed PMID: 28451921.
46. **Smith R**, Alkozei A, Killgore WDS, Lane RD. Nested positive feedback loops in the maintenance of major depression: An integration and extension of previous models. *Brain Behav Immun.* 2018;67:374-97. Epub 2017/09/26. doi: 10.1016/j.bbi.2017.09.011. PubMed PMID: 28943294.
47. **Smith R**, Bajaj S, Dailey NS, Alkozei A, Smith C, Sanova A, Lane RD, Killgore WDS. Greater cortical thickness within the limbic visceromotor network predicts higher levels of trait emotional awareness. *Conscious Cogn.* 2018;57:54-61. Epub 2017/11/24. doi: 10.1016/j.concog.2017.11.004. PubMed PMID: 29169034.
48. **Smith R**, Killgore WDS, Alkozei A, Lane RD. A neuro-cognitive process model of emotional intelligence. *Biol Psychol.* 2018;139:131-51. Epub 2018/11/06. doi: 10.1016/j.biopsycho.2018.10.012. PubMed PMID: 30392827.
49. **Smith R**, Killgore WDS, Lane RD. The structure of emotional experience and its relation to trait emotional awareness: A theoretical review. *Emotion.* 2018;18(5):670-92. Epub 2017/11/28. doi: 10.1037/emo0000376. PubMed PMID: 29172623.
50. **Smith R**, Lane RD, Alkozei A, Bao J, Smith C, Sanova A, Nettles M, Killgore WDS. The role of medial prefrontal cortex in the working memory maintenance of one's own emotional responses. *Sci Rep.* 2018;8(1):3460. Epub 2018/02/24. doi: 10.1038/s41598-018-21896-8. PubMed PMID: 29472625; PMCID: PMC5823866.
51. **Smith R**, Lane RD, Sanova A, Alkozei A, Smith C, Killgore WDS. Common and Unique Neural Systems Underlying the Working Memory Maintenance of Emotional vs. Bodily Reactions to Affective Stimuli: The Moderating Role of Trait Emotional Awareness. *Front Hum Neurosci.* 2018;12:370. Epub 2018/10/04. doi: 10.3389/fnhum.2018.00370. PubMed PMID: 30279652; PMCID: PMC6153922.
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53. Alkozei A, **Smith R**, Demers LA, Weber M, Berryhill SM, Killgore WDS. Increases in Emotional Intelligence After an Online Training Program Are Associated With Better Decision-Making on the Iowa Gambling Task. *Psychol Rep.* 2019;122(3):853-79. Epub 2018/04/28. doi: 10.1177/0033294118771705. PubMed PMID: 29699472.
54. Alkozei A, **Smith R**, Kotzin MD, Waugaman DL, Killgore WDS. The Association Between Trait Gratitude and Self-Reported Sleep Quality Is Mediated by Depressive Mood State. *Behav Sleep Med.* 2019;17(1):41-8. Epub 2017/01/28. doi: 10.1080/15402002.2016.1276017. PubMed PMID: 28128978.
55. Bajaj S, Raikes AC, **Smith R**, Vanuk JR, Killgore WDS. The Role of Prefrontal Cortical Surface Area and Volume in Preclinical Suicidal Ideation in a Non-Clinical Sample. *Front*

