Dear Friends,

Summer has been slow to arrive with all of the rain this spring, but the hot temperatures and sunshine are finally here!

The last few months have been busy ones at the Aphasia Center. We recently had a visit from Dr. Joel Kupersmith, the Chief of Research and Development from the VA Central Office in Washington, DC. For the last few months, he has been touring VA hospitals around the country and visiting VA research centers like ours to see firsthand the kind of work that goes on. His stop at our lab was an important opportunity for us to showcase our projects and highlight their significance for the understanding and treatment of aphasia and related disorders.

We are also happy to welcome two student interns into the lab this summer. John and Sabrina will be completing the last step of their training to become licensed speech pathologists and helping to carry out a new treatment study spearheaded by our colleague, Dr. Patterson of Cal State East Bay.

In other news, I recently became honored recipient of the VA Research Career Scientist Award. This award will allow me to dedicate my efforts to being a fulltime researcher, which means spending more time around the lab!

And, last but not least, we sincerely hope to see you at our annual summer picnic. As usual, it will be held at Nancy Boyd Park and will be an event for stroke survivors, family, friends, and caregivers to share in the summer fun with food and drink, a singalong, and plenty of catching up with familiar faces and longtime friends.

Sincerely,
Nina Dronkers, Ph.D., Director
Center for Aphasia and Related Disorders
The frontiers of most modern sciences are largely limited by two things. First, of course, is the scientist’s intellect and capacity for insight into natural phenomena. Second, and equally important, is the availability of tools for the observation of those phenomena. As with Galileo’s first telescope, it is frequently the advent of a new technology that leads to major breakthroughs in a scientific field.

So, what are the tools and methods that neuroscientists employ to study something as hard to get at as the brain? Encased in the skull and wrapped in three layers of membrane tissue, the brain, until very recently, was only observable through post-mortem analysis. Still, this “primitive” method shed considerable light on brain function before the advent of more advanced imaging techniques about three decades ago. For example, perhaps the most famous neurological case in history was reported in France in 1861 by Paul Broca. Broca’s patient had suffered a stroke and lost the ability to utter almost anything except for the sound “tan”, but could still understand speech reasonably well. He was later found to have damage in the left frontal lobe of his brain. Hence, the name “Broca’s aphasia” was born, and the lesioned site in the brain was termed “Broca’s area”. This and other early cases gave birth to the “localizationist” view that different brain functions are localized to discrete brain regions.

Today, this view persists to some extent, but growing evidence shows that certain brain functions such as language and memory are integrated across the whole brain. As opposed to post-mortem analysis, the primary tools that are being used to shape modern theories of neuroscience are much less invasive. They can not only look at the structure of the brain in living people, but can actually see what the brain is doing while a person exercises a particular mental faculty. The distinction between these two forms of imaging are called structural and functional, and will be discussed in further detail below. If you are a stroke survivor yourself or are close to someone who is, you may already be familiar with a few of these methods.

### The CAT scan (1974)

One of the most commonly used imaging techniques is the CAT (Computed Axial Tomography) scan, also known as the CT scan. This is a structural imaging technique: It shows what the brain looks like in three dimensions, but tells us nothing about the activity inside of the brain. This method is an advanced version of the conventional x-ray, but instead of compressing a three-dimensional object into a two-dimensional image, it preserves the 3D quality of the object under study. This is accomplished by rotating an x-ray emitter around a person’s head and obtaining a series of 2D x-ray images from many angles and then recombining them with computer software to generate a 3D image. CAT scans are most commonly used to assess neurological damage in living people immediately following stroke or head trauma. They work because different tissues in the brain have different densities. For example, blood is less dense than brain tissue, and will absorb less of the radiation that passes through the head during a scan. As a result, areas that have been infarcted will show up as a darker area on a scan than healthy, living brain tissue and will thus aid the neurologist in identifying the size, location, and type of stroke.
The MRI scan (1983)
A more recent innovation in imaging technology is the MRI (Magnetic Resonance Imaging) scan. As opposed to using x-rays, this technique employs powerful magnetic fields generated within the scanner. These magnetic fields act upon the rotations of protons found in one of the most commonly occurring elements in the human body, hydrogen. Radio waves are then passed through the magnetized regions and absorbed by the protons. Once the radio waves are turned off, the energy in the protons rebounds and is picked up by detectors surrounding the head. The MRI system then constructs a three dimensional image of the brain which reflects the distribution of protons in brain tissue.

