

UNIVERSITY OF PENNSYLVANIA
CENTER FOR COGNITIVE NEUROSCIENCE (CCN)

CENTER FOR COGNITIVE NEUROSCIENCE PATIENT DATABASE

The University of Pennsylvania Center for Cognitive Neuroscience Patient Database is thriving with 190 patients and 90 non-brain injured control subjects enrolled for participation in neuropsychological research studies. To-date, there have been greater than 1800 research sessions. Descriptions of the studies are on page 1 and 2 of this newsletter, and scientific publications and presentations resulting from these studies can be found on page 5. We thank all our participants for their generous contributions of time to help our understanding of brain function.



MOTOR SKILLS AFTER STROKE/STEVEN JAX, PH.D.

The studies in our lab are aimed at understanding how making movements with the arm and hands may be disrupted after people have a stroke. In particular, we are interested in knowing how strokes make it more difficult for people to learn new movement skills. In a typical study, we look at how well and how quickly people with a stroke are able to learn an unusual movement task, such as holding onto a computer mouse that doesn't move the way a mouse typically moves. Such an unusual task allows us to study motor skill learning without having to worry about whether an individual has done that particular task in the past. By better understanding how motor skill learning is disrupted after stroke, we hope to help clinicians develop more efficient methods for training motor skills during rehabilitation.

WORD MEANINGS/ MARINA BEDNY, PH.D.

Virginia Woolf once described words as "...the wildest, freest, most irresponsible, most un-teachable of all things...because the truth they try to catch is many sided. And they convey it by being many sided, dashing first this way than that..." (Woolf, 1937). In psycholinguistics, this fluid property of words has been described as lexical-semantic ambiguity. Most words have multiple meanings and are therefore ambiguous. There are different kinds of ambiguous words. Some words like "bank" have multiple unrelated meanings (financial institution or side of river). Other words, like "chicken" have multiple related meanings (bird or meat). Prior neuroimaging and neuropsychological evidence suggest that an area in the frontal lobe called the left inferior frontal gyrus (LIFG) may play a role in resolving competition during language processing. By testing people with LIFG damage, we examined the hypothesis that the LIFG allows us to pick the right meaning of a word based on context. The results support our hypothesis that the LIFG is important for selecting the right meaning of words like "bank" and "chicken" when we read and listen to speech.

TOOL USE/ EVANGELIA G. CHRYSIKOU, PH.D.

People with frontal lobe injuries often experience difficulties with certain language and problem-solving tasks. One of our interests is to examine the extent of these impairments in tasks involving everyday tool use and to evaluate the possibility that people with frontal-lobe damage preserve their ability to use objects innovatively to achieve goals. Through the contributions of our research participants, we are able to expand our knowledge on frontal lobe functioning and provide a context for the generation of new interventions that build on peoples' skills and everyday needs.

MEMORY/INGRID OLSON, PH.D.

Does the parietal lobe have a critical role in memory? The neuroimaging literature indicates that it has an important role, especially in episodic memory. However, the neuropsychological literature suggests that its role is more limited to attentional, spatial, or imagery aspects of memory. Our research investigates the role of the parietal lobe in memory retrieval across different tasks and procedures. In addition, we are interested in how the hippocampus, part of the temporal lobe, supports memory for the situations in which events occur. Outside of the memory domain, we are interested in spatial disorders and how disrupted spatial perception contributes to disruptions in other aspects of mental activity.

MEMORY AND THE PARIETAL LOBE

MARIAN BERRYHILL, PH.D.