- Psychiatry. 2019;10:445. Epub 2019/07/18. doi: 10.3389/fpsy.2019.00445. PubMed PMID: 31312146; PMCID: PMC6613495.
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58. **Smith R**, Kaszniak AW, Katsanis J, Lane RD, Nielsen L. The importance of identifying underlying process abnormalities in alexithymia: Implications of the three-process model and a single case study illustration. *Conscious Cogn.* 2019;68:33-46. Epub 2019/01/04. doi: 10.1016/j.concog.2018.12.004. PubMed PMID: 30605861.
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62. **Smith R**, Weihs KL, Alkozei A, Killgore WDS, Lane RD. An Embodied Neurocomputational Framework for Organically Integrating Biopsychosocial Processes: An Application to the Role of Social Support in Health and Disease. *Psychosomatic Medicine.* 2019;81(2):125-45. Epub 2018/12/07. doi: 10.1097/PSY.0000000000000661. PubMed PMID: 30520766.
63. **Smith R**, Khalsa SS, Paulus MP. An Active Inference Approach to Dissecting Reasons for Nonadherence to Antidepressants. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging.* 2021;6(9):919-34. Epub 2020/02/12. doi: 10.1016/j.bpsc.2019.11.012. PubMed PMID: 32044234; PMCID: PMC7272309.
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65. Alkozei A, **Smith R**, Waugaman D, Kotzin M, Bajaj S, Killgore WDS. The mediating role of interpretation bias on the relationship between trait gratitude and depressive symptoms. *International Journal of Applied Positive Psychology* 2020.
66. Lane RD, **Smith R**, Nadel L. Neuroscience of Enduring Change and Psychotherapy. In: Lane RD, Nadel L, editors. *Neuroscience of Enduring Change: Implications for Psychotherapy*: Oxford University Press; 2020.
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68. **Smith R**. Subjective Experience and Its Neural Basis. In: Zeise M, editor. *Neuroscience for Psychologists*. 1 ed: Cham: Springer; 2021. p. 253-84.

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70. **Smith R**, Schwartenbeck P, Stewart JL, Kuplicki R, Ekhtiari H, Investigators T, Paulus MP. Imprecise Action Selection in Substance Use Disorder: Evidence for Active Learning Impairments When Solving the Explore-exploit Dilemma. *Drug and Alcohol Dependence*. 2020;215:108208.
71. **Smith R**, Steklis HD, Steklis NG, Weihs KL, Lane RD. The evolution and development of the uniquely human capacity for emotional awareness: A synthesis of comparative anatomical, cognitive, neurocomputational, and evolutionary psychological perspectives. *Biological Psychology*. 2020;154:107925. Epub 2020/07/02. doi: 10.1016/j.biopsycho.2020.107925. PubMed PMID: 32610156.
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73. **Smith R**, Kuplicki R, Teed A, Upshaw V, Khalsa SS. Confirmatory Evidence that Healthy Individuals Can Adaptively Adjust Prior Expectations and Interoceptive Precision Estimates. In: Verbelen T, Lanillos P, Buckley C, De Boom C, editors. *Active Inference*: Springer, Cham.; 2020. p. 156-64.
74. Hesp C, **Smith R**, Parr T, Allen M, Friston KJ, Ramstead MJD. Deeply felt affect: the emergence of valence in deep active inference. *Neural Comput*. 2021;33(2):398-446. Epub 2020/12/01. doi: 10.1162/neco_a_01341. PubMed PMID: 33253028.
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77. **Smith R**, Lane RD. Thinking through others' emotions: Incorporating the role of emotional state inference in thinking through other minds. *Behavioral and Brain Sciences*. 2020;43:e114. Epub 2020/05/29. doi: 10.1017/S0140525X19002644. PubMed PMID: 32460920.
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79. **Smith R**, Kuplicki R, Feinstein J, Forthman KL, Stewart JL, Paulus MP, Tulsa i, Khalsa SS. A Bayesian computational model reveals a failure to adapt interoceptive precision estimates across depression, anxiety, eating, and substance use disorders. *PLoS Computational Biology*. 2020;16(12):e1008484. Epub 2020/12/15. doi: 10.1371/journal.pcbi.1008484. PubMed PMID: 33315893; PMCID: PMC7769623.
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Invited Scholarly Talks

National

1. October 24, 2013. **A Primer on the Brain, Emotion, and Emotional Disorders**. Arizona Center for Psychoanalytic Studies.
2. March 30, 2016. **Nested Positive Feedback Loops in Major Depression: An integration and extension of previous models**. Grand Rounds Talk, Department of Psychiatry, University of Arizona.
3. September 15-16, 2017. **Implicit and Explicit Emotion**. Conference Talk at: Neuroscience of Enduring Change: Applications to Psychotherapy, University of Arizona.
4. July 23, 2018. **The neural basis of Hierarchical Emotion Processing and Emotional Awareness: Clinical Relevance and opportunities for computational modeling**. Talk at: Laureate Institute for Brain Research.