MRI scans have two distinct advantages over the CAT scan. First, they give a much more detailed image of the brain, and second, it is possible to obtain a functional MRI scan, or fMRI. By obtaining a continuous stream of MRI images over the course of seconds or minutes, we can see the changes in blood flow to different brain regions while a person is engaged in a particular cognitive task. Blood carries the oxygen required by active brain cells, so if blood rushes to a certain region when a person tries to speak, then that region is likely to be important for forming words. Due to all of these advantages, MRI and fMRI are some of the most powerful and commonly used imaging methods today.

In our lab, we use MRI scans together with VLSM, or Voxel-based Lesion Symptom Mapping. VLSM is a recent imaging technique that is used to link the location of a person’s lesion to the function of the damaged brain area. It works in the following way. First, we obtain structural MRI scans of a group of patients and determine the sizes and locations of their strokes. Then, we administer behavioral tests and establish what cognitive/language functions are affected in those patients. Finally, we compare the lesion sites with the results of the behavioral tests to reveal the roles of common areas of injury. Essentially, this method allows us to do what Paul Broca did with his patient to establish the relationship between brain and behavior, only without having to physically get inside of the brain.

The PET scan (1975)
The PET scan is another functional imaging technique. To obtain a PET scan, a person is injected with a tracer such as a radioactive isotope of oxygen. The person then performs a cognitive task relevant to the current study. For example, if the goal of the study is to identify what brain regions participate in face recognition, the subject may be asked to fixate on photographs of familiar faces. While the subject does this, the radioactive isotope circulates through the arteries supplying the brain. Sensors around the head of the person in the PET scanner detect the radioactivity, and pinpoint its source. Where there is more radiation, there is more blood flow and thus more neural activity. One major issue with PET is that due to its radioactivity, it is considered to be a
Research Tools in Neuroscience (cont’d)

More invasive technique than fMRI. Also, it is more costly to maintain and operate a PET scanner, and fMRI is generally considered to be a more accurate procedure.

EEG (Early 1970’s)
Another important neuroscientific tool with very widespread use today is the EEG, or electroencephalogram. This method provides a continuous recording of overall brain activity. It is thus by nature a functional imaging method. When large numbers of neurons work together in the brain, they produce electrical response potentials (ERP’s) that can be measured by electrodes placed on the scalp. The advantage of EEG as opposed to fMRI or PET is that it measures brain wave activity directly from brain cells and does not have the time lag associated with blood flow responses. Among other things, EEG is very useful in detecting abnormalities in brain function, such as in people with epilepsy.

As you can see, the last three decades have ushered in an era of ever-increasing ability to diagnose brain disorders and explore research questions as to how the brain works. The powerful tools available to neuroscientists today ensure that this is an ever-expanding field, and as we gain a better understanding of brain function and cognition, we can translate this knowledge into more effective prevention, treatment, and therapy for those at risk and those living with brain injury and stroke.

A few other research and diagnostic tools:

TMS: Transcortical magnetic stimulation—applying a magnetic pulse to the surface of the scalp in order to temporarily and harmlessly disrupt brain activity, simulating a transitory lesion.

MEG: Magnetoencephalography—A method similar to EEG that detects magnetic fields around the brain as opposed to directly measuring electrical current.

Single Cell Unit Recording: Implanting an electrode directly into the brain to record electrical impulses from individual brain cells.

SPECT: An imaging technique used to measure blood flow in the brain.

Angiography: A procedure used to X-ray blood vessels in and around the brain. This method is commonly used to diagnose aneurysms.

Fig. 4: PET Brain activations for different tasks

Fig. 5: EEG Electrode cap
David has been living with stroke and aphasia for five years. He has volunteered at the VA in Martinez and is an active member of the Wednesday Stroke Support Group. David was happy to have this interview included in the newsletter.

Juliana Baldo: Where are you from originally?

**David:** Albany [New York] … Saratoga

J.B.: When did you move West?

**David:** 1960s. I went down here and went to school here [Louisiana]. Then I went here [Southern California], and then I went here [Alaska].

J.B.: Did you go to Alaska to serve in the military?

**David:** Yeah. And then we came down here and went back here.

J.B.: So you came back and settled in Northern California after the military?

**David:** Yeah.

J.B.: What did you do for work?

**David:** I worked for a big deal [company]. manager.

J.B.: How long did you work there?

**David:** 12 years. And then we moved to go to Nevada.

J.B.: What did you do there?

**David:** I worked downtown.

J.B.: In a casino?

**David:** Yeah—I stayed there for many years.

J.B.: Did you deal cards?

**David:** No. Manager… Keno.

J.B.: Was it fun? Did you enjoy it?

**David:** Yeah. We would talk to people.

J.B.: Was working there like the TV show *Las Vegas*?

**David:** No no.

J.B.: Did you ever catch anyone cheating?

