

Learning for Life Week 1 Summary 9-26-18

Topic: Integrative and Personalized Neuroscience

Speakers: Ravi Allada MD and Dimitri Krainc MD, PhD

Shirley welcomed everyone warmly and highlighted the importance of learning about “the next frontier”-the brain and neuroplasticity. She recommended a book, The Brain That Changes Itself by Norman Doidge, MD.

Ravi Allada then gave an overview of how the modern technological revolution with methods like *optogenetics* will transform neuroscience. Advanced imaging of the brain while subjects (animals or humans) are learning, moving, crying or thinking will permit a deeper understanding of how and why humans behave the way that they do. It will give us opportunities to make diagnostic and therapeutic impact in conditions ranging from depression to Alzheimer’s disease. Applications will also be possible in business, marketing, the arts and humanities. “Why do people make the decisions that they do?”

He then moved on to his particular area of research-“Why Do We Sleep?” He focused mostly on the importance of *circadian clocks* which exist in all life forms. Our circadian clock controls not only sleep, but also things like body temperature, hormone release and blood pressure. The clock is not only in the brain- it is in all of the body’s tissues and cells. We know that certain conditions like heart attacks happen more frequently in the morning, while asthma is more nocturnal. Cancer cells may replicate more in the early hours of the day, so the timing of chemotherapy may have an impact on the cancer’s growth. In the not too distant future there may be *personalized chronotheapy*, where each person’s internal clock is known and targeted for the best timing of medication administration.

Ravi asserted that people need 8 hours of sleep, and that lack of sleep leads to a significant reduction of motor performance and learning. Sufficient sleep improves memory. It seems to consolidate what we have learned. Sleep may serve a “brainwashing” function overnight so that toxins that build up in the brain are washed out overnight. The disruption of effective sleep and circadian clock disruption may interfere with this brainwashing and has been theorized to contribute to the development of diseases like dementia, mood disorders and Parkinson’s Disease.

Dimitri Krainc took the stage and told us that the research collaboration he has experienced in the last five years at Northwestern has been exceptional. His personal and departmental research focus is on finding targeted therapies for neurodegenerative diseases like Parkinson’s. He walked us through the steps of the protocol which includes taking skin cells from patients and utilizing advanced techniques to turn these cells first into stem cells and then into the patient’s neurons. In effect, he is able to mimic the patient’s brain in the petri dish. He sequences the patient’s genome to identify genetic mutations and cellular targets for novel drug treatments. Dimitri gave us the example of a treatment for Parkinson’s disease that is currently in clinical trials which evolved out of this type of approach. Ultimately the goal will be to utilize a combination of genome sequencing and biomarkers to identify patients in the “pre-symptomatic” stage of a disease like Parkinson’s or Alzheimer’s so that treatment can begin earlier and ideally improve prognosis.

Take Home Points:

1. Learn about neuroplasticity in the book, The Brain That Changes Itself by Norman Doidge MD.
2. All life forms have circadian clocks that regulate not only sleep, but many other biologic functions. Disruption of this clock can lead to many diseases.
3. Sleep may serve a “brainwashing” function to remove toxins from the brain, that if left to build up may contribute to diseases like Alzheimer’s and Parkinson’s.
4. Novel research techniques like that occurring in Dr. Krainc’s lab, combined with genomic sequencing is allowing for the development of new treatments in many neurodegenerative diseases.

See you next week!

Marianne and Diane