5. November 11, 2019. **The neural basis of Hierarchical Emotion Processing and Emotional Awareness: Clinical Relevance and opportunities for computational modeling.** Principles of Neuroscience Course. University of Tulsa.
6. December 2, 2019. **An introduction to the active inference approach to computational modeling.** Brownbag lecture. Laureate Institute for Brain Research.
7. Friday April 30, 2021. **Reduced Action Precision and Biased Learning in Substance Users When Solving the Explore-Exploit Dilemma: An Active Inference Modelling Approach.** Society for Biological Psychiatry – Annual Conference. Virtual Meeting.
8. Friday Sep 17, 2021. **An introduction to computational psychiatry.** Symposium talk. American Psychosomatic Society – Annual Meeting. Webinar Series.
9. Saturday Sep 25, 2021. **Individuals with Depression, Anxiety, Eating, and Substance Use Disorders Show a Failure to Update Beliefs about the Precision of Interoceptive signals: A Bayesian Computational Modelling Study.** Symposium talk. Society for Research in Psychopathology – Annual Meeting. Virtual Meeting
10. Thursday, November 4, 2021. **Active Inference and its Application to Empirical Data.** MAPs (Methods and Primers for Computational Psychiatry and Neuroeconomics) Lecture Series. Yale University.
11. Saturday, March 19, 2022. **Lower Levels of Directed Exploration and Reflective Thinking Are Associated with Greater Anxiety and Depression.** ADAA annual meeting. Denver, CO.
12. Sunday, March 20, 2022. **Computational Measures of Cardiac Interoception in Depression and Anxiety and Their Relationship to Symptom Change over Time.** ADAA annual meeting. Denver, CO.
13. Thursday, October 20, 2022. **Testing the effects of specific psychotherapeutic interventions on computational phenotypes.** Computational Psychotherapy Meeting. Princeton University, New Jersey.
14. Wednesday, April 12, 2023. **Active Learning Impairments in Substance Use Disorders when Solving the Explore-Exploit Dilemma: Longitudinal Stability, Symptom Prediction, and Replication.** Rutgers-Princeton Center for Computational Cognitive Neuropsychiatry (CCNP).
15. Thursday October 12, 2023. **A step-by-step tutorial on active inference and its application to empirical data (full day tutorial workshop).** Invited Talk, Dartmouth University, Hanover, New Hampshire.
16. Friday October 13, 2023. **Novel approaches for understanding the neurocomputational basis of interoception and emotion-cognition interactions.** Invited Talk, Dartmouth University, Hanover, New Hampshire
17. Saturday, April 13, 2024. **Breath-Holding Modulates Computational Mechanisms of Interoception in Healthy but Not Transdiagnostic Patient Samples.** ADAA annual meeting. Boston, MA.
18. Wednesday, July 17, 2024. **Symposium Chair: Computational mechanisms of anxiety: transdiagnostic effects on interoception, planning, and avoidance.** Computational Psychiatry Conference. University of Minnesota, Minneapolis, Minnesota.
19. Wednesday, July 17, 2024. **Anxiety induction amplifies aversive pruning during multi-step planning in individuals with anxious depression.** Computational Psychiatry Conference. University of Minnesota, Minneapolis, Minnesota.
20. Thursday June 29, 2025. **Applied modeling as a resource for addressing underdetermination problems in mathematical models of consciousness.** Natural Philosophy Symposium 2025, Johns Hopkins University, Baltimore, Maryland.
21. Friday November 21, 2025. **Novel approaches for understanding the neurocomputational basis of interoception and emotion-cognition interactions.**

Icahn School of Medicine at Mount Sinai and Center for Computational Psychiatry (CCP) Speaker Series.

