

# Candace M. Raio, Ph.D.

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## Education & Training

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- 2015 – present      **Postdoctoral Fellow**, Center for Neural Science, New York University  
Mentor: *Paul Glimcher, PhD*
- 2009 – 2014        **Ph.D.**, Cognition & Perception Program, Department of Psychology, NYU  
Mentor: *Elizabeth A. Phelps, PhD*
- 2008 – 2009        **Junior Research Scientist**, Phelps Lab, New York University
- 2007 – 2008        **Research Assistant**, Neuroscience PET/fMRI Lab, Department of  
Psychiatry Mt. Sinai School of Medicine
- 2006 – 2008        **M.A.** (Psychology; *Biopsychology concentration*), New York University
- 1998 – 2002        **B.A.** (Psychology/English), Muhlenberg College

## Honors & Awards

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- 2018 - 2020      NARSAD Young Investigator Award, Brain and Behavior Research Foundation  
2018              Association for Psychological Science *Rising Star Award*  
2018              Anxiety & Depression Association of America (ADAA) *Career Development  
Leadership Award*
- 2016-2019      NIH Ruth L. Kirschstein NRSA Postdoctoral Fellowship  
2016              NeuroLeadership Award for Breakthrough Research (1<sup>st</sup> Runner up)  
2012              Fellowship, Cold Spring Harbor Workshop on the *Biology of Social Cognition*
- 2009 - 2014      Henry M. MacCracken PhD Fellowship, Graduate School of Arts and Sciences, NYU  
2008              Student Travel Award, New York University  
2007, 2008      M.A. Scholar Distinction, New York University  
2007, 2008      Dean's 1<sup>st</sup> Prize, M.A. Research Competition, Graduate School of Arts & Science, NYU  
1998 - 2002      Dean's list, Muhlenberg College

## Research Funding (*Principal Investigator*)

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### **NARSAD Young Investigator Grant (Brain and Behavior Research Foundation)**

1/15/18 – 1/14/20

*The Effects of Acute and Lifetime Stress on the Subjective Cost of Self Control*

### **NIH Ruth L. Kirschstein NRSA Postdoctoral Fellowship**

9/16/16 - 9/1/19

*The Influence of Stress on the Intrinsic Cost of Self-Control*

## **Manuscripts (under revision)**

**Raio, C.M.**, Lu, B., Grubb, M., Shields, G.S., Slavich, G.M. and Glimcher, P.G. (*under revision, Nature Communications*) Cumulative lifetime stress accounts for economic ambiguity aversion but not risk aversion.

## **Publications**

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**Raio, C.M.**, Hartley, C.A., Li, J., O'Deru, T., and Phelps E.A. (2017) Stress exposure attenuates flexible updating of aversive value. *Proceedings of the National Academy of Sciences*.

Brown, C.\*, **Raio, C.M.\***, and Neta, M. (2017) Cortisol responses enhance negative valence perception for ambiguous facial expressions. *Scientific Reports*. \*equal contribution

**Raio, C.M.**, Goldfarb, E.V., Lempert, K. M. and Sokol-Hessner, P. (2016) Classifying emotion regulation strategies. *Nature Reviews Neuroscience—Correspondence*.

Sokol-Hessner, P., **Raio, C.M.**, Gottesman, S., Lackovic, S.F., Phelps, E.A. (2016) Acute stress does not affect risky monetary decision-making. *Neurobiology of Stress*.

**Raio, C.M.** & Phelps, E.A. (2015) The influence of stress on the regulation of conditioned fear. *Neurobiology of Stress*.

FeldmanHall, O., **Raio, C.M.**, Seiler, M., Kubota, J., Phelps, E.A. (2015) The effects of social context and stress on decision-making under uncertainty. *Psychological Science*.

**Raio C.M.** and Phelps E.A. (2015) Observational Fear Learning. In: Arthur W. Toga, editor. Brain Mapping: An Encyclopedic Reference. Academic Press: Elsevier.

**Raio, C.M.**, Brignoni-Perez, E., Goldman, R., and Phelps E.A., (2014) Acute stress impairs the retrieval of extinction memory in humans. *Neurobiology of Learning & Memory*.

Kubota, J.T., Mojdehbakhsh, R., **Raio, C.M.**, Brosch, T., Uleman, J.S., and Phelps, E.A. (2014) Stressing the person and not the situation: Person attributions under stress. *Biological Psychology*.

