



Jong H. Yoon

Associate Professor of Psychiatry and Behavioral Sciences (Public Mental Health & Population Sciences)

Bio

BIO

Jong H. Yoon, MD, is a clinician-scientist who is focused on applying novel neuroimaging methods to discover the brain mechanisms of schizophrenia and stimulant abuse disorder, as well as developing mechanism based treatments for these conditions. He is dually appointed at the Palo Alto VA, where he serves as the Director of the Repetitive Transcranial Magnetic Stimulation (rTMS) Neuromodulation Clinic. As a cognitive neuroscientist, he has led a number of federally funded projects developing and utilizing advanced in vivo neuroimaging methods. His work is particularly interested in investigating impairments in the function of the basal ganglia, which gives rise to cognitive and information processing deficits and psychosis in schizophrenia and other psychiatric conditions. Towards these ends, he has been developing novel fMRI methods to accurately measure the functional properties of basal ganglia nuclei. Dr. Yoon is also developing new neuroimaging approaches for indexing brain function and dysfunction, including methods for measuring task-evoked GABA levels in the brain and applying a newly developed PET tracer for determining synaptic health in humans and in disease. He received his medical degree from the New York University School of Medicine and residency training in adult psychiatry at the Langley Porter Psychiatric Institute at University of California San Francisco. He completed a post-doctoral fellowship in cognitive neuroscience and functional neuroimaging at University of California Berkeley.

ACADEMIC APPOINTMENTS

- Associate Professor - University Medical Line, Psychiatry and Behavioral Sciences
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Director, Repetitive Transcranial Magnetic Stimulation (rTMS) Neuromodulation Clinic, VA Palo Alto Health Care System, Palo Alto Division, (2018- present)

HONORS AND AWARDS

- NARSAD Young Investigator Award, Brain & Behavioral Research Foundation (7/1/11-6/30/13)
- David Mahoney Neuroimaging Award, The Dana Foundation (5/1/14-4/30/17)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Editorial Board Member, Biological Psychiatry: Cognitive Neuroscience Neuroimaging (2018 - present)

PROFESSIONAL EDUCATION

- BA, Swarthmore College, Sociology/Anthropology (1990)
- MD, New York University School of Medicine, Medicine with Honors (1995)
- Medical Student Fellow, Howard Hughes Medical Institute - National Institutes of Health (HHMI-NIH), Research Scholars Program (1994)

- Internship, University of California San Francisco (1996)
- Residency, Langley Porter Psychiatric Institute - University of California San Francisco , Psychiatry (1999)
- Board Certification, American Board of Psychiatry and Neurology , Psychiatry (1999)
- Post-Doctoral Fellowship, University of California Berkeley , Cognitive Neuroscience/Functional Neuroimaging (2005)

LINKS

- Lab Website: <http://med.stanford.edu/yoonlab/>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My research seeks to discover the brain mechanisms responsible for schizophrenia and to translate this knowledge into the clinic to improve how we diagnose and treat this condition. Towards these ends, our group has been developing cutting-edge neuroimaging tools to identify neurobiological abnormalities and test novel systems-level disease models of psychosis and schizophrenia directly in individuals with these conditions.

We have been particularly interested in the role of neocortical-basal ganglia circuit dysfunction. A working hypothesis is that some of the core symptoms of schizophrenia are attributable to impairments in neocortical function that results in disconnectivity with components of the basal ganglia and dysregulation of their activity. The Yoon Lab has developed new high-resolution functional magnetic resonance imaging methods to more precisely measure the function of basal ganglia components, which given their small size and location deep within the brain has been challenging. This includes ways to measure the activity of nuclei that store and control the release of dopamine throughout the brain, a neurochemical that is one of the most important factors in the production of psychosis in schizophrenia and other neuropsychiatric conditions.

CLINICAL TRIALS

- Does rTMS Induce Synaptic Plasticity?, Not Recruiting
- Imaging Synapses With [11C] UCB-J in the Human Brain, Not Recruiting
- Treating Stimulant Addiction With Repetitive Transcranial Magnetic Stimulation, Not Recruiting