22. Tuesday March 17, 2026. **Computational Psychiatry Approaches for Modeling Affect, Decision Making, and Neural Responses.** Softmax Organic Alignment Meeting. San Francisco, CA

International

23. October 15, 2018. **Modeling emotional awareness as hierarchical active inference.** Talk at: Functional Imaging Laboratory, University College London, England.
24. December 14, 2018. **Modeling emotional awareness as hierarchical active inference.** Talk at: University of Sussex, England.
25. January 7, 2019. **Modeling emotional awareness as hierarchical active inference.** Talk at: University of Stirling, Scotland.
26. January 14, 2019. **Modeling emotional awareness as hierarchical active inference.** Talk at: Max Planck center, University College London, England.
27. March 6, 2019. **Neurocognitive approaches in studying Emotion and Decision-making: Cognitive and computational measures.** Talk at: American psychosomatic Society conference, Vancouver, Canada.
28. March 8, 2019. **An embodied neurocomputational framework for organically integrating biopsychosocial processes.** Talk at: American psychosomatic Society conference, Vancouver, Canada.
29. March 8, 2019. **Computational Neuroscience Roundtable speaker.** American psychosomatic Society conference, Vancouver, Canada.
30. November 4, 2019. **Emotion-Cognition Interactions as Deep Active Inference.** Social-Cultural, and Computational Neuroscience and Psychiatry Network Conference, Montreal, Canada.
31. November 5, 2019. **Modeling behavior in empirical studies with the Markov decision process formulation of active inference.** Social-Cultural, and Computational Neuroscience and Psychiatry Network Conference, Montreal, Canada.
32. Friday Jan 17, 2020. **Emotion-Cognition Interactions as Deep Active Inference.** University of Waterloo. Series of Artificial Intelligence (AI) colloquium. Waterloo, Canada.
33. March 26, 2020. **Investigating active inference approaches to modeling the neural basis of auditory hallucinations.** Theoretical Neurobiology Meeting. University College London, England.
34. Monday Sep 14, 2020. **Confirmatory evidence that healthy individuals can adaptively adjust prior expectations and interoceptive precision estimates.** 1st International Workshop on Active Inference (IWAI), ECML/PKDD conference 2020. Ghent, Belgium
35. Friday Sep 3, 2021. **Gut inference: a computational modeling approach.** Nested Minds Network Ltd. Liverpool, England.
36. Wednesday Sep 15, 2021. **An introduction to active inference.** Computational Psychiatry Course. Zurich, Switzerland.
37. Thursday Jan 13, 2022. **Active Learning Impairments in Substance Use Disorders when Solving the Explore-Exploit Dilemma: Longitudinal Stability and Symptom Prediction.** Transcontinental Computational Psychiatry Workgroup.
38. Thursday Feb 17, 2022. **An Active Inference Model Reveals that individuals with Substance Use Disorder Have Consistently Reduced Learning Rates in Response to**