Over the past year, the Olson lab has been investigating various forms of memory in patients with parietal lobe damage. We have been very lucky to test so many of our database members and have had several articles accepted for publication. We have found that right-parietal patients may need some extra support with their working memory, the kind of memory you use when you need to hold on to pieces of information for a brief period of time. We examined working memory by asking people to remember four locations, objects, or both the object + location over a short pause. Right-parietal patients had a harder time at this task, whereas left-parietal patients were no different from control subjects. In a different study, we found that these same right-parietal patients had no difficulty in an implicit learning task. We asked people to press a key underneath a colored light every time the light came on. We secretly hid a pattern in the key presses. Over time, the patients and controls got faster with each repetition of the hidden pattern. Finally, we were able to test a few patients with bilateral parietal damage in a study of long-term memory. In this study we examined how people described their own autobiographical memories. Patients mentioned fewer details unless they were asked specific questions. In sum, these studies help us understand how the parietal lobe influences memory: working, implicit and long-term. These studies are also important because few people have looked at parietal involvement in memory. Our findings show that people with some kinds of parietal damage may need to write themselves extra notes, or be asked more questions in order to retrieve memories, but they will be able to learn new skills without special help. We are indebted to the fantastic patients who let us come in to test and we thank all of you for participating in the patient database. With your help, we are able to shed a little light on the workings of the brain.

THE SIXTH SENSE: PROPRIOCEPTION

JARED MEDINA, PH.D.

In *De Anima*, Aristotle wrote about how all we perceive comes from these five senses: sight, hearing, smell, taste, and touch. These senses are all exteroceptive, in that they respond to stimuli outside the body. However, Aristotle (and others) ignored a very important interoceptive sense (a sense that originates within the body). This sense is easily taken for granted, and is involved in everyday life. That sense is proprioception.

Proprioception, a term coined by Sherrington in the early 20th century, is the sense of the relative position of parts of our body. Information from sensors in our body, such as muscle, tendon, and joint receptors, provide information as to where body parts are in space at any given moment. Proprioceptive input, along with vision and touch, feeds into a representation of our body known as the body schema.

We are currently doing research with subjects who have proprioceptive deficits. These deficits can arise either via stroke or peripheral deafferentation (an inability to transmit signals from senses such as touch and proprioception to the brain). Subjects with peripheral deafferentation have deficits so profound

that they are often unable to stand unless they can see their limbs. This is because, without vision, they have no sense of where their body is in space.

In current studies, we have found that contributions from other sensory systems help mitigate the loss of these important body senses. In one study, we have found subjects with damage to the left parietal lobe that are much better at localizing a limb when they actively move it to a target, compared to when that limb is passively moved to a target (Medina, Jax, & Coslett, 2007a). Furthermore, we have found other subjects that are accurate during the initial, but not final stages of reaching (Medina, Jax & Coslett, 2007b). In both cases, we surmise that information from motor planning mechanisms is involved in providing information about body position, even without proprioception.

Our research is ongoing on this vital yet underappreciated sense. If you would like to participate in any of our current studies, please contact Dr. Marianna Stark.

Medina, J., Jax, S.A., & Coslett, H.B. (2007a). Representing Effector Location: Contributions of Predicted State and Sensory State Information. *Cognitive Neuroscience Society*, New York, NY.

Medina, J., Jax, S.A., & Coslett, H.B. (2007b). Reaching to moving targets after deafferentation. *Progress in Motor Control VI*, Santos, Brazil.

WELCOME NEW POST-DOCTORAL FELLOWS

Eileen Cardillo, D.Phil.



I've long been intrigued by the blurry boundary between animal and human minds, and the degree and import of a distinctly human way of experiencing the world. As an undergraduate at the College of William and Mary, this interest inspired my pursuit of biological psychology and many hours spent poking at bird neurons under microscopes and working with orangutans at the Smithsonian National Zoological Park. However, by graduate school I had determined that my preference was to work with people instead. Given its arguably unique presence in humans, I became especially intrigued by the neural adaptations that allowed for the emergence of language in our species. I pursued this interest with behavioral and neuroimaging research while at the University of Oxford on a Rhodes scholarship and in 2005 received my doctorate in experimental psychology. I came to the Chatterjee lab this fall after completing an NIH postdoctoral training fellowship in cognitive neuroscience at the Institute of Neural Computation and the Center for Research in Language at UC-San Diego. My research continues to focus on the neural basis of language and its relation to other forms of cognition. In particular, I investigate interactions between spatial and linguistic processing, and the impact of brain injury on these functions. Outside the lab, I spend a lot of time trying to teach my dog English and drinking too much coffee.

