James J. DiCarlo MD, PhD

Curriculum vitae updated May 2016

Contact information

Department of Brain and Cognitive Sciences and
McGovern Institute for Brain Research
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Degrees

1998 Ph.D. Biomedical Engineering, Johns Hopkins University, Baltimore, MD
1998 M.D., Johns Hopkins University School of Medicine, Baltimore, MD
1990 B.S.E. with *Highest Distinction* in Biomedical Engineering,
Northwestern University, Evanston, IL

Employment

Present appointment

2012-Present Peter de Florez Professor of Neuroscience
Head, Department of Brain and Cognitive Sciences
Investigator, McGovern Institute for Brain Research
Massachusetts Institute of Technology, Cambridge, MA

Previous appointments

2007-2012 Associate Professor of Neuroscience (tenured 2009)
McGovern Institute for Brain Research
Department of Brain and Cognitive Sciences
Massachusetts Institute of Technology, Cambridge, MA

2002-2007 Assistant Professor of Neuroscience,
McGovern Institute for Brain Research
Department of Brain and Cognitive Sciences
Massachusetts Institute of Technology, Cambridge, MA

1998 - 2002 Research Associate, Howard Hughes Medical Institute and
Division of Neuroscience, Baylor College of Medicine, Houston, TX
Laboratory of Dr. John H.R. Maunsell

1998 Postdoctoral Fellow, Krieger Mind/Brain Institute,
Johns Hopkins University, Baltimore, MD
Laboratory of Dr. Kenneth O. Johnson

Other research appointments

1992-1998 Research Assistant, Department of Biomedical Engineering and Krieger Mind/Brain Institute, Johns Hopkins University
1991 Research Assistant, Department of Psychology, Johns Hopkins University
1987-1990 Research Assistant, Department of Psychology, Northwestern University
1987-1989 Research Intern, National Aeronautics and Space Agency, Cleveland, OH

External positions held

Section Co-Editor, "Sensation and Perception", The Cognitive Neurosciences textbook (2011-2013)
General Co-Chair, *Computational and Systems Neuroscience (COSYNE)* (2011-2012)
Program Committee Co-Chair, *Computational and Systems Neuroscience (COSYNE)* (2010-2011)
Program Committee, *Computational and Systems Neuroscience (COSYNE)* (2008-2011)
Program Planning Committee, *Society for Neuroscience* (2007-2010)
Technical Advisory Board, *Numenta, Inc.*, Menlo Park, CA (2008-2011)
Consultant, *The PreTesting Company, Inc*, Tenafly, NJ (2008)
Scientific Advisor, *BayLabs Inc.*, San Francisco, CA (2015-present)

Membership:

Society for Neuroscience (1994-present)
American Physiological Society
American Association for the Advancement of Science (AAAS)
Associate Member, Canadian Institute for Advanced Research (CIFAR), Neural Computation and Adaptive Perception (2010-present)

Honors and awards

McKnight Scholar Award in Neuroscience, McKnight Foundation, 2006-2009
Surdna Research Foundation Award, MIT, 2005
MIT School of Science Prize for Excellence in Undergraduate Teaching, 2005
Pew Scholar in the Biomedical Sciences, 2002-2006
Alfred P. Sloan Research Fellow, 2002
Martin and Carol Macht Young Investigator Research Prize, Johns Hopkins University, 1998
National Institutes of Health Medical Scientist Training Program Award, Johns Hopkins University, 1990-1998
Honors in Biomedical Engineering, Northwestern University, 1990

Student and postdoctoral supervision

Sponsored undergraduates in research (UROP)

David Van Aken (MIT class of 2003), fall 2002
Nadja Oertelt (MIT class of 2007), 2003-2004, 2007
Jonathan Karr (MIT class of 2006), spring 2006
Prashant Dilwali (MIT class of 2008), spring 2006
Julia Green (Brown class of 2008), summer 2006
Michelle Fogerson (MIT class of 2007), spring 2005-2006
Imran Hendley (MIT class of 2007), summer 2006

Sabrina Tsang (MIT class of 2008), summer 2007 - 2008
Laura Mariano (UCONN class of 2008) AMGEN Scholar, Summer 2007
Rebecca Rothkopf (Wellesley class of 2009), summer 2008
Radhika Palkar (Univ. of California at Irvine class of 2008), MSRP Student, Summer 2008
Isaac Buenrostro (MIT class of 2011), fall 2008
Ethan Solomon (MIT class of 2012), fall 2009-2012
Edith Reshef (MIT class of 2011), spring 2010-2011
Darren Seibert (U of Houston class of 2012), summer 2011
Cesar Echavarria (MIT class of 2012), Fall 2011-2012
Christopher Compton (MIT class of 2018), Spring 2015-present
Archana Ram (MIT class of 2018), Summer 2015-present
Richard Oats (MIT class of 2018), Fall 2015-present

Masters students thesis supervised

Vuong, Yihvan, ME Biological Engineering, MIT, 2003-2004
Current position: Materials Engineer, US Department of Defense, Washington, DC (USA)

Oreper, Daniel, ME Electrical Engineering and Computer Science, MIT, 2004-2006
Current position: Senior Software Engineer, BAE Systems, Burlington, MA (USA)

Pinto, Nicolas, ME Computer Science, UTBM, France 2006-2007
Current position: Postdoctoral fellow, MIT / Harvard (USA).

Radwan, Basma, ME Biomedical Engineering, Boston University, 2007-2008
Current position: PhD candidate, New York University, New York, NY (USA).

Ardila, Diego, ME Computational Neuroscience, MIT.
Current position: Google, CA (USA)

Visiting students supervised

Pagan, Marino, ME Control Engineering, University of Pisa, Italy, 2008
Current position: PhD candidate, University of Pennsylvania, Philadelphia, PA (USA).

Corda, Benoit, ME Computer Science, University of Technology of Compiégne, France
Current position: Second year PhD student at New York University, New York, NY (USA).

Doukhan, David, École Pour l'Informatique et les Techniques Avancées, France
Current position: PhD student at LIMSI / CNRS (France)

Mirza-Mohammadi, Mehdi. MS Artificial Intelligence, Universitat Politècnica de Catalunya, Spain
Current position: Trainee at Idiap Research Institute, Martigny, (Switzerland)

Bendale, Abjijit. MS Computer Science, University of Colorado, 2009
Current position: PhD Candidate, Media Lab, MIT (USA)

Barhomi, Youseff. MS Mathematics, Vision and Learning, École Polytechnique. France
Current position: Research Associate, Laboratory of Dr. Thomas Serre, Brown University (USA).

