

Student Project: The Effects of Seasonality on Brain Function

Neuroimaging research in humans offers a unique opportunity to determine how different aspects of brain function relate to individual differences in personality, behavior and risk for psychiatric illness. Currently, the Center for Integrated Molecular Brain Imaging (Cimbi, www.cimbi.org) is applying this unique technology in multiple research studies aimed at understanding how the neuromodulator, serotonin, contributes to individual differences in brain function, personality, risk for affective disorders and responsiveness to related treatment methods. We are now recruiting motivated young students who are interested in participating in this exciting neuroimaging research.

A recent study from our research group found that seasonal changes and daylight minutes are associated with alterations in the serotonin system. Interestingly, we found that as the number of daylight minutes changes, so too does the level of a critical protein for regulating serotonin signaling, the serotonin transporter. Because the serotonin transporter is critical for regulating serotonin signaling, this suggests that these seasonal fluctuations in serotonin levels may be related to risk for affective illness like seasonal affective disorder or “the winter blues”. Even more interestingly, our research group found that a subgroup of people with a specific version of the gene that codes for the serotonin transporter showed a particularly pronounced fluctuation in serotonin transporter levels with the seasons. This suggests that individuals may be more or less sensitive to changes in daylight minutes in a manner that depends on genetic differences. To investigate this further, our research group is carrying out a set of neuroimaging studies in humans to see how aspects of brain function change from summer to winter.

We are looking for motivated and interested students to join this exciting research project. Specifically, we are looking for a student to participate in a project that investigates how the brain’s response to emotionally salient stimuli changes with the seasons. BOLD fMRI is a neuroimaging technique used to identify areas of the brain that are activated when processing specific types of information. Within our current project we are examining how the brain responds to faces expressing various emotions. Previous research shows that this response is related to serotonin signaling and function of the serotonin transporter. Because of our finding that serotonin transporter levels are modulated by seasonal changes, we expect that the brain’s response to threat will show similar fluctuations. Additionally, we expect that individuals with a DNA type that we found show a more dramatic change in serotonin transporter levels from summer to winter will also show similar fluctuations in the brain’s response to threat.

Another component of this study will be to evaluate the effect of bright-light therapy on serotonin levels and brain function. Previous studies have shown that adverse effects associated with decreasing daylight minutes during the winter time can be reduced by exposure to light therapy. We anticipate that bright light therapy will dampen the impact of changes in daylight minutes on serotonin signaling. Additionally, we anticipate that those receiving this therapy will show a smaller change in their brain's response to threat, consistent with greater stability of brain systems that are affected by changes of the seasons.

The student's responsibilities in this project will include:

- 1) Recruitment of participants for each of the two studies.
- 2) Interview the participants, e.g., to assess symptoms of seasonality. Book appointments for neuropsychological, neurological and psychiatric examinations and fMRI scanning.
- 3) Organize saliva and blood samples for analysis.
- 4) Organize randomization for bright light therapy vs. placebo and follow-up with participants throughout experiment.
- 5) Preprocess and initiate the analysis of BOLD fMRI datasets from participants in these two projects. Analyses include evaluating differences in brain response that are related to genotype and factors such as seasonality and daylight minutes. Prior experience with neuroimaging research is beneficial, but not necessary. In addition to training provided by experienced staff members, project supervisors (Prof. Gitte Moos Knudsen from Neurobiology Research Unit, Rigshospitalet and Prof. Hartwig Siebner from Danish Research Center for Magnetic Resonance, Hvidovre Hospital), there will be an opportunity to attend international training courses. Please contact Research Administrator Helle Marijnissen (Helle.Marijnissen@nru.dk) if you would like to become involved in this exciting translational research project.