The PHI BETA KAPPA Society

VISITING SCHOLAR PROGRAM

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PUBLIC LECTURE OFFERINGS

PREHISTORIC PROZAC: ENHANCING EMOTIONAL AND NEURAL RESILIENCE WITH EFFORT-BASED REWARDS

Although extensive research efforts have been directed toward identifying effective therapies for depression, current treatment outcomes remain disappointing. The pharmaceutical approach (e.g., antidepressants) has been at the forefront of therapeutic options despite controversial evidence of the chemical imbalance targeted by the drugs. Pivoting from traditional pharmaceutical approaches, I introduced the term behaviorceuticals to emphasize the ability of behavior to alter neurochemicals in adaptive ways. Considering that a large part of our brain's real estate is devoted to the movement of our bodies, sedentary lifestyles may negatively impact neural health. Perhaps behaviorceuticals represent the preferred antidepressant (i.e., Prehistoric Prozac) of our active human ancestors. To learn more about the effectiveness of behavioral-focused therapeutic strategies, we developed an animal model that builds connections between physical effort and rewarding outcomes (i.e., effort-based rewards). Our findings indicate higher levels of emotional resilience markers in the trained animals-- results that may have translational value for humans.

BRAIN SCULPTING: CREATING OPTIMAL NEURAL NETWORKS AND FUNCTIONS WITH EXPERIENCE-BASED NEUROPLASTICITY

KELLY LAMBERT

Considering that our brains change from the womb to the tomb, it is critical to understand how life experiences alter neural functions. The ability to change our minds and our brains---known as neuroplasticity---is one of our most valuable "superpowers." A discussion of neuroplasticity research will span from the earliest "enriched environment" rodent studies to current research focusing on tuning brains for optimal functions throughout our lives. Over a half-century of research has identified fascinating neurobiological tools that the brain uses to adapt to our changing worlds. Knowledge that the brain can also change in maladaptive ways serves as a potent reminder that we should be mindful of our brain's experiences throughout our lives.

BRAINS GONE WILD: LOOKING BEYOND LABORATORY RODENTS FOR ADAPTIVE NEURAL STRATEGIES THAT TRANSLATE FROM THE BUSH TO BEDSIDE

Most mental health research is conducted on laboratory rats and mice. In this talk, the limitations of focusing on a few selectively-bred species housed in stripped-down laboratory cages will be discussed. As a researcher who uses animal models, I have examined these limitations in my own research and, consequently, have commenced an exciting journey exploring diverse brains in natural habitats. Research comparing wild-trapped rats and laboratory-bred rats of the same species indicates vast neural differences between captive and wild populations. Although rodents are representative of mammalian brains, fascinating species-specific differences exist among mammals that will inform perspectives of healthy brain functions. My lab's investigations of raccoons, for example, suggest that their brains have similar neural patterns as primate brains---maybe that's why they're always breaking into our garbage bins despite our clever locking systems. Focusing on a unique primate model, recent investigations of the world's smallest primate (i.e., mouse lemurs in Madagascar) are leading to insights about neurodegenerative conditions such as Alzheimer's Disease. Indeed, there is much to be learned from examining diverse mammalian brains.

THE DYNAMIC PARENTAL BRAIN: HOW REPRODUCTIVE EXPERIENCE TRANSFORMS NERVOUS SYSTEMS TO OPTIMIZE OFFSPRING OUTCOMES

It's common knowledge that parental care is essential for the development of healthy brains and the survival of offspring. Additionally, the presence of offspring also has impactful effects on the parental brain---which for most mammals is the maternal brain considering that paternal investment is observed in a mere 3-5% of mammals. The transitioning of the maternal rat

from an animal that finds pup odors aversive to an animal that is obsessed with her offspring is a fascinating neurobiological journey. Interestingly, maternal rats appear to be "smarter" in spatial foraging tasks, exhibiting several behavioral and cognitive adjustments to meet the demands of caring for offspring. In less than optimal conditions such as environments with limited resources or multiple threats to safety, parental responses are compromised and lead to long-lasting effects in the offspring. Thus, the rodent super-moms can teach us a lot about the importance of healthy nurturing relationships for mammalian species.

CLASSROOM DISCUSSION TOPICS

1. WHY I TAUGHT RATS TO DRIVE CARS

Several years ago my students and I designed a rodent-operated vehicle (ROV) to learn more about spatial training in rats. Little did we know that this would become a popular outreach program that was included in a recent Netflix series The Hidden Lives of Pets (Episode 1) and covered in over 1500 media stories. Beyond providing relevant information about rodent training experiences, the driving rats have served as an effective neuroscience outreach platform.

2. WHY HAVE NEUROSCIENTISTS FOCUSED ON LABORATORY RODENTS AS THEIR PRIMARY RESEARCH MODEL?

I'll dive into the history of the domestication of rats for laboratory use, leading to their adoption as the most popular animal model (along with mice) in biomedical research, especially neuroscience research.

3. THE HOPEFUL RAT

During a time when most neuroscience research focuses on negative emotions such as fear, stress, and aggression, it's also important to investigate the value of positive emotions. How are neuroscientists tackling this methodological challenge in animal models?