Alex Kranjec, Ph.D.



I joined Anjan Chatterjee's lab in the Department of Neurology and the Center for Cognitive Neuroscience this past summer shortly after completing my Ph.D. in Experimental Psychology at the City University of New York. In my thesis work, I looked at how the ways we think about space are closely related to the ways that we think about time. In general, my research focuses on the similarities between spatiotemporal thought and language. Currently, I'm investigating brain areas responsible for processing particular kinds of motion information to see if they are also implicated in related kinds of linguistic processing. I'm also exploring how abstract social concepts are organized mentally along particular spatial axes. I live in Philadelphia with my wife Danielle and my son Eli who was born here in June of last year.

Gwen L. Schmidt, Ph.D.



I recently joined our research team as a postdoctoral research fellow. As an undergraduate, I studied linguistics at York University in Toronto before moving to Colorado to complete my Ph.D. at Colorado State University in 2006. As a cognitive neuroscientist my doctoral work focused on how the brain is used when people understand metaphors. I have used functional MRI and other methods to explore my interests in the brain-language connection. My primary research interests include how the brain processes metaphors and other non-literal language, the role of the right hemisphere of the brain in language processing, and the connection between right hemisphere language and other right hemisphere cognitive functions, such as processing visual and spatial information. I hope to become a research professor once I have finished my fellowship. I have now begun a project to study metaphor understanding in people with brain damage. Perhaps you will be able to participate in this study!

OUR RESEARCHERS

These are some of the people with whom you may have the opportunity to work on their current research studies.

Marian Berryhill, Ph.D., Post-Doctoral Fellow University of Pennsylvania and Temple University (July, 2007), [Ph.D., Dartmouth College]

Research Interests: Distance perception, working and long-term memory.

Current Affiliation: Dr. Ingrid Olson's laboratory, Temple University and University of Pennsylvania.

Eileen Cardillo, D. Phil., Post-Doctoral Fellow [D. Phil. University of Oxford]

Research Interests: Interactions between spatial and linguistic processing; figurative language comprehension.

I came to UPenn/Chatterjee Lab in October, 2007 after a two-year NIH postdoctoral training fellowship in cognitive neuroscience at the Institute of Neural Computation and the Center for Research in Language at UC-San Diego.

Evangelia G. Chryssikou, Ph.D., Post-Doctoral Fellow [Ph.D. Temple University]

Research Interests: The neural bases of semantic knowledge and goal-oriented action, with emphasis on human problem solving and innovative tool use in everyday tasks.

Current Affiliation: Dr. Sharon Thompson-Schill's laboratory, University of Pennsylvania.

Steven Jax, Ph.D., Institute Scientist [Ph.D. Pennsylvania State University]

Research Interests: Upper extremity motor control and motor learning.

Alex Kranjec, Ph.D., Post-Doctoral Fellow [Ph.D. City University of New York]

Research Interests: Language and spatiotemporal representation.

Current Affiliation: Dr. Anjan Chatterjee's lab in the Neurology Department (HUP), August, 2007.

Ingrid Olson, Ph.D., Assistant Professor Temple University, Adjunct Professor University of Pennsylvania [Ph.D. Yale University]

Research Interests: Memory; distance and space perception.

Eiling Yee, Ph.D., Post-Doctoral Fellow [Ph.D. Brown University]

Research Interests: Language comprehension and semantic memory.

Current Affiliation: Dr. Sharon Thompson-Schill's laboratory, University of Pennsylvania.

AN INTERNATIONAL VISITOR

Robert Langner, Ph.D.-Candidate in Psychology [Graduate Student RWTH Aachen University, Germany]

I am visiting Anjan Chatterjee's lab for three months to study the effects of brain damage on the ability to maintain attention over time. This collaboration is funded by a training grant received by the RWTH Aachen University in collaboration with investigators from the University of Pennsylvania.

FORMER RESEARCHERS: WHERE ARE THEY NOW?