Publications

PUBLICATIONS

- **Absence of altered in vivo concentration of dorsolateral prefrontal cortex GABA in recent onset schizophrenia.** *Schizophrenia research*
Yoon, J. H., Maddock, R. J., Laufer, J., Minzenberg, M. J., Niendam, T. A., Lesh, T. A., Solomon, M., Ragland, J. D., Carter, C.
2021
- **A Clinical Program to Implement Repetitive Transcranial Magnetic Stimulation for Depression in the Department of Veterans Affairs.** *Federal practitioner : for the health care professionals of the VA, DoD, and PHS*
Carrico, W. T., Georgette, G. n., Madore, M. R., Kozel, F. A., George, M. S., Lindley, S. n., Lovett, S. n., Yoon, J. H., Yesavage, J. A.
2020; 37 (6): 276–81
- **Transcranial Magnetic Stimulation: A Clinical Primer for Nonexperts.** *Journal of psychiatric practice*
Minzenberg, M. J., Yoon, J. H.
2020; 26 (5): 423–28
- **Transcranial Magnetic Stimulation: A Clinical Primer for Non-Experts** *Journal of Psychiatric Practice*
Minzenberg, M. J., Yoon, J. H.
2020
- **Reduced in vivo visual cortex GABA in schizophrenia, a replication in a recent onset sample.** *Schizophrenia research*
Yoon, J. H., Maddock, R. J., DongBo Cui, E., Minzenberg, M. J., Niendam, T. A., Lesh, T., Solomon, M., Ragland, J. D., Carter, C.

2019

- **Psychotic symptoms in youth with Pediatric Acute-onset Neuropsychiatric Syndrome (PANS) may reflect syndrome severity and heterogeneity (vol 110, pg 93, 2019)** *JOURNAL OF PSYCHIATRIC RESEARCH*
Silverman, M., Frankovich, J., Nguyen, E., Leibold, C., Yoon, J., Freeman, G., Karpel, H., Thienemann, M.
2019; 113: 45
- **Impaired prefrontal functional connectivity associated with working memory task performance and disorganization despite intact activations in schizophrenia** *PSYCHIATRY RESEARCH-NEUROIMAGING*
Chari, S., Minzenberg, M. J., Solomon, M., Ragland, J., Quynh Nguyen, Carter, C. S., Yoon, J. H.
2019; 287: 10–18
- **Subthalamic Nucleus Activation Occurs Early during Stopping and Is Associated with Trait Impulsivity.** *Journal of cognitive neuroscience*
Yoon, J. H., Cui, E., Minzenberg, M. J., Carter, C. S.
2019: 1–12
- **Psychotic symptoms in youth with Pediatric Acute-onset Neuropsychiatric Syndrome (PANS) may reflect syndrome severity and heterogeneity.** *Journal of psychiatric research*
Silverman, M., Frankovich, J., Nguyen, E., Leibold, C., Yoon, J., Mark Freeman, G. J., Karpel, H., Thienemann, M.
2018; 110: 93–102
- **Altered brainstem responses to modafinil in schizophrenia: implications for adjunctive treatment of cognition** *TRANSLATIONAL PSYCHIATRY*
Minzenberg, M. J., Yoon, J. H., Soosman, S. K., Carter, C. S.
2018; 8: 58
- **Early interventions in a US military FIRST episode psychosis program.** *Early intervention in psychiatry*
Hann, M. C., Caporaso, E. n., Loeffler, G. n., Cuellar, A. n., Herrington, L. n., Marrone, L. n., Yoon, J. n.
2018
- **Automatic Detection of Incoherent Speech for Diagnosing Schizophrenia** *Computational Linguistics and Clinical Psychology Workshop*
Iter, D., Yoon, J. H., Jurafsky, D.
2018
- **Dorsolateral Prefrontal Cortex GABA Concentration in Humans Predicts Working Memory Load Processing Capacity** *JOURNAL OF NEUROSCIENCE*
Yoon, J. H., Grandelis, A., Maddock, R. J.
2016; 36 (46): 11788-11794
- **Sustained Modafinil Treatment Effects on Control-Related Gamma Oscillatory Power in Schizophrenia** *NEUROPSYCHOPHARMACOLOGY*
Minzenberg, M. J., Yoon, J. H., Cheng, Y., Carter, C. S.
2016; 41 (5): 1231-1240
- **A case of butane hash oil (marijuana wax)-induced psychosis** *SUBSTANCE ABUSE*
Keller, C. J., Chen, E. C., Brodsky, K., Yoon, J. H.
2016; 37 (3): 384-386
- **Control-related frontal-striatal function is associated with past suicidal ideation and behavior in patients with recent-onset psychotic major mood disorders** *JOURNAL OF AFFECTIVE DISORDERS*
Minzenberg, M. J., Lesh, T. A., Niendam, T. A., Yoon, J. H., Cheng, Y., Rhoades, R. N., Carter, C. S.
2015; 188: 202-209
- **Delay Period Activity of the Substantia Nigra during Proactive Control of Response Selection as Determined by a Novel fMRI Localization Method** *JOURNAL OF COGNITIVE NEUROSCIENCE*
Yoon, J. H., Larson, P., Grandelis, A., La, C., Cui, E., Carter, C. S., Minzenberg, M. J.
2015; 27 (6): 1238-1248
- **Conflict-related anterior cingulate functional connectivity is associated with past suicidal ideation and behavior in recent-onset schizophrenia** *JOURNAL OF PSYCHIATRIC RESEARCH*
Minzenberg, M. J., Lesh, T., Niendam, T., Yoon, J. H., Cheng, Y., Rhoades, R., Carter, C. S.
2015; 65: 95-101
- **Frontal Motor Cortex Activity During Reactive Control Is Associated With Past Suicidal Behavior in Recent-Onset Schizophrenia** *CRISIS-THE JOURNAL OF CRISIS INTERVENTION AND SUICIDE PREVENTION*