Moghimi Pantea. ME Biomedical Engineering, Chalmers University of Tech., Gothenburg, Sweden, 2011
Current position: PhD Candidate, U of Minnesota (USA)

Zhang, Xiyaun. MS Mathematics, Vision and Intelligence, École Normale Superieur de Cachan, France,

2011

Iqbal, Asim. MSc Neural Systems and Computation, University and ETH Zurich, Switzerland, 2015-2016.

Ph.D. students supervised (primary advisor role)

Cox, David. *The role of visual experience in the tolerance of neuronal object representations in monkeys and humans.* Supervised 2002-2007 (PhD granted 2007 Dept. of Brain and Cog Sciences, MIT). Current position: Assistant Professor of Molecular and Cellular Biology, Harvard University, Cambridge, MA

Li, Nuo. *The construction of invariant neuronal object representations in the primate ventral stream*. Supervised 2005-2010 (PhD granted 2010 Dept. of Brain and Cog Sciences, MIT). Current position: Assistant Professor, Baylor College of Medicine, TX.

Pinto, Nicolas. *High-throughput exploration of bio-inspired visual object recognition algorithms.* Supervised 2006-2010 (PhD granted 2010 Dept. of Brain and Cog Sciences, MIT). Current position: CTO & Chief Scientist at Perceptio (startup), CA

Aparicio, Paul (PhD candidate 2003-2013), Dept. of Brain and Cognitive Sciences, MIT. *Functional organization of object-selectivity in monkey temporal lobe.* Supervised 2005-2013. Current position: Postdoctoral Associate, NIH, Laboratory of Dr. Bruce Cummings.

Hong, Ha (PhD candidate 2009-in progress), Health Sciences Technology Program, MIT.
The performance of the ventral visual stream in real-world visual object recognition.
Supervised 2009-2015
Current position: Investigator & Co-Founder of BayLabs, Inc., CA

Rajalingham, Rishi (PhD candidate 2012-in progress), Dept. of Brain and Cognitive Sciences, MIT. Supervised 2013-present

Seibert, Darren (PhD candidate 2012-in progress), Dept. of Brain and Cognitive Sciences, MIT. Supervised 2013-present.

Hyodong Lee (PhD candidate 2013-in progress), Dept. of Electrical Engineering & Computer Science, MIT. Supervised 2014-present

Postdoctoral researchers supervised (primary supervisor role)

Hung, Chou (Ph.D.) 2002-2006
Read-out and write-in of neuronal object representations in non-human primates.
Current position: Research Assistant Professor, Department of Neuroscience, Georgetown University.

Op de Beeck, Hans (Ph.D., Human Frontiers Long-term Postdoctoral Fellow Award) 2003-2006
Functional organization of neuronal object representations in monkeys and humans; Effects of visual experience.
Current position: Tenured Associate Professor, Laboratory of Experimental Psychology, University of Leuven, Leuven, Belgium

Zoccolan, Davide (Ph.D., Human Frontiers Long-term Postdoctoral Fellow Award) 2003-2008

Selectivity and tolerance of neuronal populations underlying object recognition in clutter.
Current position: Assistant Professor, International School for Advanced Studies (SISSA), Trieste, Italy

Papanastassiou, Alexander (M.D.) 2005-2007
Spiking- and fMRI-determined spatial organization of object representations in monkeys.
Current position: Assistant Professor, Department of Neurosurgery, University of Texas Health Science Center, San Antonio,Texas

Rust, Nicole (Ph.D., NIH NRSA Postdoctoral Award) 2006-2009
Transformation of visual representations along the ventral visual processing stream.
Current position: Assistant Professor, Department of Psychology, University of Pennsylvania

Majaj, Najib (Ph.D., New York University) 2007-present
The role of learning in building invariant neuronal object representation and supporting perception.
Current position: Senior Research Scientist, Center for Neural Science, New York University

Cadieu, Charles (Ph.D., University of California, Berkeley) 2011-2014
Understanding the neural basis of visual face processing
Current position: Co-Founder and CEO at BayLabs (Stealth Startup), San Francisco, CA

Jia, Xiaoxuan (Ph.D., Albert Einstein College of Medicine) 2012-2015
Unsupervised learning of object representation in primate temporal lobe
Current position: In transition.

Issa, Elias (Ph.D., Johns Hopkins University; NIH NRSA Postdoctoral Award) 2008-present
Neural properties of fMRI identified face, body, and object selective regions in IT cortex
Pending position: Assistant Professor, Columbia University, NY

Afraz, Seyed Reza (Arash) (Ph.D., Harvard University) 2009-present
Manipulation of the neural responses in IT cortex through light-sensitive channels.
Pending position: Assistant Professor, US National Institutes of Health, Bethesda, MD

Yamins, Daniel (Ph.D., Harvard University) 2010-present
High-throughput exploration of bio-inspired object recognition algorithms.
Pending position: Assistant Professor, Stanford University, CA.

Ohayon, Shay (Ph.D., California Institute of Technology) 2014-present
Deep Brain Imaging Using Fluorescence Microendoscopy

Kubilius, Jonas (Ph.D.,University of Leuven, Belgium) 2015-present
Using deep convolutional neural networks to understand primate object perception

Kar, Kohitij (Ph.D., Rutgers University) 2015-present
Using large scale neurophysiology and optogenetics to test the role of bi-directional computing in visual object recognition

Teaching experience

CBMM Summer Course Instructor (graduate / postdoctoral course)
Woods Hole, MA
Summers taught: 2014, 2015
Role: Approximately 3 hours of direct lecture teaching.

MIT 9.02 Systems Neuroscience Laboratory (undergraduate neurophysiology laboratory)
Department of Brain and Cognitive Sciences, MIT
Semesters taught: spring 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2015*
Role: Lead instructor (along with one or two co-instructors), course design, organization, execution and administration.
Approximately 10 hours of lecture and 60 hours of direct laboratory teaching per semester.
(* reduced role: one week only)

MIT 9.720 Neural Basis of Object Recognition in Monkeys and Humans (graduate course)
Department of Brain and Cognitive Sciences, MIT
Semesters taught: spring 2005, fall 2006, spring 2008, fall 2009
Role: Co-instructor (of two), course design, organization, execution and administration
Approximately 10 hours of lecture and 30 hours of shared teaching per semester.

MIT Matlab (undergraduate IAP course)
Department of Brain and Cognitive Sciences, MIT
Semesters: IAP 2008, 2009

MIT 9.95 Research Topics in Neuroscience (undergraduate IAP course)
Department of Brain and Cognitive Sciences, MIT
Semesters taught: IAP 2004, IAP 2005, IAP 2006, IAP 2007, !AP 2009, IAP 2010, IAP 2011
Role: Lecturer, Approximately 3 hours of direct lecture teaching per semester.