**David:** No. There was nothing.

J.B.: Were there a lot of regulars who spent a lot of money?

**David:** Oh yeah.

J.B.: So how long ago was your stroke?

**David:** July, 2001.

J.B.: Did you get a lot of therapy when you were in the hospital?

**David:** No, it was hard there. People would come in and tell me I was doing good. Once I got home, I got more.

J.B.: Could you talk at all when it first happened?

**David:** No, it would come out, but I didn’t know. I couldn’t even move this [arm].

J.B.: Are you still getting therapy?

**David:** Yeah—from you people—very nice people. I just wanna get better and I want more help.

J.B.: What would you say to people who have just had a stroke?

**David:** Let’s help them and talk to them a lot… talk to them.
Stroke Support Group
Annual Summer Picnic!

When: Wednesday, July 12th 12:30-3:00 p.m.
Where: Nancy Boyd Park in Martinez

(direcƟons below)

What to bring: a dish or drink to share if you can

Questions: Call Juliana (925) 372-4649

Directions to Nancy Boyd Park:
From Highway 4, take the Alhambra Ave. exit
Go South on Alhambra Ave. for 3/4 mile to Truitt Ave.
Go left on Truitt Ave.
Make first left on Valley Ave.
You will see park in front of you once you hit Church St.
Stroke Support Group of Contra Costa County
Mt. Diablo Medical Center, Concord, or John Muir Medical Center, Walnut Creek; Contact: Ann Dzuna, B.S., MBA, (925) 376-6218. Email: ADZUNA@COMCAST.NET

Stroke and Head Injury Support Group
Washington Hospital, Washington West in Fremont; Contact: Karen Benedetti, (510) 818-6253.

CSU Hayward Aphasia Group
California University - Hayward, Speech, Language & Hearing Clinic; Contact: Shelley Simrin, M.A., CCC-SLP, Clinic Director, (510) 885-4762 or (510) 885-3233. Email: ssimrin@csuhayward.edu

Interpersonal Skills - Stroke Support Group
College of Marin, Disabled Student Services Program, in Kentfield; Contact: Maureen Green, M.A., CCC-SLP, (415) 457-8811 ext. 7702

Veterans Stroke Support and Communication Group
VA Outpatient Clinic, Speech; Contact: Jennifer Ogar, CCC-SLP, (925) 370-4129; Email: jenny.ogar@med.va.gov

Aphasia Center of California
Oakland, CA ; Contact: Roberta Elman, Ph.D., CCC-SLP, BC-NCD, (510) 336-0112; Email: RJElman@aol.com Website: www.aphasiacenter.org

Peninsula Stroke Association Support Group Network
Palo Alto; Contact: Clara Roa, Program Director, (650) 565-8485. Email: clara@psastroke.org

Stroke Club
Stonestown Family YMCA, San Francisco; Contact: Kathy Orsi (415) 759-9632 ext. 217

Stroke/Communication Group
City College of San Francisco. Note: Must call to register, this is a Group Speech Therapy Course; Contact: Judi Kaplan, M.S., CCC-SLP, or Joyce Foreman (415) 561-1005. E-mail: KPLNJ@aol.com or jforeman@ccsf.org

West Contra Costa County Stroke and Aphasia Support Group
Doctors Medical Center, San Pablo; Contact: Flo Leverenz, CCC-SLP, (925) 676-7733.

Valley Care Medical Center Stroke Support Group
Pleasanton, CA 94588; Contact: Wanda Sidun, MSW, Alvin Encarnacion, PT, Matthew Stokes, OT at 925-447-7000 x 5247

Eden Hospital Stroke Support Group
Castro Valley; Contact: Liz Whitaker, Sylvia Dawson at 510-727-2761

Easter Seals Society Stroke Support Group
Oakland,; Contact: Susan Ewing M.A., CCC-SLP at 510-835-2131

Cal State University Sacramento Aphasia Group
Maryjane Reese Language, Speech, and Hearing Center in Sacramento; Contact: Lynda Oldenburg, Clinic Coordinator, 916-278-6601; E-mail: oldenburgls@csus.edu
How many words can you make by rearranging the letters in the name “Benjamin Franklin”?

- bin
- rink

Circle names diagonally, across, up, down and backwards.
Contributors

Thanks to:
Nina Dronkers
David Wilkins
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We would also like to thank the members of the Stroke Support Group and their families, the Speech Pathology staff, and the East Bay Institute for Research and Education.

Newsletter Information

If you would like to receive this newsletter or you have comments/suggestions, call Juliana Baldo at (925) 372-4649 or email her at juliana@ebire.org, or write to:

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We welcome your comments and questions!

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