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- Minzenberg, M. J., Lesh, T., Niendam, T., Yoon, J. H., Cheng, Y., Rhoades, R. N., Carter, C. S.
2015; 36 (5): 363-370
- **Modafinil Effects on Middle-Frequency Oscillatory Power During Rule Selection in Schizophrenia** *NEUROPSYCHOPHARMACOLOGY*
Minzenberg, M. J., Yoon, J. H., Cheng, Y., Carter, C. S.
2014; 39 (13): 3018-3026
 - **Modafinil effects on middle-frequency oscillatory power during rule selection in schizophrenia.** *Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology*
Minzenberg, M. J., Yoon, J. H., Cheng, Y., Carter, C. S.
2014; 39 (13): 3018-26
 - **Task-evoked substantia nigra hyperactivity associated with prefrontal hypofunction, prefrontonigral disconnectivity and nigrostriatal connectivity predicting psychosis severity in medication naïve first episode schizophrenia** *SCHIZOPHRENIA RESEARCH*
Yoon, J. H., Westphal, A. J., Minzenberg, M. J., Niendam, T., Ragland, J. D., Lesh, T., Solomon, M., Carter, C. S.
2014; 159 (2-3): 521-526
 - **Task-evoked substantia nigra hyperactivity associated with prefrontal hypofunction, prefrontonigral disconnectivity and nigrostriatal connectivity predicting psychosis severity in medication naïve first episode schizophrenia.** *Schizophrenia research*
Yoon, J. H., Westphal, A. J., Minzenberg, M. J., Niendam, T., Ragland, J. D., Lesh, T., Solomon, M., Carter, C. S.
2014; 159 (2-3): 521-6
 - **Frontal cortex control dysfunction related to long-term suicide risk in recent-onset schizophrenia** *SCHIZOPHRENIA RESEARCH*
Minzenberg, M. J., Lesh, T. A., Niendam, T. A., Yoon, J. H., Rhoades, R. N., Carter, C. S.
2014; 157 (1-3): 19-25
 - **Modafinil augments oscillatory power in middle frequencies during rule selection** *PSYCHOPHYSIOLOGY*
Minzenberg, M. J., Gomes, G. C., Yoon, J. H., Watrous, A. J., Geng, J., Firl, A. J., Carter, C. S.
2014; 51 (6): 510-519
 - **Disrupted action monitoring in recent-onset psychosis patients with schizophrenia and bipolar disorder** *PSYCHIATRY RESEARCH-NEUROIMAGING*
Minzenberg, M. J., Gomes, G. C., Yoon, J. H., Swaab, T. Y., Carter, C. S.
2014; 221 (1): 114-121
 - **Impaired context processing as a potential marker of psychosis risk state** *PSYCHIATRY RESEARCH-NEUROIMAGING*
Niendam, T. A., Lesh, T. A., Yoon, J., Westphal, A. J., Hutchison, N., Ragland, J. D., Solomon, M., Minzenberg, M., Carter, C. S.
2014; 221 (1): 13-20
 - **Impaired Prefrontal-Basal Ganglia Functional Connectivity and Substantia Nigra Hyperactivity in Schizophrenia** *BIOLOGICAL PSYCHIATRY*
Yoon, J. H., Minzenberg, M. J., Raouf, S., D'Esposito, M., Carter, C. S.
2013; 74 (2): 122-129
 - **Semantic processes leading to true and false memory formation in schizophrenia** *SCHIZOPHRENIA RESEARCH*
Paz-Alonso, P. M., Ghetti, S., Ramsay, I., Solomon, M., Yoon, J., Carter, C. S., Ragland, J. D.
2013; 147 (2-3): 320-325
 - **Abnormal Activity-Dependent Brain Lactate and Glutamate plus Glutamine Responses in Panic Disorder** *BIOLOGICAL PSYCHIATRY*
Maddock, R. J., Buonocore, M. H., Miller, A. R., Yoon, J. H., Soosman, S. K., Unruh, A. M.
2013; 73 (11): 1111-1119
 - **Oxytocin and Vasopressin in Children and Adolescents With Autism Spectrum Disorders: Sex Differences and Associations With Symptoms** *AUTISM RESEARCH*
Miller, M., Bales, K. L., Taylor, S. L., Yoon, J., Hostetler, C. M., Carter, C. S., Solomon, M.
2013; 6 (2): 91-102
 - **Windows to the soul: vision science as a tool for studying biological mechanisms of information processing deficits in schizophrenia** *Frontiers in Psychology*