MIT Responsible Conduct in Science
Department of Brain and Cognitive Sciences, MIT
Semesters taught: IAP 2004, IAP 2005, IAP 2006, IAP 2007, !AP 2009, IAP 2010
Role: Guest instructor on ethics of animal research, Approximately 3 hours of student instruction.

Computational Neuroscience of Vision (graduate / postdoctoral course)
Cold Spring Harbor Laboratories Summer Courses, Cold Spring, NY
Semesters taught: summer 2004
Role: Co-instructor, Approximately 4 hours of direct lecture teaching.

Methods in Computational Neuroscience (graduate / postdoctoral course)
Marine Biological Laboratory at Woods Hole, MA
Semesters taught: summer 2008, 2009, 2010
Role: Guest lecturer, Approximately 2 hours of direct lecture teaching.

BU CN730 Models of Visual Perception (graduate)
Department of Cognitive and Neural Systems, Boston University
Semesters taught: spring 2007
Role: Guest lecturer, Approximately 3 hours of direct lecture teaching.

Neural Networks (undergraduate course)
Department of Biomedical Engineering, Johns Hopkins University

Semesters taught: 1995
Role: Teaching assistant

Computational models of the Neuron (undergraduate course)
Department of Biomedical Engineering, Johns Hopkins University
Semesters taught: 1994
Role: Teaching assistant

Human Histology (medical student course)
School of Medicine, Johns Hopkins University
Semesters taught: 1994
Role: Teaching assistant

Service

MIT Internal service:

Departmental service (Dept. of Brain and Cognitive Sciences, BCS)

Department Head (2012-present)
Chair, BCS Council (2012-present)
BCS Education Committee, standing member (2009-present)
Principal Investigator for NEI-funded BCS Core Vision Processes Grant (2010-present).
Primary supervisor of BCS Electronics Fabrication and Repair Shop (2004-present)
Primary supervisor of BCS Machine Shop (2010-present)
McGovern / Martinos Imaging Center user committee, McGovern Institute for Brain Research, MIT (2005-present).
BCS Graduate Admission Committee (2009-present)
BCS Research Rotation Coordinator (2009-2012)
Principal Investigator for NIH-funded Graduate Student Training Grant (2014-present)

MIT Faculty search committees:
McGovern Institute for Brain Research (2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012);
Dept. of Brain and Cognitive Sciences (2006, 2007, 2008, 2009, 2011, 2012, 2014, 2015, 2016)

Institute-wide service

Head, MIT's Department of Brian and Cognitive Sciences (2012-present)
Science Council, School of Science (2012-present)
MIT Committee on Curricula (CoC) (2011-2012)
MIT Pre-health Undergraduate Student Advisor (2009-2012)
Participation in MIT commencement 2003, 2011, 2012

Ph.D. student committees (MIT, outside of primary PhD mentorship role)
Liu, Jia. Dept. of Brain and Cognitive Sciences, MIT, 2002-2003 (PhD 2003)
Wu, Wan-Chen. Dept. of Mechanical Engineering, MIT, 2003-2006 (PhD 2006)
Serre, Thomas . Dept. of Brain and Cognitive Sciences, MIT, 2004-2006 (PhD 2006)
Balas, Benjamin. Dept. of Brain and Cognitive Sciences, MIT, 2006-2007 (PhD 2007)
Feingold, Joseph. Dept. of Brain and Cognitive Sciences, MIT, 2002-present
Haushofer, Johannes. Dept. of Neurobiology, Harvard, 2004-2007 (PhD 2007)

Schwarzlose, Rebecca. Dept. of Brain and Cognitive Sciences, MIT, 2005-2007 (PhD 2008)
Cronin, Beau. Dept. of Brain and Cognitive Sciences, MIT, 2007-2008 (PhD 2008)
Tan, Cheston. Dept. of Brain and Cognitive Sciences, MIT, 2009-2013 (PhD 2013).
Ghadooshahy, Azriel. Dept. of Brain and Cognitive Sciences, MIT, 2011-2015 (PhD 2015)
Sam Norman-Haignere. Dept. of Brain and Cognitive Sciences, MIT, 2011-2015 (PhD 2015)
Kornblith, Simon. Dept. of Brain and Cognitive Sciences, MIT, 2011-present
Lynch, Galen. Dept. of Brain and Cognitive Sciences, MIT, 2012-present
Lafer-Sousa, Rosa. Dept. of Brain and Cognitive Sciences, MIT, 2014-present
Kell, Alex. Dept. of Brain and Cognitive Sciences, MIT, 2014-present

MIT undergraduate advisees (past and present)
Kim, JinSuk (class of 2005), Won, Annie (class of 2005), Bobrow, Laurel (class of 2006), Golji, Javad (class of 2006), Liang, Joy (class of 2006), Dohlman, Thomas (class of 2007), Motola-Barnes, Rebecca (class of 2007), Evrony, Gilad (class 2007), Garcia, Adrian (class of 2007), Nakano, Lisa (class of 2008), Wentz, Christian (class of 2008), Chandawarker, Akash (class of 2009), Pollard, Courtney (class of 2009), Thornton, Elliot (class of 2009), Pointer, Kelli (class of 2009), Hatch, Mary (class of 2008), Greenman, Susan (class of 2011), DeBoer, Caroline (class of 2011), Dere, Kathryn (class of 2013), Feather, Jenelle (class of 2013), Kim, Heejung (class of 2013), Gaur, Priyanka (class of 2016), Gaillard, Schuyler (class of 2017),

External Service:

Society for Neuroscience, Annual Meeting **Program Planning Committee** (2007-2010)

Computational and Systems Neuroscience (COSYNE), Annual Meeting **Program Committee** (2008-2010), **Program Committee Co-Chair** (2010-2011), **General Co-Chair** (2011-present)

Reviewer for *Behavioral Brain Research, Biological Cybernetics, Cerebral Cortex, Computation and Systems Neuroscience (COSYNE), Current Biology, Journal of Cognitive Neuroscience, Journal of Neurophysiology, Journal of Neuroscience, Journal of Neuroscience Methods, Learning and Memory, Nature, Nature Neuroscience, Neural Information Processing Systems (NIPS), Neuron, Pattern Recognition Letters, Public Library of Science (PLOS), Proceedings of the National Academy of Sciences (PNAS), Visual Neuroscience, Science*

Study section reviewer
- NIH Sensorimotor Integration (SMI) study section, Ad hoc member.
- NSF study section, Ad hoc reviewer
- NIH Mechanisms of Sensory, Perceptual and Cognitive Neuroscience (SPC) Study Section, Ad hoc member (2012), Standing member 2012-present.
- NIH NEI Core Grant Review Panel (2016) Ad hoc member.