Steinfurth, E.C.K., Kanen, J.W., **Raio, C.M.**, Clem, R., Haganir, R. and Phelps, E.A. (2014) Recent and remote Pavlovian fear memories can be modified with extinction training during reconsolidation in humans. *Learning & Memory*.

**Raio, C.M.**, O'Deru, T., Palazzolo, L., Shurick, A. and Phelps, E.A. (2013) Cognitive emotion regulation fails the stress test. *Proceedings of the National Academy of Sciences*.

Otto, A. R., **Raio, C. M.**, Chiang, A., Phelps, E. A., & Daw, N. D. (2013). Working-memory capacity protects model-based learning from stress. *Proceedings of the National Academy of Sciences*.

**Raio, C.M.\***, Carmel, D.\*, Carrasco, M. and Phelps, E.A. (2012) Unconscious fear: Quickly acquired, swiftly forgotten. *Current Biology*. \*equal contribution

Schiller D., **Raio C.M.** and Phelps, E.A. (2012) Extinction training during the reconsolidation window prevents recovery of fear. *Journal of Visualized Experiments*.

Schiller D., Monfils, M., **Raio C.M.**, Johnson D., LeDoux J.E., Phelps E.A. (2010) Blocking the return of fear in humans using reconsolidation update mechanisms. *Nature*.

Sharot T., Riccardi A.M., **Raio C.M.**, and Phelps E.A. (2007) Neural mechanisms mediating optimism bias. *Nature*.

### **Chaired/Organized Conference Symposia**

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**2019** Co-Chair and Organizer, ***Affective & Motivational Influences on Decision-Making***  
Computational and Systems Neuroscience (Cosyne) Workshop, Cacaais, Portugal

**2018** Co-Chair and Organizer, ***Emotion & Decision-Making Pre-Conference***  
Society for Affective Science, Los Angeles, CA

**2017** Co-Chair and Organizer, ***Nanosymposium***  
“Self-control and decision-making”  
Society for Neuroscience, Washington, D.C.

**2015** Chair and Organizer, ***Symposium***  
“Fear, stress & psychopathology: factors that modulate emotion regulation”  
Association for Psychological Science, New York, NY.

**2015** Co-Chair and Organizer, ***Symposium***  
“The influence of stress on extinction processes in humans”  
Society of Biological Psychiatry, Toronto, Canada.

**2015** Organizer, ***Nanosymposium***  
“Stress and negative emotion”  
Society for Neuroscience, Chicago, IL.

**2014** Co-Chair and Organizer, ***Symposium***  
“Emotional and social influences on learning and decision-making”  
Association for Psychological Science, San Francisco, CA.

**2013** Organizer, ***Nanosymposium***  
“Fear, stress and social networks”  
Society for Neuroscience, San Diego, CA.

**2012** Organizer, ***Nanosymposium***  
“Neural mechanisms of emotion regulation”  
Society for Neuroscience, New Orleans, LA.

## Invited Talks

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- 2018** Symposium Speaker, *American College of Neuropsychopharmacology*, Hollywood, FL  
“Stress Modulates Learning and Decision-Making under Uncertainty”
- 2018** Symposium Speaker, Society for Neuroeconomics, Philadelphia, PA  
“Monetizing the Subjective Cost of Self-Control”
- 2018** Symposium Speaker, Social Affective Neuroscience Society, Brooklyn, NY  
“A novel approach to quantifying the subjective cost of self-control”
- 2018** Symposium Speaker, Society for Biological Psychiatry, New York, NY  
“Stress modulates the subjective cost of behavioral control”
- 2018** Anxiety & Depression Association of America CLDP Award Presentation  
“Stress exposure diminishes aversive value updating”
- 2018** Mount Sinai Neuroscience Seminars, Icahn School of Medicine, New York, NY  
“Affective control and decision-making under stress”
- 2017** Nanosymposium Speaker, Society for Neuroscience, Washington, D.C.  
“Stress and incentive effects on the subjective cost of self-control”
- 2017** Institute for the Study of Decision-Making, New York University.  
“Quantifying the subjective cost of self-control”
- 2017** NYU-Boston University McDonnell Collaborative Network.  
“Nonconscious threat-learning and extinction”
- 2016** Symposium Speaker, NY-SAN Meet Up, New York University.  
“Quantifying the subjective cost of self-control”
- 2016** Psi Chi Colloquium, Adelphi University.  
“The effects of stress exposure on affective decision-making.”
- 2016** Sackler Science Seminar, Weill Cornell Medical College.  
“Acute stress effects on affective learning and regulation”
- 2015** Cognition Club, Icahn School of Medicine at Mount Sinai.  
“Affective regulation and decision-making under stress”
- 2015** Nanosymposium Organizer and Speaker, Society for Neuroscience, Chicago, IL.  
“Stress exposure decreases cooperative decision-making”
- 2015** Symposium Speaker, Society of Biological Psychiatry, Toronto, Canada.  
“The influence of stress on extinction retrieval in humans”
- 2015** Symposium Speaker, Association for Psychological Science, New York, NY.  
“The influence of stress exposure on fear regulation”