Yoon, J. H., Sheremata, S. L., Rokem, A., Silver, M. A.
2013
 - **Windows to the soul: vision science as a tool for studying biological mechanisms of information processing deficits in schizophrenia.** *Frontiers in psychology*
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- Yoon, J. H., Sheremata, S. L., Rokem, A., Silver, M. A.
2013; 4: 681-?
- **Proactive and reactive cognitive control and dorsolateral prefrontal cortex dysfunction in first episode schizophrenia.** *NeuroImage. Clinical*
Lesh, T. A., Westphal, A. J., Niendam, T. A., Yoon, J. H., Minzenberg, M. J., Ragland, J. D., Solomon, M., Carter, C. S.
2013; 2: 590-599
 - **Excessive contralateral motor overflow in schizophrenia measured by fMRI** *PSYCHIATRY RESEARCH-NEUROIMAGING*
Minzenberg, M. J., Yoon, J. H., Soosman, S. K., Carter, C. S.
2012; 202 (1): 38-45
 - **Automated classification of fMRI during cognitive control identifies more severely disorganized subjects with schizophrenia** *SCHIZOPHRENIA RESEARCH*
Yoon, J. H., Nguyen, D. V., McVay, L. M., Deramo, P., Minzenberg, M. J., Ragland, J. D., Niendam, T., Solomon, M., Carter, C. S.
2012; 135 (1-3): 28-33
 - **Neural correlates of relational and item-specific encoding during working and long-term memory in schizophrenia** *NEUROIMAGE*
Ragland, J. D., Blumenfeld, R. S., Ramsay, I. S., Yonelinas, A., Yoon, J., Solomon, M., Carter, C. S., Ranganath, C.
2012; 59 (2): 1719-1726
 - **From lumping to splitting and back again: Atypical social and language development in individuals with clinical-high-risk for psychosis, first episode schizophrenia, and autism spectrum disorders** *SCHIZOPHRENIA RESEARCH*
Solomon, M., Olsen, E., Niendam, T., Ragland, J. D., Yoon, J., Minzenberg, M., Carter, C. S.
2011; 131 (1-3): 146-151
 - **General and Specific Functional Connectivity Disturbances in First-Episode Schizophrenia During Cognitive Control Performance** *BIOLOGICAL PSYCHIATRY*
Fornito, A., Yoon, J., Zalesky, A., Bullmore, E. T., Carter, C. S.
2011; 70 (1): 64-72
 - **Modafinil modulation of the default mode network** *PSYCHOPHARMACOLOGY*
Minzenberg, M. J., Yoon, J. H., Carter, C. S.
2011; 215 (1): 23-31
 - **Prefrontal Cortical Deficits and Impaired Cognition-Emotion Interactions in Schizophrenia** *AMERICAN JOURNAL OF PSYCHIATRY*
Ursu, S., Kring, A. M., Gard, M. G., Minzenberg, M. J., Yoon, J. H., Ragland, J. D., Solomon, M., Carter, C. S.
2011; 168 (3): 276-285
 - **An Index of Relative Central alpha-Adrenergic Receptor Antagonism by Antipsychotic Medications** *EXPERIMENTAL AND CLINICAL PSYCHOPHARMACOLOGY*
Minzenberg, M. J., Yoon, J. H.
2011; 19 (1): 31-39
 - **Broader orientation tuning in patients with schizophrenia** *Frontiers in Human Neuroscience*
Rokem, A. S., Yoon, J. H., Ooms, R. E., Maddock, R. J., Minzenberg, M. J., Carter, C. S.
2011
 - **Gamma Oscillatory Power is Impaired During Cognitive Control Independent of Medication Status in First-Episode Schizophrenia** *NEUROPSYCHOPHARMACOLOGY*
Minzenberg, M. J., Firl, A. J., Yoon, J. H., Gomes, G. C., Reinking, C., Carter, C. S.
2010; 35 (13): 2590-2599
 - **Use of Eye Movement Monitoring to Examine Item and Relational Memory in Schizophrenia** *BIOLOGICAL PSYCHIATRY*
Hannula, D. E., Ranganath, C., Ramsay, I. S., Solomon, M., Yoon, J., Niendam, T. A., Carter, C. S., Ragland, J. D.
2010; 68 (7): 610-616
 - **Response to Comment on "Modafinil Shifts Human Locus Coeruleus to Low-Tonic, High-Phasic Activity During Functional MRI"** *SCIENCE*
Minzenberg, M. J., Watrous, A. J., Yoon, J. H., La, C., Ursu, S., Carter, C. S.
2010; 328 (5976)