Ph.D. student committees (outside of MIT)
Maimon, Gaby. Dept. of Neurobiology, Harvard Medical School, 2004-2005 (PhD 2005)
Mruczek, Ryan. Dept. of Neuroscience, Brown University, 2006-2007 (PhD 2007)
Cury, Kevin. Dept. of Neurobiology, Harvard Medical School (PhD 2011)
Ni, Amy. Dept. of Neurobiology, Harvard Medical School (PhD candidate)
Millman, Daniel. Dept. of Neurobiology, Harvard Medical School (PhD candidate)

Science Fair Judge: The Driscoll School Science Fair (Grades K-8), March 2011, 2012.

Publications

Refereed papers (* indicates papers arising from a supervised PhD thesis)

* Hong H, Yamins DL, Majaj NJ, and DiCarlo JJ. Explicit information for category-orthogonal object properties increases along the ventral stream. ***Nature Neuroscience***. (2016)

* Majaj NJ, Hong H, Solomon EA, and DiCarlo JJ. Simple Learned Weighted Sums of Inferior Temporal Neuronal Firing Rates Accurately Predict Human Core Object Recognition Performance. ***Journal of Neuroscience*** 35(39): 13402-18 (2015) PMID: 26424887

* Rajalingham R., Schmidt K., DiCarlo JJ. Comparison of Object Recognition Behavior in Human and Monkey. ***Journal of Neuroscience*** 35(35) 2127-12136 *(*2015). PMCID: PMC4556783

Afraz A, Boyden ES, DiCarlo JJ. Optogenetic suppression of “face neurons” reveals their causal role in face gender discrimination behavior. ***PNAS*** 112 (21) 6730–6735 (2015) PMCID: PMC4450412

Cadieu CF, Hong H, Yamins D, Pinto N, Ardila D, Soloman EA, Majaj NJ, and DiCarlo JJ. Deep Neural Networks Rival the Representation of Primate IT Cortex for Core Visual Object Recognition. ***PLoS Computational Biology***, 10(12):e1003963 (2014). PMCID: PMC4270441

Yamins D, Hong H, Cadieu C, Soloman E, Siebert D and DiCarlo JJ. Performance-Optimized Hierarchical Models Predict Neural Responses in Higher Visual Cortex. ***PNAS*** 111 (23) 8619-8624 (2014) PMCID: PMC4060707

Issa EB, Papanastassiou AM, and DiCarlo JJ. Large-scale, high-resolution neurophysiological maps underlying FMRI of macaque temporal lobe. ***Journal of Neuroscience*** 33(38): 15207-19 (2013).

Yamins DL, Hong H, Cadieu C, and DiCarlo JJ. Hierarchical Modular Optimization of Convolutional Networks Achieves Representations Similar to Macaque IT and Human Ventral Stream. ***Neural Information Processing Systems*** (2013). PMCID: PMC4060707

Baldassi C, Alemi-Neissi A, Pagan M, DiCarlo JJ, Zecchina R, Zoccolan D. Shape similarity, better than semantic membership, accounts for the structure of visual object representations in a population of monkey inferotemporal neurons. ***PLoS Computational Biology*** 9(8): e1003167 (2013).

Rust N and DiCarlo JJ. Balanced increases in selectivity and tolerance produce constant sparseness along the ventral visual stream. ***Journal of Neuroscience*** 32(30): 10170-10182 (2012).

Issa EB and DiCarlo JJ. Precedence of the eye region in neural processing of faces. ***Journal of Neuroscience*** 32(47: 16666-82 (2012).

* Li N and DiCarlo JJ. Neuronal learning of invariant object representation in the ventral visual stream is not dependent on reward. ***Journal of Neuroscience*** 32(19): 6611-20 (2012).

DiCarlo JJ, Zoccolan DD, and Rust N. How does the ventral visual stream solve object recognition? Refereed Perspective in ***Neuron*** 73(3): 415-34 (2012).

Majaj N, Hong H, Solomon E, and DiCarlo JJ. A unified neuronal population code fully explains human object recognition. Accepted for oral presentation (top 3% of papers); ***Computation and Systems Neuroscience (COSYNE)***, Salt Lake City, UT (2012).

* Pinto N, Barhomi Y, Cox DD, and DiCarlo JJ. Comparing State-of-the-Art Visual Features on Invariant Object Recognition Tasks. ***IEEE Workshop on Applications of Computer Vision,*** Kona, HI (2011).

Rust N and DiCarlo JJ. Selectivity and tolerance ("invariance") both increase as visual information

propagates from cortical area V4 to IT. ***Journal of Neuroscience*** 30: 12978 - 12995 (2010).

* Li N and DiCarlo JJ. Unsupervised Natural Visual Experience Rapidly Reshapes Size-Invariant Object Representation in Inferior Temporal Cortex. ***Neuron*** 67(6): 1062 - 1075 (2010).

* Pinto N, Doukan D, DiCarlo JJ, and Cox DD. A high-throughput screening approach to discovering good forms of visual representation. ***PLoS Computational Biology*** 5(11): e1000579 (2009).

* Li N, Cox DD, Zoccolan D, DiCarlo JJ. What response properties do individual neurons need to underlie position and clutter "invariant" object recognition? ***J Neurophysiology***: 102: 360-376 (2009).

* Zoccolan D, Oertelt N, DiCarlo JJ, and Cox DD. Rodent model for the study of invariant object recognition, ***PNAS*** 106 (21):8748-53 (2009)

* Pinto N, DiCarlo JJ, and Cox DD. How far can you get with a modern face recognition test set using only simple features? ***IEEE Computer Vision and Pattern Recognition*** (2009)

* Cox DD, Papanastassiou A, Oreper D, Andken B, and DiCarlo JJ. High-resolution three-dimensional microelectrode brain mapping using stereo microfocal x-ray imaging, ***Journal of Neurophysiology*** 100: 2966-2976 (2008)

Op de Beeck H, DiCarlo JJ, Goense J, Grill-Spector K, Papanastassiou A, Tanifuji M, and Tsao D. Fine-scale spatial organization of face and object selectivity in the temporal lobe: Do fMRI, optical imaging, and electrophysiology agree? ***Journal of Neuroscience*** 28: 11796-11801 (2008).

* Pinto N, DiCarlo JJ, and Cox DD. Establishing Good Benchmarks and baselines for Face Recognition. Proceedings of the ***European Conference on Computer Vision*** (ECCV) (2008).

* Li N and DiCarlo JJ. Unsupervised natural experience rapidly alters invariant object representation in visual cortex ***Science***, 321:1502-07 (2008).

* Cox DD and DiCarlo JJ. Does learned shape selectivity in inferior temporal cortex automatically generalize across retinal position? ***Journal of Neuroscience***, 28: 10045-55 (2008).