- 2014** Symposium Speaker, *Association for Psychological Science*, San Francisco, CA.  
“Stress exposure decreases cooperative behavior in the Prisoner’s Dilemma game“
- 2013** Nanosymposium Organizer and Speaker, Society for Neuroscience, San Diego, CA.  
“Stress impairs the reversal of conditioned threat associations“
- 2012** Computational Neuroeconomics Conference, California Institute of Technology, NSF-STC, Pasadena, CA.  
“Acute stress impairs the cognitive control of fear“
- 2012** Nanosymposium Organizer and Speaker, Society for Neuroscience, New Orleans, LA.  
“Acute stress impairs the cognitive regulation of fear“
- 2010** New York University Neuroscience Retreat, New Paltz, NY.  
“Fear conditioning without awareness using continuous flash suppression“
- 2010** Affect, Learning, and Decision-Making Symposium, New York University, NY.  
“Acquiring fear without awareness using continuous flash suppression“

**Selected Conference Posters** (*mentee presenters underlined*)

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Leone, L., **Raio, C.M.**, Lu, B., Grubb, M. and Glimcher, P.W. (2018) Acute stress exposure yields no effect on risk or ambiguity preferences in the loss or gain domain. *Society for Neuroeconomics*, Philadelphia, PA.

Banaver, N.V., **Raio, C.M.**, Konova, A.B. and Glimcher, P.W. (2018) The influence of stress and craving on subjective value: a temporal and attribute based examination. *Social Affective Neuroscience Society*, Brooklyn, NY.

**Raio, C.M.**, Konova, A.B., Banaver, N.V. and Glimcher, P.W. (2018) Stress causes distinct time-dependent increases in reward valuation in the presence versus absence of explicit temptation. *Society for Neuroscience*, San Diego, CA.

**Raio, C.M.** and Glimcher, P.W. (2018) Quantifying the subjective cost of self-control under stress. *Society for Affective Science*, Los Angeles, CA.

Banaver, N.V., Raio, C.M., Konova, A.B. and Glimcher, P.W. (2018) Temporal dissociation in how stress enhances subjective valuation in the presence versus absence of explicit temptation. *Cognitive Neuroscience Society*. Boston, MA.

**Raio, C.M.**, Konova, A.B., Banaver, N.V. and Glimcher, P.W. (2017) Stress exposure and cue-induced craving exert distinct time-dependent influences on subjective valuation. *Society for Neuroeconomics*, Toronto, Canada.

Lu, B., **Raio, C.M.**, Grubb, M., Shields, G.S., Slavich, G.M. and Glimcher, P.W. (2017) Ambiguity aversion, but not risk aversion, is associated with cumulative lifetime stress exposure. *Society for Neuroeconomics*, Toronto, Canada.

Homan, P., Lau, H.L., **Raio, C.M.**, Bach, D.R., Carmel, D. and Schiller, D. (2017) Affective flexibility without perceptual awareness. *Society for Neuroscience*, Washington. D.C.

**Raio, C.M.**, Hartley, C.A., Orederu, T.A., Li, J., and Phelps, E.A. (2017) Inflexible under stress: Acute stress impairs aversive value updating in humans. *Gordon Research Conference: Amygdala Function in Cognition, Emotion and Disease*. Easton, MA.

Banaver, N.V., **Raio, C.M.**, Konova, A.B. and Glimcher, P.W. (2017) Stress and cue-induced craving show distinct time-dependent enhancement of valuation. *Association for Psychological Science*. Boston, MA.