Marina Bedny, Ph.D., Post-Doctoral Fellow, [Ph.D. University of Pennsylvania]

Research Interests: Plasticity, semantic memory.

Current Affiliation: Pascual-Leone Lab (Beth Israel Deaconess Medical) and Saxe Lab (MIT). Affiliation with Berenson-Allen Center for Non-Invasive Brain Stimulation, Beth Israel Deaconess Medical Center, Harvard Medical School beginning 2007.

Joseph W. Kable, Ph.D., Post-Doctoral Fellow [Ph.D. University of Pennsylvania]

Research Interests: Decision-making, "neuroeconomics."

Current Affiliation: Dr. Paul Glimcher at the Center for Neural Science, NYU.

Jessica F. Lease-Spellmeyer, Ph.D. [Ph.D. Drexel University]

Previous Affiliation: Dr. Anjan Chatterjee's laboratory, University of Pennsylvania. In 2007, Dr. Lease-Spellmeyer successfully defended her dissertation in which she investigated attentional differences in the ability to detect and monitor visual changes among parietal and frontal brain-injured patients.

RECENT DATABASE RESEARCH

The following publications and presentations were made possible thanks to the kind participation of our patients and control subjects.

Publications:

- Bedny, M., Hulbert, J., Thompson-Schill, S. L. (2007). Understanding words in context: The role of Broca's area in word comprehension. Brain Research, 1146, 101-114.
- Berryhill, M.E., Phuong, L., Picasso, L., Cabeza, R., & Olson, I.R. (2007). Parietal lobe and episodic memory: Bilateral damage causes impaired free recall of autobiographical memory. The Journal of Neuroscience, 27(52), 11415-14423. <http://www.jneurosci.org/cgi/content/full/27/52/14415>
- Berryhill, M.E. & Olson, I.R. (in press). The right parietal lobe is critical for working memory. Neuropsychologia.
- Berryhill, M.E., Mazuz, Y.M. & Olson, I.R. (in press). Learning on the serial reaction time task is not affected by right parietal lobe damage. Journal of Neuropsychology.
- Fellows, L.K. & Farah, M.J. (2007). The role of ventromedial prefrontal cortex in decision making: Judgment under uncertainty, or judgment *per se*? Cerebral Cortex doi: 10.1093/cercor/bhl176.
- Fellows, L.K., Stark, M., Berg, A. & Chatterjee, A. (2008) Patient registries for cognitive neuroscience research: Advantages, challenges, and practical advice. Journal of Cognitive Neuroscience, Jan Epub.
- Heberlein, A.S., Gillihan, S.J., Padon, A.A., Farah, M.J. & Fellows, L.K. (2007). Prefrontal contributions to facial emotion recognition. Journal of Cognitive Neuroscience, Dec 4 Epub.

Scientific Conferences:

- Berryhill, M.E. & Olson, I.R. (2008). Presentation on visual memory in parietal lobe patients at visual memory symposium. Vision Science Society, Sarasota Florida.
- Fellows, L.K. (March, 2007). The role of orbitofrontal cortex in decision making: A component process account. Linking affect to action. New York Academy of Sciences, New York, NY.
- Fellows, L.K., Stark, M., Berg, A. & Chatterjee, A. (May, 2007). Establishing patient registries for cognitive neuroscience research: Advantages, challenges, and practical advice based on the experience at two centers. Cognitive Neuroscience Society, New York, NY.
- Fellows, L.K. & Tsuchida, A. (November, 2007). Validating neurocognitive measures of distinct prefrontal functions in patients with focal frontal lobe damage. Society for Neuroscience, San Diego, CA.
- Modirrousta, M. & Fellows, L.K. (March, 2007). Does medial prefrontal cortex play a role in the monitoring of working memory performance? Rotman Research Institute Conference, "Advances in memory research."
- Modirrousta, M. & Fellows, L.K. (May, 2007). Is medial prefrontal cortex critical in monitoring learning and memory? Cognitive Neuroscience Society, New York, NY.
- Modirrousta, M. & Fellows, L.K. (November, 2007). Is intact medial prefrontal cortex necessary for error processing in humans? Society for Neuroscience, San Diego, CA.
- Modirrousta, M. & Fellows, L.K. (April, 2008). Is medial prefrontal cortex necessary for the sensation of mental effort? Cognitive Neuroscience Society, San Francisco, CA.
- Shaikh, T.M., Tsuchida, A. & Fellows, L.K. (April, 2007). Dissecting the frontal lobe syndrome: Do specific behavioral changes follow damage to specific subregions within prefrontal cortex? American Academy of Neurology, Boston, MA.
- Simioni, A.S. & Fellows, L.K. (March, 2007). A novel decision-making task to measure subjective valuing. Linking affect to action. New York Academy of Sciences, New York, NY.
- Tsuchida, A. & Fellows, L.K. (March, 2007). Prefrontal contributions to the recognition of subtle emotional expressions in humans. Linking affect to action. New York Academy of Sciences, New York, NY.
- Tsuchida, A. & Fellows, L.K. (May, 2007). Two regions within prefrontal cortex are necessary for response inhibition measured with the stop-signal task. Cognitive Neuroscience Society, New York, NY.
- Tsuchida, A. & Fellows, L.K. (November, 2007). The role of prefrontal cortex in task switching: Is it about the tasks, or about the switching? Society for Neuroscience, San Diego, CA.
- Tsuchida, A. & Fellows, L.K. (April, 2008). Multiple routes to cognitive control? Behavioural adjustment triggered by changes in response conflict does not depend on intact prefrontal cortex. Cognitive Neuroscience Society, San Francisco, CA.



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H. Branch Coslett, M.D.
Martha Farah, Ph.D.
Daniel Kimberg, Ph.D.
Ingrid Olson, Ph.D.
Sharon L. Thompson-Schill, Ph.D.

PATIENTS NEEDED

If you are interested in any of the following studies, please contact
Dr. Marianna Stark at 215-615-3649.

Dr. Ingrid Olson's lab is looking for individuals with memory disorders and spatial perception disorders. If you have brain damage to the medial temporal lobes/hippocampus, anterior temporal lobes, retrosplenial cortex, superior occipital lobe, or parietal lobe, we are interested in testing you.

Dr. Lila Chryssikou and Dr. Sharon Thompson-Schill are currently recruiting patients with frontal lobe injuries for participation in a study on the use of everyday objects. The study involves looking at images of everyday tools and answering short questions about them. Your help is greatly appreciated!

WE NEED VOLUNTEERS

Non brain-injured subjects are needed for our research studies. These individuals are often the spouses and caregivers of our patients. Subjects receive the same tests as the patients, and they help to establish a baseline for how non brain-injured individuals perform on the same tasks. Payment is \$15 per hour plus mileage and parking. Call 215-614-1971 for more information.

YOUNG STROKE SUPPORT GROUP

Penn's Young Stroke Support Group provides a chance for stroke patients to meet and talk with others facing similar challenges. The group is positive and upbeat, and guest-speakers are invited to address issues relevant to younger adults.

Meetings: 3rd Thursday of the month, 6:30 p.m.

Ravdin-6 Conference Room, HUP (34th & Spruce Streets)

For more information and to confirm meeting times, contact Jeanie Luciano, MSN, CRNP (Stroke) at 215-614-0175 or jluciano@mail.med.upenn.edu.

INTERNET RESOURCES

A quick check on the internet turns up a variety of organizations with information that may be of use for patients. Here are a few sites that were provided by Dr. Evangelia Chryssikou (Penn, CCN).

Brain Injury Association of America <http://www.biausa.org/>

Traumatic Brain Injury Model Systems National Data and Statistical Center (TBINDSC)
<http://www.tbindsc.org/>

The Perspectives Network <http://www.tbi.org/>

The Brain Injury Information Network <http://www.tbinet.org/>

Brain Injury Resource Center <http://www.headinjury.com/>

The Brain Injury Recovery Network <http://www.tbirecovery.org/>

My Trauma.org <http://www.mytrauma.org/> (a survivor's story)

Headway <http://www.headway.org.uk/>