* Pinto N, Cox DD, DiCarlo JJ. Why is real-world object recognition hard? ***PLoS Computational Biology***, 4(1): e27 (2008).

Op de Beeck H, Deutsch J, Vanduffel W, Kanwisher N, DiCarlo JJ. A stable topography of selectivity for unfamiliar shape classes in monkey inferior temporal cortex. ***Cerebral Cortex***, 18: 1676-94 (2008).

Zoccolan D, Kouh M, Poggio T and DiCarlo JJ. Trade-off between shape selectivity and tolerance to identity-preserving transformations in monkey inferotemporal cortex. ***Journal of Neuroscience***, 27: 12292-307 (2007).

* DiCarlo JJ and Cox DD. Untangling invariant object recognition. ***Trends in Cognitive Neuroscience*** 11: 333-341 (2007).

Op de Beeck H, Baker C, DiCarlo JJ and Kanwisher N. Discrimination training alters object representations in human extrastriate cortex. ***Journal of Neuroscience*** 26: 13025-36 (2006).

Kreiman GK, Hung CP, Kraskov A, Quian Quiroga R, Poggio TA, DiCarlo JJ. Object selectivity of local field potentials and spikes in the macaque inferior temporal cortex. ***Neuron*** 49: 433-445 (2006).

Hung CP, Kreiman GK, Poggio T, and DiCarlo JJ. Fast read-out of object identity from macaque inferior temporal cortex. ***Science*** 310: 863-866 (2005).

* Zoccolan, D, Cox DD, DiCarlo JJ. Multiple objects response normalization in monkey inferotemporal cortex. ***Journal of Neuroscience*** 36: 8150-64 (2005).

* Cox DD, Meier P, Oertelt N, and DiCarlo JJ. "Breaking" position invariant object recognition. ***Nature Neuroscience*** 8:1145-1147 (2005).

DiCarlo JJ and Maunsell JHR. Using neuronal latency to determine sensory-motor processing pathways in reaction time tasks. ***Journal of Neurophysiology*** 5: 2974-86 (2005).

DiCarlo JJ and Maunsell JHR. Anterior inferotemporal neurons of monkeys engaged in object recognition can be highly sensitive to object retinal position. ***Journal of Neurophysiology*** 89: 3264-3278 (2003).

DiCarlo JJ and Maunsell JHR. Form representation in monkey inferotemporal cortex is virtually unaltered by free viewing. ***Nature Neuroscience*** 3: 814-821 (2000).

DiCarlo JJ and Johnson KO. Changes in stimulus scanning direction reveal the spatial and temporal receptive field structure of neurons in primary somatosensory cortical area 3b of the alert monkey. ***Journal of Neuroscience*** 20: 495-510 (2000).

DiCarlo JJ and Johnson KO. Velocity invariance of receptive field structure in somatosensory cortical area 3b of the alert monkey. ***Journal of Neuroscience*** 19: 401-419 (1999).

DiCarlo JJ, Johnson KO, Hsiao SS. Structure of receptive fields in area 3b of primary somatosensory cortex in the alert monkey. ***Journal of Neuroscience*** 18: 2626-2645 (1998).

DiCarlo JJ, Lane JW, Hsiao SS, and Johnson KO. Marking microelectrode penetrations with fluorescent dyes. ***Journal of Neuroscience Methods*** 64: 75-81 (1996).

Schmajuk NA and DiCarlo JJ. Stimulus configuration, classical conditioning and hippocampal function. ***Psychological Review*** 99: 268-305 (1992).

Schmajuk NA and DiCarlo JJ. A neural network approach to hippocampal function in classical conditioning. ***Behavioral Neuroscience*** 105: 125-153 (1990).

Non-refereed publications

Yamins DL and DiCarlo JJ. Using goal-driven deep learning models to understand sensory cortex. ***Nature Neuroscience*** 19(3):356-65 (2016).

Yamins DL and DiCarlo JJ. Eight open questions in the computational modeling of higher sensory cortex. ***Current Opinion in Neurobiology***, 37, 114-120 (2016).

Afraz A, Yamins DL, DiCarlo JJ. Neural Mechanisms Underlying Visual Object Recognition. In ***Cold Spring Harbor symposia on quantitative biology*** (Vol. 79, pp. 99-107). Cold Spring Harbor Laboratory Press (2014)

DiCarlo JJ. Do we have a strategy for understanding how the visual system accomplishes object recognition? ***Object Categorization: Computer and Human Vision Perspectives,*** Dickenson A, Leonardis A, Schiele B, and Tarr MJ (Eds.), Cambridge University Press (2010)

DiCarlo JJ. Making faces in the brain (*News & Views)*. ***Nature*** 442: 644 (2006).

Kourtzi Z and DiCarlo JJ. Learning and neural plasticity in visual object recognition. ***Current Opinion in Neurobiology*** 16: 152-8 (2006).

Hung CP, Kreiman GK, Poggio TA, DiCarlo JJ. Ultra-fast object recognition from few spikes, ***MIT AI Memo 2005-022*** (2005).

Kreiman GK, Hung CP, Poggio TA, DiCarlo JJ. Selectivity of local field potentials in macaque inferior temporal cortex, ***MIT AI Memo 2004-020*** (2004).

DiCarlo JJ and Johnson KO. Receptive field structure in cortical area 3b of the alert monkey. ***Behavioral Brain Research*** 135: 167-178 (2002).

Hsiao SS, Johnson KO, Twombly IA, DiCarlo JJ. Form processing and attention effects in somatosensory cortex. ***Somesthesis and the Neurobiology of the Somatosensory Cortex***, Birkhauser, O. Franzen, R. Johansson, and L. Terenius (Eds.), Birkhauser Verlag Basel, Switzerland (1996).

Schmajuk NA and DiCarlo JJ. Neural dynamics of hippocampal modulation of classical conditioning. ***Neural Network Models of Conditioning and Action***, M. Commons, S. Grossberg, and J.E.R. Staddon (Eds.), Lawrence Erlbaum Assoc., Hillsdale, NJ, (1991).

Schmajuk NA and DiCarlo JJ. A hippocampal theory of schizophrenia. ***Behavioral and Brain Sciences*** 14: 47-49 (1991).

Abstracts

Issa EB, Cadieu C & DiCarlo JJ. Evidence that the ventral stream uses gradient coding to perform hierarchical inference. ***COSYNE*****,** Salt Lake City, UT (2015).

Yamins D, Hong H, DiCarlo JJ. Emergence of identity-independent object properties in ventral visual cortex. ***COSYNE***, Salt Lake City, UT (2015).

Hong H, Yamins D, Majaj N, DiCarlo JJ. IT cortex contains a general-purpose visual object representation. ***COSYNE***, Salt Lake City, UT (2014).