Brown, C., **Raio, C.M.**, and Neta, M. (2017) Cortisol responses enhance negative valence perception for ambiguous facial expressions. *Society for Affective Science*, Boston, MA.

**Raio, C.M.**, and Glimcher, P.W. (2016) Quantifying the subjective cost of self-control. *Society for Neuroscience*, San Diego, CA.

Lu, B., **Raio, C.M.**, Grubb, M., Shields, G.S., Slavich, G.M. and Glimcher, P.W. (2016) Lifetime stress exposure correlates with ambiguity aversion. *Society for Neuroeconomics*, Berlin, Germany.

**Raio, C.M.**, and Glimcher, P.W. (2016) Dynamic quantification of the subjective cost of self-control. *Society for Neuroeconomics*, Berlin, Germany.

**Raio, C.M.**, LeDoux, J.E., Augusto, C., Orederu, T. Lackovic, S.F. & Phelps, E.A. (2016) Nonconscious extinction of conditioned threat responses in humans. *Social, Affective Neuroscience Society*, NY, NY.

**Raio, C.M.**, FeldmanHall, O., Gaikwad, M., J., Phelps, E.A. (2015) Cooperative decision-making is decreased with acute stress exposure. *Annual Meeting of the Society for Neuroeconomics*, Miami, FL.

**Raio, C.M.**, FeldmanHall, O., Gaikwad, M., J., Phelps, E.A. (2015) Stress exposure decreases cooperative behavior. *Social, Affective Neuroscience Society*, Boston, MA.

Orederu, T., **Raio, CM.**, Hartley, CA., Phelps, EA. (2013) Stress impairs the reversal of conditioned fear. *Annual Meeting of the Society for Neuroscience*, San Diego, CA.

**Raio, CM**, Orederu, T, Palazzolo, L, Shurick, A and Phelps, EA. (2013) Regulating fear in the face of stress. *NYU Annual Neuroscience Retreat*, New Paltz, NY.

**Raio, CM**, Brignoni-Perez, E, and Phelps, EA. (2013) The influence of stress on extinction recall. *Gordon Research Conference: Amygdala in Health and Disease*, Easton, MA.

**Raio, CM**, Orederu, T, Palazzolo, L, Shurick, A and Phelps, EA . (2013) Regulating fear in the face of stress. *Social, Affective Neuroscience Society*, San Francisco, CA.

**Raio, CM**, Brignoni-Perez, E, Goldman, R and Phelps, EA. (2013) The influence of stress on extinction recall. *Cognitive Neuroscience Society*, San Francisco, CA.

**Raio, CM**, Brignoni-Perez, E, and Phelps, EA. (2012) The Influence of Stress on Extinction Recall. *Pavlovian Society*, Weehawken, NJ.

**Raio, CM**, Carmel, D, Carrasco, M and Phelps, EA (2012) Unconscious fear is rapidly acquired and forgotten. *Cold Spring Harbor Summer Institute: The Neurobiology of Social Cognition*, Long Island, NY.

**Raio, CM**, Orederu, T, Palazzolo, L and Phelps, EA (2012) Acute stress impairs the cognitive regulation of fear. *Cognitive Neuroscience Society*, Chicago, IL.

**Raio, CM**, Carmel, D, Carrasco, M and Phelps, EA (2012) Unconscious fear is rapidly acquired and forgotten. *Social, Affective Neuroscience Society*, New York, NY.

**Raio, CM**, Carmel, D, Carrasco, M and Phelps, EA (2011) Fear conditioning without awareness using continuous flash suppression. *Cognitive Neuroscience Society*, San Francisco, CA.

**Raio, CM**, Johnson, D, Schiller, D, Monfils, M-H, LeDoux, JE and Phelps, EA (2009) Behaviorally modifying fear memory: Extinction learning during reconsolidation blocks recovery of fear in humans. *Cognitive Neuroscience Society*, San Francisco, CA.

**Raio, CM**, Schiller, D, Monfils, M-H, and Phelps, EA. (2008). Altering Fear Memories: Reactivation, Extinction & Erasure. *New York University Research Poster Competition*, **GSAS Dean's First Prize**.