- Negative Outcomes Over a 1-Year Period.** Conference: The Free Energy Principle: Science, Tech and Philosophy. Humboldt University of Berlin, School of Mind and Brain.
39. Thursday June 30, 2022. **An Active Inference Model of Emotional Awareness.** Porto Affective Neuroscience Seminars 2022, Portugal.
 40. Wednesday July 6, 2022. **Modeling gastrointestinal interoception as Bayesian inference: Individual differences and their neural correlates.** Psychiatry Department, Oxford, UK.
 41. Wednesday July 13, 2022. **The relationship between trait emotional awareness, general reflectiveness, and socio-emotional skills.** European Conference on Personality, Madrid, Spain.
 42. Wednesday July 13, 2022. **The relationship between trait emotional awareness, general reflectiveness, and socio-emotional skills.** European Conference on Personality, Madrid, Spain.
 43. Friday July 15, 2022. **Modeling gastrointestinal interoception as Bayesian inference: Individual differences and their neural correlates.** Monash Centre for Consciousness & Contemplative Studies, Melbourne, Australia.
 44. Saturday July 16, 2022. **A step-by-step tutorial on active inference and its application to empirical data (full day tutorial workshop).** 31st Annual Computational Neuroscience Meeting (CNS*2022), Melbourne, Australia
 45. Wednesday, Sep 14, 2022. **Simulating the Computational Mechanisms of Emotional Awareness and their Breakdown in Affective Disorders.** The Centre for Addiction and Mental Health. The Krembil Centre for Neuroinformatics (KCNI) Speaker Series
 46. Saturday Sep 17, 2022. **Tutorial: Active Inference using SPM.** Computational Psychiatry Course. Zurich, Switzerland.
 47. Monday, Sep 26, 2022. **A computational neuroscience perspective on subjective wellbeing.** "Coffee, Tea, and Computational Wellbeing" International Online Talk Series.
 48. Friday, November 4, 2022. **Active inference as a hypothesis-generating framework for investigating resignation syndrome.** International symposium: Is Resignation Syndrome a Functional Neurological Disorder? Wellcome Centre for Human Neuroimaging, 12 Queen Square, London.
 49. Friday, March 17, 2023. **Hierarchical representation and decoding as a framework for understanding mechanisms of phenomenal and access consciousness.** Computational phenomenology weekly discussion group. VERSES Research Lab, High Tech Campus 6a. 5656 AE, Eindhoven. The Netherlands.
 50. Monday, July 17, 2023. **Using hidden markov models to capture individual differences in interoception.** Hideki Lab, University of Nagoya, Japan.
 51. Tuesday, July 18, 2023. **Using hidden markov models to capture individual differences in interoception.** National Center of Neurology and Psychiatry (NCNP), Tokyo, Japan.
 52. Thursday, July 20, 2023. **Keynote: Novel approaches for understanding the neurocomputational basis of interoception and emotion-cognition interactions.** International Symposium on Predictive Brain and Cognitive Feelings. Ito International Research Center, The University of Tokyo, Japan.
 53. Wednesday Sep 15, 2023. **An introduction to active inference.** Computational Psychiatry Course. Zurich, Switzerland.
 54. Saturday September 18, 2023. **A step-by-step tutorial on active inference and its application to empirical data (full day tutorial workshop).** Computational Psychiatry Course. Zurich, Switzerland.

55. Wednesday, May 22, 2024. **Novel approaches for understanding the neurocomputational basis of interoception and emotion-cognition interactions.** Université catholique de Louvain (UCLouvain), Louvain, Belgium.
56. Thursday, May 23, 2024. **Breath-Holding Modulates Computational Mechanisms of Interoception in Healthy but Not Transdiagnostic Patient Samples.** European Society for Cognitive and Affective Neuroscience (ESCAN), Ghent, Belgium.
57. Monday, May 27, 2024. **Novel approaches for understanding the neurocomputational basis of interoception and emotion-cognition interactions.** University of Amsterdam, Department of Psychology, Amsterdam, Netherlands.
58. Tuesday, August 20, 2024. **Computational Predictors of Subjective Well-Being.** Hitotsubashi University, Tokyo, Japan.
59. Tuesday, September 3, 2024. **Novel approaches for understanding the neurocomputational basis of interoception and emotion-cognition interactions.** University of Aarhus, Aarhus, Denmark.
60. Wednesday Sep 11, 2024. **An introduction to active inference.** Computational Psychiatry Course. Zurich, Switzerland.
61. Saturday September 14, 2024. **A step-by-step tutorial on active inference and its application to empirical data (full day tutorial workshop).** Computational Psychiatry Course. Zurich, Switzerland.
62. Thursday June 19, 2025. **Computational Modeling Reveals Transdiagnostic Deficits in Interoceptive Inference (Symposium Talk).** Psychology and the Brain (PuG) Conference. Wurzburg, Germany.
63. Wednesday July 16, 2025. **A hierarchical Bayesian model reveals increased precision weighting for afferent cardiac signals, and reduced anxiety, as a function of interoceptive training (Spotlight Presentation).** Computational Psychiatry Conference. Tübingen, Germany.
64. Friday August 22, 2025. **Computational Predictors of Subjective Well-Being.** Japanese Ministry of Science and Education. Tokyo, Japan.
65. Wednesday Sep 3, 2025. **An introduction to active inference.** Computational Psychiatry Course. Zurich, Switzerland.
66. Saturday September 6, 2025. **A step-by-step tutorial on active inference and its application to empirical data (full day tutorial workshop).** Computational Psychiatry Course. Zurich, Switzerland.
67. Wednesday October 16, 2025. **An introduction to active inference.** International Workshop on Active Inference (IWAI). McGill University, Montreal, Canada.
68. Wednesday October 16, 2025. **Current Progress on Empirical Applications of Active Inference in Computational Psychiatry.** International Workshop on Active Inference (IWAI). McGill University, Montreal, Canada.
69. Wednesday October 16, 2025. **Fireside Chat Discussion Panel.** International Workshop on Active Inference (IWAI). McGill University, Montreal, Canada.
70. Thursday October 23, 2025. **What might evidence of conscious affect look like?** Active Inference and Conscious Affect Retreat. Wits University Rural Campus, Hoedspruit, South Africa.
71. Wednesday January 14, 2026. **Sacrificing quality of life to avoid feared outcomes: The relationship between maladaptive avoidance, anxiety, and subjective well-being.** American College of Neuropsychopharmacology (ACNP) Annual Meeting. Nassau, Bahamas