Seibert D, Yamins D, Hong H, DiCarlo JJ, Gardner J. Quantifying and modeling the emergence of object recognition in the vernal stream. ***COSYNE***, Salt Lake City, UT (2014).

Yamins D, Hong H, Seibert D, DiCarlo JJ. Predicting IT and V4 neural responses with performance-optimized neural networks. ***COSYNE***, Salt Lake City, UT (2014).

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Aparicio, EB and DiCarlo, JJ. Is the monkey middle face patch a module for face detection? ***Society for Neuroscience*** *Annual Meeting*, Washington, DC (Nov. 2011)

Pagan A, Alemi-Neissi A, Baldassi C, Zecchina R, DiCarlo JJ, Zoccolan D. From luminance to semantics: how natural objects are represented in monkey inferotemporal cortex. ***COSYNE***, Salt Lake City, UT (2011).

Aparicio, P., Issa EB, and DiCarlo, JJ. What is the middle face patch? ***Society for Neuroscience*** *Annual Meeting*, San Diego, CA (Nov. 2010)

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Pinto N, Cox DD, DiCarlo JJ. Unlocking Brain-Inspired Computer Vision. GPU@BU, Boston University, MA (2009).

Pinto N, Cox DD, DiCarlo JJ. The Visual Cortex and GPUs. GPU Computing for Biomedical Research, MGH Boston, MA (2009).

Pinto N, Cox DD, DiCarlo JJ. Unlocking Biologically-Inspired Computer Vision: a High-Throughput Approach. ***NVIDIA GPU Technology Conference***, San Jose, CA (2009).

Li N, and DiCarlo JJ. The size invariance of neuronal object representations can be reshaped by temporally contiguous visual experience ***Society for Neuroscience*** *Annual Meeting*, Chicago, IL (Oct. 2009)

Rust N and DiCarlo JJ. Balanced increases in selectivity and invariance produce constant sparseness across the ventral visual pathway, ***Vision Science Society*** *Annual Meeting*, (May. 2009)

Papanastassiou A, Op de Beeck H, Andken B and DiCarlo JJ. A systematic exploration of the relationship of fMRI signals and neuronal activity in the primate temporal lobe, ***Society for Neuroscience*** *Annual Meeting (mini-symposium)*, Washington, DC (Nov. 2008)

Majaj N, Li N and DiCarlo JJ. Inferior temporal cortex robustly signals encounters with new objects, but is not an online representation of the visual world***, Society for Neuroscience*** *Annual Meeting*, Washington, DC (Nov. 2008)

Rust N and DiCarlo JJ. Increases in selectivity are offset by increases in tolerance ("invariance") to maintain sparseness across the ventral visual pathway, ***Society for Neuroscience*** *Annual Meeting*, Washington, DC (Nov. 2008)

Li N, and DiCarlo JJ. Unsupervised natural experience rapidly alters invariant object representation in visual cortex, ***Society for Neuroscience*** *Annual Meeting*, Washington, DC (Nov. 2008)

Rust N, and DiCarlo JJ. Concurrent increases in selectivity and tolerance produce constant sparseness across the ventral visual stream. ***COSYNE***, Salt Lake City, Utah (Feb. 2008).

Li N, and DiCarlo JJ. Natural experience drives online learning of tolerant object representations in visual cortex. ***COSYNE***, Salt Lake City, Utah (Feb. 2008).

Cox DD*, Pinto N*, Doukhan D, Corda B and DiCarlo JJ. A high-throughput screening approach to discovering good forms of visual representation. ***COSYNE***, Salt Lake City, Utah (Feb. 2008).

Pinto N*, Cox DD*, Corda B, Doukhan D and DiCarlo JJ. Why is real-world object recognition hard?: Establishing honest benchmarks and baselines for object recognition. ***COSYNE***, Salt Lake City, Utah (Feb. 2008).

Zoccolan D, Cox D, Oertelt N, Radwan B, Tsang S and DiCarlo JJ. Is the rodent a valuable model system for studying invariant object recognition? ***COSYNE***, Salt Lake City, Utah (Feb. 2008).

Li N, Cox DD, Zoccolan D, and DiCarlo JJ. Flexible and robust object recognition in inferior temporal cortex supported by neurons with limited position and clutter tolerance. ***Society for Neuroscience***, Atlanta, GA, Oct. (2006).

Zoccolan D, Kouh M, Poggio T and DiCarlo JJ. Trade-off between shape selectivity and tolerance to identity-preserving transformations in monkey inferotemporal cortex. ***Gordon Conference:*** *Sensation and the Natural Environment*, Bozeman, MT, Aug. (2006).

Op de Beeck H, Deutsch J, Vanduffel W, Kanwisher N, DiCarlo JJ. A large-scale shape map in monkey inferior temporal cortex. ***Society for Neuroscience***, Atlanta, GA, Oct. (2006).

Cox DD and DiCarlo JJ. Is the “binding problem” a problem in inferiotemporal cortex? ***Society for Neuroscience***, Washington, DC, Nov. (2005).

Zoccolan D, Cox DD and DiCarlo JJ. Multiple object response normalization in monkey inferotemporal

cortex. ***Society for Neuroscience***, Washington, DC, Nov. (2005).

Hung CP, Kreiman GK, Quiroga R, Kraskov A, Poggio T, and DiCarlo JJ. Using 'read-out' of object identity to understand object coding in the macaque anterior inferior temporal cortex**. *Computational and Systems Neuroscience (COSYNE),*** Salt Lake City, UT, March (2005).

Cox DD and DiCarlo JJ. The effect of visual experience on the position tolerance of primate object representations. ***Society for Neuroscience,*** San Diego, CA, Nov. (2004).

Kreiman GK, Hung CP, Poggio TA, and DiCarlo JJ. Object recognition by selective spike and LFP data in macaque inferior temporal cortex. ***Society for Neuroscience***, San Diego, CA, Nov. (2004).

DiCarlo JJ and Maunsell JHR. Mapping functional neuronal processing chains underlying sensory-motor tasks in the primate. ***Gordon Research Conference: Sensory coding and the natural environment***, Oxford, UK, August (2004).

DiCarlo JJ and Maunsell JHR. Using reaction time tasks to map sensory-motor chains in the monkey. ***Society for Neuroscience***, Orlando, FL, Nov. (2002).

DiCarlo JJ and Maunsell JHR. Inferotemporal representations underlying object recognition in the free viewing monkey. ***Society for Neuroscience***, New Orleans, LA, Nov. (2000).

DiCarlo JJ and Johnson KO. Form processing in area 3b. ***International Symposium on Brain Mechanisms of Tactile Perception,*** Stockholm, Sweden, Oct. (1999).