**Raio, CM**, Mulhern, SC, Sharot, T, Phelps, EA. (2007) Neural Mechanisms of the Optimism Bias. *New York University Research Poster Competition*, **GSAS Dean's First Prize**

### **Mentorship Experience (undergraduate/graduate mentees)**

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Spring 2016 – 2018 **Nidhi Banavar** (Post-Bacc Research Assistant), *Glimcher Lab, NYU*  
*Currently: Doctoral Student, University of California—Irvine*

Spring 2016 **Ben Lu** (PhD Rotational student), *Glimcher Lab, NYU*  
*Currently: Doctoral Student, New York University*

Spring 2015-2017 **Michelle Rosenblum** (Senior Honor's Thesis: Somer's High School)  
4<sup>th</sup> place winner, Westchester County Science & Engineering Competition  
*Currently: Undergraduate at Emory University*

Fall 2013 – 2015 **Mrulalini Gaikwad** (NYU Psychology Undergraduate Research Assistant)  
*Currently: Clinical Research Coordinator, NYU Medical Center*

Fall 2011 – 2015 **Temidayo Orederu** (Undergraduate Honor's Thesis, McNair Scholar)  
*Currently: MD/PhD candidate, Mt. Sinai School of Medicine*

Fall 2012 – 2013 **Rachel Goldman** (Undergraduate Honor's Thesis, Psychology)  
*Currently: PhD Candidate, Clinical Program, Yeshiva University*

Summer 2013 **Frederico DePaoli** (NSF-funded Neuroscience Summer fellowship)  
*Currently: Research Coordinator, Mt. Sinai School of Medicine*

Summer 2012 **Edith Brignoni-Perez** (NSF-funded Neuroscience Summer fellowship)  
*Currently: PhD Candidate, Neuroscience Program, Georgetown University*

Fall 2011 – 2012      **Laura Palazzolo** (Undergraduate Honor's Thesis, Pre-Medicine)  
*Currently: MD Candidate, SUNY-Downstate School of Medicine*

### **Workshops and Summer Institutes**

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Fall 2018              Computational Psychiatry Course: from theory to practice, San Diego, CA  
Computational Psychiatry Publishing Group

Spring 2018          Career Development Leadership Award Program, Washington, D.C.  
Anxiety & Depression Association of America

Fall 2017              Computational Psychiatry Course, Washington, D.C.  
Transcontinental Computational Psychiatry Workgroup

Summer 2017        Gordon Research Conference  
Amygdala Function in Emotion, Cognition and Disease

Spring 2017         Model Fitting Workshop  
Rutgers-Princeton Center for Cognitive Computational Neuropsychiatry

Fall 2015              Women in Science & Engineering Programming Workshop  
Software Carpentry Foundation

Summer 2012        Summer Institute: Biology of Social Cognition  
Cold Spring Harbor Laboratory

Fall 2010              Advanced Science Communication Writing Workshop  
Arthur Carter Journalism Institute

Spring 2010         Science Communication Workshop  
Arthur Carter Journalism Institute

### **Teaching Experience**

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Fall 2013              Head Teaching Assistant, *Introduction to Psychology*  
Department of Psychology, New York University

Fall 2012              Head Teaching Assistant, *Introduction to Psychology*  
Department of Psychology, New York University

Spring 2011          Teaching Assistant, *Cognitive Neuroscience*  
Department of Psychology, New York University

Summer 2010        Teaching Assistant, *Abnormal Psychology*  
Department of Psychology, New York University

Spring 2008         Teaching Assistant, *Introduction to Psychology*  
Department of Psychology, New York University



## **Professional Service**

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**2018** Co-Organizer, **Emotion & Decision-Making Pre-Conference**, *Society for Affective Science Annual Meeting*, Los Angeles, CA

**2018** Judge, Final Round, **NYC Science & Engineering Fair**

## **Professional Memberships**

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Society for Neuroscience

Society for Neuroeconomics

Social Affective Neuroscience Society

Anxiety & Depression Association of America

Cognitive Neuroscience Society

Association for Psychological Science

Pavlovian Society

Society for Affective Science

## **Ad hoc Reviewer**

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*Neuron, Current Biology, Neuropsychopharmacology, Scientific Reports, Social Cognitive and Affective Neuroscience, Journal of Experimental Psychology: General, Biological Psychiatry, Cerebral Cortex, Emotion, Behavioral Neuroscience, Neurobiology of Learning & Memory, Neurobiology of Stress, Psychoneuroendocrinology, Psychological Medicine.*