Grants

Principal Investigator

50% effort: National Institute for General Medical Sciences (NIGMS): Center Grant Research Project Leader. Investigating the effects of aversive interoceptive states on computations underlying avoidance behavior and their neural basis. (P20GM121312)

20% effort: Wellbeing for Planet Earth Foundation: 2022-2025. Using active inference to uncover the neurocomputational mechanisms that contribute to well-being and their potential differences across diverse populations.

Co-Investigator

10% effort: National Institute of Mental Health (NIMH) R01. An Approach-Avoidance, Computational Framework for Identifying Mechanisms and Predictors of Behavioral Therapy Outcome in Anxiety and Depression (R01 MH123691).

10% effort: National Institute of Mental Health (NIMH) R01. A Neurocomputational Assay of Gastrointestinal Interoception in Anorexia Nervosa.

NIH Grant or External Career Advancement Reviewer

NIH RFA Review Panel: BRAIN Initiative (Theories, Models and Methods for Analysis of Complex Data from the Brain). Feb. 2024

NIH Human Complex Mental Function (HCMF) Study Section. Mar. 2026

NIH Complex Mental Development and Changes across Lifespan (CDCL) Special Emphasis Panel. Apr. 2026

Medical Research Council, UK Research and Innovation (Since 2021)

Austrian Science Fund (FWF), Austria (Since 2022)

Fulbright Grant Award, Poland (Since 2022)

Wellcome Trust/DBT India Alliance Fellowship (Since 2022)

National Science Foundation (NSF) (Since 2023)

Riken Research Institute, Japan (since 2023)

Swiss National Science Foundation (SNSF) (since 2024)

Editorial Contributions

Editorial Board Member - Journal of Emotion and Psychopathology (2021-present)

Editorial Board Member (Review Editor) - Autonomic Neuroscience, a specialty section of Frontiers in Neuroscience, Neuroscience and Physiology (2022-2023)

Editorial Board Member (Associate Editor) – Computational Psychiatry (2025-present)

Scholarly Journal or Conference Submission Reviewer

Conferences

Reinforcement Learning and Decision-Making (RLDM). 2020.

Computational Psychiatry Conference. 2024.

Reinforcement Learning and Decision-Making (RLDM). 2025.

Computational Psychiatry Conference. 2025.

Computational Psychiatry Conference. 2026.