DiCarlo JJ, Hsiao SS, and Johnson KO. Spatial and temporal properties of neural receptive fields in area 3b of the awake monkey. ***Society for Neuroscience***, New Orleans, LA, Nov. (1997).

Twombly IA, DiCarlo JJ, Hsiao SS and Johnson KO. Linear and non-linear processing of tactile spatial form in area 3b of the awake macaque. ***Society for Neuroscience***, Washington, D.C., Nov. (1996).

DiCarlo JJ, Twombly IA, Hsiao SS and Johnson KO. Laminar differences in spatiotemporal receptive field structure of neurons in area 3b of the awake macaque. ***Society for Neuroscience***, Washington, D.C., Nov. (1996).

Hsiao SS, DiCarlo JJ and Johnson KO. Interlaminar processing of tactile spatial form in area 3b of the somatosensory system. ***Biomedical Engineering Society***, Boston, Oct. (1995).

DiCarlo JJ, Hsiao SS and Johnson KO. Transformation of tactile spatial form within a cortical column in area 3b of the macaque. ***Society for Neuroscience***, Miami, FL, Nov. (1994).

Schmajuk NA and DiCarlo JJ. The short-term memory regulation hypothesis of hippocampal function. ***Midwestern Psychology Association***, Chicago, IL, May, (1990).

Schmajuk NA and DiCarlo JJ. Neural dynamics of hippocampal modulation of classical conditioning. ***12th Symposium on Models of Behavior: Neural Network Models of Conditioning and Action***, Cambridge, MA, June, (1989).

Submitted publications

Issa E, Cadieu C & DiCarlo J. Evidence that the ventral stream codes the errors used in hierarchical inference and learning. Submitted

Aparicio P*, Issa E* & DiCarlo J. Neurophysiological organization of the middle face patch in macaque inferior temporal cortex. Submitted

Invited presentations and lectures

1. Stanford University, Department of Neurobiology, Palo Alto, CA (1997)
2. Baylor College of Medicine, Division of Neuroscience, Houston, TX (1997)
3. Johns Hopkins University, Department of Biomedical Engineering, Baltimore, MD (1997)
4. Massachusetts Institute of Technology, Department of Brain and Cognitive Sciences, Cambridge, MA (2001)
5. University of California at Davis, Center for Neuroscience, Davis, CA (2001)
6. University of California at Santa Barbara, Institute for Theoretical Physics, Santa Barbara, CA (2001)
7. McGovern Institute 1st Annual Retreat, M.I.T., Falmouth, MA (2002)
8. Harvard University, Department of Psychology, Cambridge, MA (2002)
9. Harvard Medical School, Department of Neurobiology, Boston, MA (2002)
10. Pew Scholars and Fellows Annual Meeting, Bahamas (2002)
11. Johns Hopkins University, Krieger Mind/Brain Institute, Baltimore, MD (2003)
12. Conte Center Annual Meeting, Detection and Recognition of Objects in Visual Cortex, Cambridge, MA (2004)
13. Computational and Systems Neuroscience annual meeting (COSYNE), Salt Lake City, UT (2005)
14. Conte Center Annual Meeting, , Detection and Recognition of Objects in Visual Cortex, Cambridge, MA (2005)
15. Stanford University, Neuroscience Institute, Palo Alto, CA (2005)
16. Massachusetts General Hospital Martinos Imaging Center, Charlestown, MA (2005)
17. University of Washington, Dept. of Physiology and Biophysics, Seattle, WA (2006)
18. Massachusetts Institute of Technology, Dept. of Brain and Cognitive Sciences and CSAIL, Cambridge, MA (2006)
19. Pew Scholars and Fellows Annual Meeting, Costa Rica (2006).
20. Harvard University, Department of Psychology, Cambridge, MA (2006)
21. DARPA NeoVision workshop, Washington, DC (2006)
22. Gordon Research Conference: Sensory coding and the natural environment, Big Sky, MO (2006)
23. University of California at San Diego, Dept. of Neuroscience, San Diego, CA (2006)
24. California Institute of Technology, Pasadena, CA (2006)
25. Smith-Kettlewell Eye Institute, San Francisco, CA (2007)
26. University of California at San Francisco, Dept. of Neuroscience, San Francisco, CA (2007)
27. Computational and Systems Neuroscience annual meeting (COSYNE), Salt Lake City, UT (2007)
28. Cold Spring Harbor Laboratory Invited Lecture, Cold Spring Harbor, NY (2007)
29. Functional Requirements of Visual Theory Group Meeting, Montana State University, MT (2007)

30. European Brain and Behavior Society Annual Meeting, Trieste, Italy (2007)
31. International Conference on Computer Vision (ICCV), Rio de Janeiro, Brazil (2007)
32. Harvard Medical School, Department of Neurobiology, Boston, MA (2007)
33. Columbia University, New York, NY (2008)
34. University of California at Los Angeles, CA (2008)
35. University of Southern California, CA (2008)
36. National Institutes of Health, Washington, DC (2008)
37. Cognitive Neuroscience Society (CNS) Annual Meeting, San Francisco, CA (2008)
38. Principles of Biological Computation workshop, Santa Fe Institute, Santa Fe, NM (2008)
39. Perceptual Expertise Network (PEN) workshop, Banff, Canada (2008)
40. Japan Annual Neuroscience Meeting, Tokyo, Japan (2008)
41. RIKEN Brain Science Institute, Wako, Japan (2008)
42. National Institute for Physiological Sciences, Okazaki, Japan (2008)
43. Harvard University, Brigham and Women's, Cambridge, MA (2008)
44. Workshop of Learning and Dynamics in Vision, Glion, Switzerland (2008)
45. 26th Army Science Conference, Orlando, FL (2008)
46. Yale University, Swartz Computational Systems Series, New Haven, CT (Jan. 2009)
47. University of Rochester, Center for Visual Science, Rochester, NY (Jan. 2009)
48. Center for Nonlinear Studies Colloquium, Los Alamos National Laboratory Los Alamos, NM (March 2009)
49. New York University, Center for Neural Science, New York, NY (March 2009)
50. The Thirteenth International Conference on Cognitive and Neural Systems (ICCNS), Boston University,Boston, MA (May 2009)
51. McKnight Endowment Fund Annual Neuroscience Conference, Aspen, CO (June 2009)
52. Annual Meeting of the Sloan-Swartz Centers for Theoretical Neurobiology, Harvard, Cambridge, MA (July 2009)
53. Frankfurt Institute for Advanced Studies, Frankfurt, Germany (Oct. 2009)
54. International Conference on Computer Vision Systems (ICVS), Keynote speaker (Oct. 2009)
55. University of California at San Diego (UCSD), Cognitive Science colloquium, San Diego, CA (Feb. 2010)
56. Computational and Systems Neuroscience (COSYNE) Annual Meeting invited speaker, Salt Lake City, UT (March 2010).
57. Stanford University, Center for Mind, Brain and Computation Minisymposium, Palo Alto, CA (March 2010).
58. University of Texas at Austin, Workshop of Natural Environments, Tasks, and Intelligence, Austin, TX (March 2010).
59. Boston University, Department of Psychology, Boston, MA (April 2010).
60. Woods Hole MBL, Woods Hole, MA (August 2010).
61. McGill Univeristy, Montreal Canada (Oct. 2010)
62. Columbia University, New York, NY (Oct. 2010)