- **GABA Concentration Is Reduced in Visual Cortex in Schizophrenia and Correlates with Orientation-Specific Surround Suppression** *JOURNAL OF NEUROSCIENCE*
Yoon, J. H., Maddock, R. J., Rokem, A., Silver, M. A., Minzenberg, M. J., Ragland, J. D., Carter, C. S.
2010; 30 (10): 3777-3781
- **Perception Measurement in Clinical Trials of Schizophrenia: Promising Paradigms From CNTRICS** *SCHIZOPHRENIA BULLETIN*
Green, M. F., Butler, P. D., Chen, Y., Geyer, M. A., Silverstein, S., Wynn, J. K., Yoon, J. H., Zemon, V.
2009; 35 (1): 163-181
- **Diminished orientation-specific contextual modulation of visual processing in schizophrenia** *Schizophrenia Bulletin*
Yoon, J. H., Rokem, A. S., Silver, M. A., Minzenberg, M. J., Carter, C. J.
2009; 35 (6): 1078-84
- **Association of dorsolateral prefrontal cortex dysfunction with disrupted coordinated brain activity in schizophrenia: Relationship with impaired cognition, behavioral disorganization, and global function** *11th International Congress on Schizophrenia Research/8th Biennial Mt Sinai Conference on Cognition in Schizophrenia*
Yoon, J. H., Minzenberg, M. J., Ursu, S., Walters, R., Wendelken, C., Ragland, J. D., Carter, C. S.
AMER PSYCHIATRIC PUBLISHING, INC.2008: 1006-14
- **Multivariate Pattern Analysis of fMRI Data Reveals Deficits in Distributed Representations in Schizophrenia** *Biological Psychiatry*
Yoon, J. H., Tamir, D., Minzenberg, M. J., Ragland, J., Ursu, S., Carter, C. S.
2008; 64 (12)
- **Modafinil Shifts Human Locus Coeruleus to Low-Tonic, High-Phasic Activity During Functional MRI** *Science*
Minzenberg, M. J., Watrous, A. J., Yoon, J. H., Ursu, S., Carter, C. S.
2008; 322 (5908)
- **Segregation of function in the lateral prefrontal cortex during visual object working memory** *BRAIN RESEARCH*
Yoon, J. H., Hoffman, J. N., D'Esposito, M.
2007; 1184: 217-225
- **Neuroimaging of cognitive disability in schizophrenia: Search for a pathophysiological mechanism** *INTERNATIONAL REVIEW OF PSYCHIATRY*
Ragland, J. D., Yoon, J., Minzenberg, M. J., Carter, C. S.
2007; 19 (4): 419-429
- **Preserved function of the fusiform face area in schizophrenia as revealed by fMRI** *PSYCHIATRY RESEARCH-NEUROIMAGING*
Yoon, J. H., D'Esposito, M., Carter, C. S.
2006; 148 (2-3): 205-216
- **Differential effects of distraction during working memory on delay-period activity in the prefrontal cortex and the visual association cortex** *NEUROIMAGE*
Yoon, J. H., Curtis, C. E., D'Esposito, M.
2006; 29 (4): 1117-1126

PRESENTATIONS

- Cortical/Subcortical Mechanisms of Psychosis - Department of Psychiatry, Seoul National University