Journals

Philosophical Psychology (Since 2014)

Psychiatry Research: Neuroimaging (Since 2015)

Behavioural Brain Research (Since 2016)

Psychophysiology (Since 2016)

Frontiers in Human Neuroscience (Since 2016)

Brain Structure and Function (Since 2017)

Scientific Reports (Since 2017)

Social Cognitive and Affective Neuroscience (Since 2017)

Brain Imaging and Behavior (Since 2017)

Cognitive Affective and Behavioral Neuroscience (Since 2017)

Cerebral Cortex (Since 2017)

Brain Connectivity (Since 2017)

Computers in Human Behavior (Since 2018)

Autonomic Neuroscience, a specialty of Frontiers in Neurology, Neuroscience and Physiology (Since 2018)

The Lancet Psychiatry (Since 2018)

Social Neuroscience (Since 2019)

Human Brain Mapping (Since 2019)

Quarterly Journal of Experimental Psychology (Since 2020)
Biological Psychology (Since 2020)
Journal of Abnormal Psychology (Since 2020)
PLOS Computational Biology (Since 2021)
Biological Psychiatry (Since 2021)
Computational Psychiatry (Since 2021)
Neuroscience of Consciousness (Since 2021)
Cortex (Since 2021)
Proceedings of the National Academy of Sciences (Since 2021)
Neuroscience & Biobehavioral Reviews (Since 2022)
Depression & Anxiety (Since 2022)
Journal of Psychopathology and Clinical Science (Since 2022)
Nature Communications (Since 2022)
Nature Human Behavior (Since 2023)
Drug & Alcohol Dependence (Since 2023)
Cognitive, Affective, and Behavioral Neuroscience (since 2023)
Addiction Neuroscience (Since 2023)
Personality and Individual Differences (Since 2023)
Journal of Emotion and Psychopathology (Since 2023)
eClinicalMedicine (Since 2024)
European Journal of Neuroscience (Since 2024)
Emotion (Since 2024)
Translational Psychiatry (Since 2025)
Journal of the Royal Society of New Zealand (Since 2025)
Trends in Cognitive Science (Since 2026)

Professional Memberships

Society for Biological Psychiatry (SOBP) – Since 2023

Mentorship/Service

Primary Mentor for:

Rowan Hodson. **PhD student**. University of Tulsa, Co-authored 2 published papers
Marishka Mehta. **PhD student**. University of Tulsa, Co-authored 2 published papers
Ko-Ping Chou, **PhD student**. University of Tulsa, Co-authored 2 published papers
Navid Hakimi, PhD. **Post-doctoral fellow**, Co-authored 3 published papers
Toru Takahashi, PhD. **Post-doctoral fellow**, Co-authored 1 published paper

Co-Mentor for:

Christopher Whyte. **PhD student**. University of Cambridge, England, Co-authored 3 published papers

Alessandra Yu. **MS student**. University College London, England

Rowan Hodson. **MS student**. University of Cape Town, South Africa

Chatrin Suksasilp. **PhD student**. University College London, England

Other past and present lab members:

Samuel Taylor, BS. **Research Assistant** (former), Co-authored 10 published papers

Annie Chuning, BS. **Project Coordinator** (former), Co-authored 5 published papers

Claire Lavalley, BS. **Research Assistant** (former), Co-authored 4 published papers

Carter Goldman, BS. **Research Assistant** (former), Co-authored 2 published papers

Orestes Pena, BS. **Research Assistant**.

Ning Li, MS. **Project Coordinator** (former), Co-authored 3 published papers

Taylor Torres, BS. **Research Assistant**

Grace Kozlowski, BS. **Research Assistant**

Feng Li, MS, **Graduate Volunteer**

Tyler Adams, **Undergraduate Volunteer**

Local educational lectures:

1. November 11, 2019. **The neural basis of Hierarchical Emotion Processing and Emotional Awareness: Clinical Relevance and opportunities for computational modeling**. Principles of Neuroscience Course. University of Tulsa.
2. December 2, 2019. **An introduction to the active inference approach to computational modeling**. Brownbag lecture. Laureate Institute for Brain Research.
3. January-February 2022. **Methods in Computational Psychiatry Course** (5 lectures). Laureate Institute for Brain Research
4. November 15, 2023. **Understanding the neurocomputational basis of interoception and emotion-cognition interactions**. Principles of Neuroscience Course. University of Tulsa.