63. Vanderbilt University, Nashville, TN (Nov. 2010)
64. KU Leuven, Leuven, Belgium (Dec. 2010)
65. Scene Understanding Symposium (SUnS), MIT, Cambridge, MA (Jan 2011)
66. Boston University Cognitive and Neural Systems Conference, Boston, MA (May 2011)
67. DARPA NeoVision2 workshop, Washington, DC (May 2011)
68. Dolby Resarch Laboratories, San Franscisco, CA (June 2011)
69. Dartmouth College, Workshop in Neural Computation, Burlington, VT (August 2011)
70. Frontiers in Computer Vision Workshop, Campbridge, MA (August 2011)
71. Champalimaud Inaugural Neuroscience Symposium, Lisbon, Portugal (Sept. 2011)
72. Workshop of Learning and Plasticity, International Mathematics Meeting Center (CIRM), Marseille, France (Nov. 2011)
73. International Conference on Computer Vision (ICCV), Keynote speaker, Barcelona, Spain (Nov. 2011)
74. Johns Hopkins University, Ken Johnson Memorial Speaker (Nov, 2011)
75. Harvard Medical School, Dept. of Neurobiology Systems Group (March, 2012)
76. MIT Museum public lecture, Cambridge, MA (March, 2012)
77. VisoNYC (Greater New York City vision scientists), Columbia/NYU/Suny College of Optometry (March, 2012)
78. Canonical Neural Computation, Florence, Italy (May, 2012)
79. Johns Hopkins University, Center for Lnaguage and Speech Processing (July, 2012)
80. University of Pennsylvania, Dept. of Psychology (July 2012)
81. Princeton University (Nov. 2012)
82. Collaborative Research in Computational Neuroscience Meeting, MIT (June, 2013)
83. Assembly and Function of Neural Circuits Meeting, Ascona, Switzerland (Sept. 2013)
84. CIFAR Meeting, San Francisco, California (Dec. 2013)
85. NIPS, Tahoe, Nevada (Dec. 2013)
86. SPC Meeting, San Francisco, California (Feb. 2014)
87. Cornell University, Ithaca New York (March 2014)
88. VSS Meeting, St. Petersburg, Florida (May 2014)
89. McKnight Neuroscience Conference, Aspen, Colorado (June 2014)
90. Shitsukan Symposium, Tokyo, Japan (July 2014)
91. Gordon Conference, Maine (July 2014)
92. University of Tubingen, Germany (Oct. 2014)
93. SfN, Washington, DC (Nov. 2014)
94. University of Chicago (Feb. 2015)
95. New York University (Feb. 2015)
96. COSYNE, Salt Lake City, Utah (March 2015)
97. Technion and Bar Ilan University, Israel (March 2015)
98. Emory University, Atlanta, Georgia (April 2015)

99. Columbia University, Center for Theoretical Neuroscience, New York, New York (May 2015)
100. IBM Educational Panel, Washington, DC (July 2015)
101. Computer Vision Summer School, Germany (July 2015)
102. Brains, Minds and Machines, Woods Hole, Massachusetts (Aug. 2015)
103. MURI meeting, Stanford University, Stanford, California (Aug. 2015)
104. SCGB 1st Annual Meeting (Simons Foundation), New York City, New York (Sept. 2015)
105. Max Planck Symposium, Germany (Sept. 2015)
106. Baylor Neuroscience Seminar, Houston, TX (November 2015)
107. MURI meeting, University of California, Berkeley, CA (January 2016)
108. SCGB (Simons Foundation) Multiregional Models of Population Coding Workshop (January 2016)
109. Center for Molecular & Behavioral Neuroscience, Rutgers University, Newark, NJ (January 2016)
110. Future of Primate Neuroscience, Shenzhen, China (March 2016)
111. University of Texas at Austin, Workshop of Natural Environments, Tasks, and Intelligence, Austin, TX (April 2016).
112. HHMI Janelia Research Campus, Complexity of Neural Computation and Cognition (May 2016)

Research summary

My lab's research program addresses the brain's extraordinary ability to recognize visually encountered objects such as faces. Object recognition is the gateway to behavior, cognition, and memory. Given its importance to our survival and reproduction, it is likely supported by fundamental, conserved cortical sensory processing principles. We know the primate brain processing pathways that are critical to this ability – the cortical ventral visual stream, culminating in the inferior temporal cortex (IT). Thus, we are working on a problem of central importance, we know where the key circuitry is in the brain, we have tools to record and perturb those circuits, and we have a computational framework to approach the problem. The overarching goal of my research group is to obtain a deep understanding of how the brain develops and executes its remarkably powerful neuronal representation of visual objects, and how that representation underlies perception, cognition and behavior.

We use a combination of extensive behavioral testing in humans and non-human primates, large-scale neurophysiology, brain imaging, optogenetic methods, and high-throughput computational simulations to understand the neuronal mechanisms and fundamental cortical computations that underlie the construction of that powerful neuronal representation. We have systematically measured the neural population patterns of high level ventral stream neural activity in non-human primates and found that a family of simple neural mechanisms reading from IT may explain how the brain supports all core (200 ms, central ten degrees of visual field) visual object recognition tasks. Together, these studies converge to show that, in contrast to early visual areas, the top of the ventral visual stream (IT) conveys an easy-to-read, population representation of object properties -- an *explicit* neuronal population rate code of object category, identity and other object parameters (position, scale).

Our recent progress and ongoing work is in: building image-based computational models that explain these neural responses, mapping those models to the neural tissue and testing causality, and testing how those neural mechanisms might develop from supervised and unsupervised visual experience. Based on that work, we are closing in on an end-to-end understanding of the neural mechanisms of human visual object recognition — i.e. from image to neuronal activity to perceptual report. We aim to use this understanding to inspire and develop new artificial vision systems, to provide a basis for new neural prosthetics (brain-machine interfaces) to restore or augment lost senses, and to provide a foundation to understand how high-level sensory representations are altered in human conditions such as agnosia, autism and dyslexia.