Brain Development Imaging Laboratory (BDIL)
January 2015 Newsletter

SAN DIEGO STATE UNIVERSITY

UCSD

We wish you and your families a Happy New Year!

New Studies

–New funding. Aside from a study combining EEG and MRI (mentioned in our previous newsletter), BDIL has recently received a large grant from the National Institute of Mental Health that will combine MRI techniques (similar to those used in our current studies) with magnetoencephalography (MEG; **Figure 1).** This study will be conducted in collaboration with Dr. Ksenija Marinkovic, an MEG expert who has recently joined the faculty at the SDSU Department of Psychology. This will be one of the most comprehensive approaches to studying brain network organization in ASD to date. The addition of MEG is important for the following reason: MRI, which you know from your participation in our previous studies, is very good at creating pictures of the brain. These can show anatomy (size and shape of different parts of the brain) and function (which parts become active during a task). However, the images from MRI are mostly static and do not show the dynamic nature of brain processes well. For example, when a person performs a language task (deciding whether a word is an animal or something else), changes in different brain regions occur within milliseconds. This cannot be seen in MRI, but MEG is very good at detecting these very fast changes in activity. Combining the two techniques therefore has a lot of advantages because very good anatomical information from MRI will be paired with very good information about the dynamics of the process from MEG (see also here).

Figure 1. Child in MEG scanner.

–New collaboration with genetics group. If you have not already, you will soon receive an opportunity to allow us to share your information with a group at UCSD that studies the genetics of ASD, led by a top genetics expert, Dr. Jonathan Sebat. In this collaboration, we hope to be able to genotype as many of the children as possible who have participated in our imaging studies. Having both brain imaging and genetic data will allow us to investigate the links between unusual brain organization in ASD and possible genetic causes.

Research Update

– ***The 'underconnected brain' – debunked***. As explained in our last Newsletter from July 2014, the Brain Development Imaging Lab has been at the forefront of a completely new approach to brain network organization in ASD. Simply put, this discussion is about how different parts of the brain 'talk to each other'. The standard model has been *underconnectivity* in ASD (different regions 'talking' too little with each other). Our lab, however, has published many studies contradicting this simple view and showing that, on the contrary, behavioral problems in ASD can often be explained by *overconnectivity* (brain regions 'talking' too much to too many other brain regions). This model has recently received support from a study by another group showing that synaptic pruning may be impaired in ASD (see online news coverage). This has to do with the way the brain organizes itself during development. In the first years of life, nerve cells develop enormous numbers (hundreds of trillions) of connections (synapses), but learning and development then go along with a gradual reduction ("pruning") of unused connections. Reduced synaptic pruning in ASD may therefore result in cognitive and behavioral problems. Such reduced pruning, which has in fact been hypothesized by our lab for many years, can also account for the *overconnectivity* between brain regions observed in our MRI studies, with your participation. Our general model suggests reduced 'network sculpting' in ASD, as sketched in **Figure 2.**

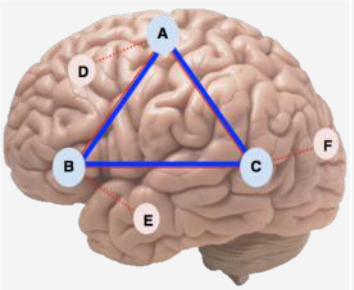

Figure 2. In this simplified diagram, an example network including three brain regions (A, B, C) is shown. The network is strongly connected in the typically developing (TD) brain (thick blue lines), whereas connections are weaker in ASD (thin red lines). However, in ASD the network also has connections to other brain regions (D, E, F) that do not exist in the TD brain.

– ***What does balance have to do with ASD?*** As some of you may remember, our lab – in collaboration with Dr. Daniel Goble's group at the SDSU Department of Exercise and Nutritional Sciences – has been performing balance tests (using a Wii board) alongside our MRI studies. In a first study published in the *Journal of Autism and Developmental Disorders* (see paper), our collaborative group showed that children with ASD indeed tend to have problems with balance. These problems were related to ASD symptom severity, but the good news is that they tended to get better with age. We are continuing to run balance tests in MRI sessions and will now work on studying the brain bases of impaired balance in children with ASD.

– ***Can neurofeedback training improve brain function in ASD?*** In collaboration with Dr. Jaime Pineda's group at UCSD, we have been studying the effects of neurofeedback training. Children with ASD learn to control certain brain rhythms while playing a computer game. Results were recently shown by our doctoral student Michael Datko in a platform presentation at the *Society for Neuroscience* in Washington DC. They indicate that children with ASD show less activity than typically developing children in important regions related to imitation. After about 20 weeks of intensive neurofeedback training, however, activation in these regions improves and looks more normal.

Help spread the word!

We are constantly looking for families who are willing to take part in our ongoing studies. We would like to nominate you *our Ambassadors* and ask you to assist us with getting more families – whether they have a child with autism spectrum disorder or not – involved in our studies, and in advancing science towards a better understanding and better treatments of ASD.

If you and your child (or your friends) are interested in learning more, or getting involved in our research, please **call us at (619) 594-0176** or email bdil@mail.sdsu.edu.