Courses Taught

1. **Introduction to Biopsychology** (PSY 302 SSI14 001). University of Arizona, Summer 2014, Summer undergraduate course. Taught online (fourteen 120-minute recorded audio/video lectures). Covered the entire textbook of Cognitive Neuroscience: The Biology of the Mind (4th edition), by Gazzaniga, Ivry, and Mangun.
2. **Human Memory** (PSY 326 SP15 791). University of Arizona, Spring 2015. Spring undergraduate course. Taught in-person (sixteen 150-minute lectures). Covered the entire textbook of Memory (2nd edition), by Baddeley, Eysenck, and Anderson.
3. **Research Methods** (PSY 289). Pima Community College, Fall 2016. Fall undergraduate course. Taught in-person (thirty-two 150-minute lectures). Covered the entire textbook of Research Methods (5th edition), by Gravetter and Forzano.
4. **Introduction to Psychology** (PSY 101). Pima Community College, Spring 2017. Spring undergraduate course. Taught in person (thirty-two 110-minute lectures). Covered the entire textbook of Psychology: An Exploration 3rd edition), by Ciccarelli and White.
5. **Research Methods** (PSY 289). Pima Community College, Fall 2017. Fall undergraduate course. Taught in-person (thirty-two 150-minute lectures). Covered the entire textbook of Research Methods (5th edition), by Gravetter and Forzano.
6. **Introduction to Psychology** (PSY 101). Pima Community College, Spring 2018. Spring undergraduate course. Taught in person (twenty-eight 115-minute lectures). Covered the entire textbook of Exploring Psychology (10th edition), by Myers and DeWall.
7. **Introduction to Computational Psychiatry**. University of Arizona, College of Medicine, Summer-Fall 2018. Psychiatry resident training course. Taught in person (six 1-hour lectures). Covered a range of recent journal articles on computational neuroscience and its application to psychiatric disorders.
8. **Methods in Computational Psychiatry**. Laureate Institute for Brain Research, January-February 2022. Graduate student and post-doc training course. Taught in-person (five 2-hour lectures). Covered a range of modelling approaches in computational neuroscience and example applications within psychiatry research.

Public Outreach and Translational Work

Public Audience Talks

Tuesday, Sep 13, 2022. **On the overlap between cognition and emotion**. Quantum Photonics Discussion Group Presentation.

Popular Articles

1. Smith, R. **How Anxiety and Depression May Interfere With Decision-Making** (2022). Psychology Today. <https://www.psychologytoday.com/us/blog/the-neuroscience-emotion-and-decisionmaking/202206/how-anxiety-and-depression-may-interfere>
2. Smith, R. **Why Some Keep Using Drugs, Even Knowing It Ruins Their Lives** (2022). Psychology Today. <https://www.psychologytoday.com/us/blog/the-neuroscience-emotion-and-decisionmaking/202207/why-some-keep-using-drugs-even-knowing-it>
3. Smith, R. **Do Emotions Help or Hinder Rational Thinking?** (2022). Psychology Today. <https://www.psychologytoday.com/us/blog/the-neuroscience-emotion-and-decisionmaking/202208/do-emotions-help-or-hinder-rational-thinking>
4. Smith, R. **What Is Computational Psychiatry? Studying the information processing mechanisms affected by mental illness** (2024). Psychology Today. <https://www.psychologytoday.com/us/blog/the-neuroscience-of-emotion-and-decisionmaking/202403/what-is-computational-psychiatry>
5. Smith, R. **When the Brain has Difficulty Listening to the Heart: Inaccurate heartbeat perception in depression, anxiety, and addiction** (2024). Psychology Today. <https://www.psychologytoday.com/us/blog/the-neuroscience-of-emotion-and-decisionmaking/202408/when-the-brain-has-difficulty-listening>



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