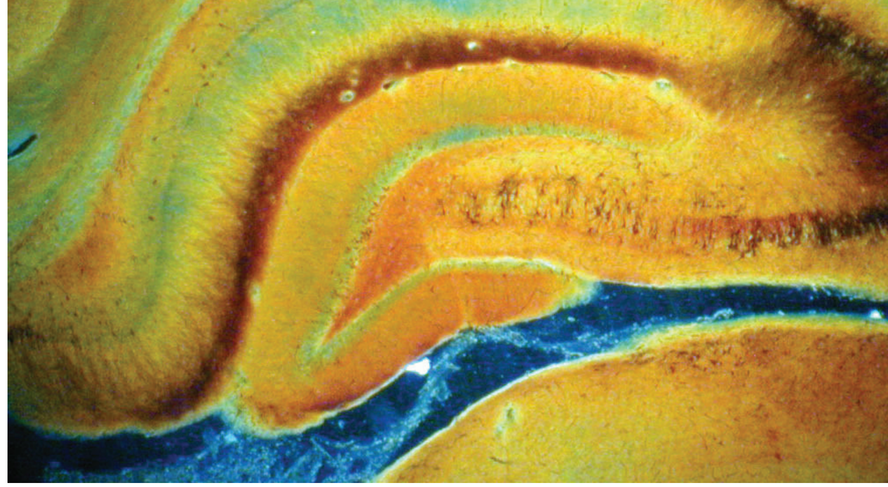


Brain image provided by TDLC investigator Dr. Gyorgy Buzsaki

Temporal Dynamics

of the World, the Brain, Movement & Exploration

At the Temporal Dynamics of Learning Center…

We read the brain, we read the face, and we read the body in ways that are deeper and faster than most human experts. This gives us a platform for a very personal form of education, entertainment, lifelong learning, and medicine.

Timing is everything…

We offer unique opportunities to partner with individuals, institutions and industries who share our collaborative values and our commitment to the advancement of

Transformative Science * Multi-disciplinary Training * Educational Innovation.

Temporal Dynamics of Learning Center
University of California, San Diego
Institute for Neural Computation
9500 Gilman Drive, Mail Code 0523
La Jolla, CA 92093-0523

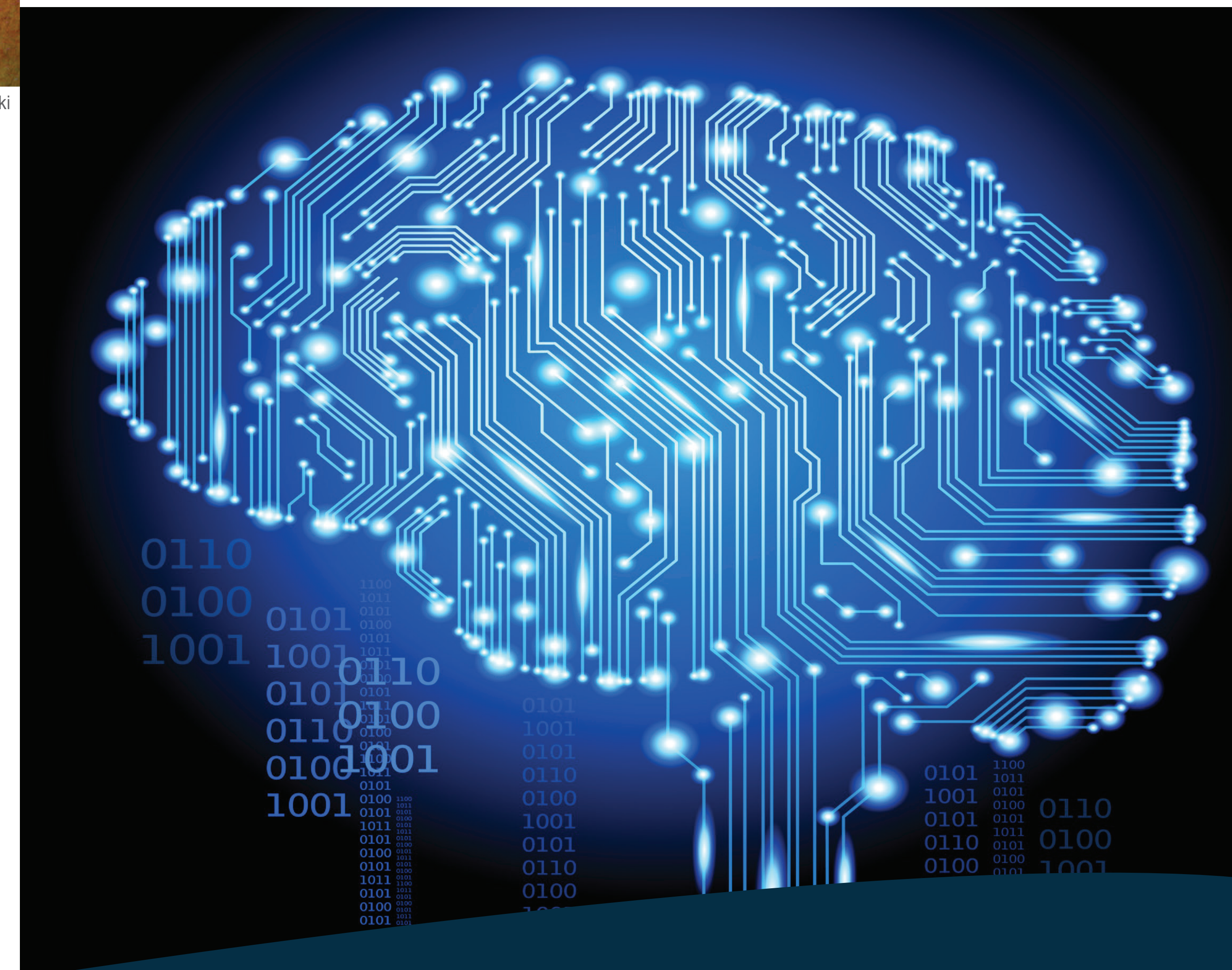
UC San Diego

Research, training & translation supported by NSF SMA 1041755.

"Life passes in milliseconds, but what we learn in those milliseconds changes us for life."

Dr. Gary Cottrell, TDLC Director

Temporal Dynamics of Learning Center



Building a better science of learning: It's about time!

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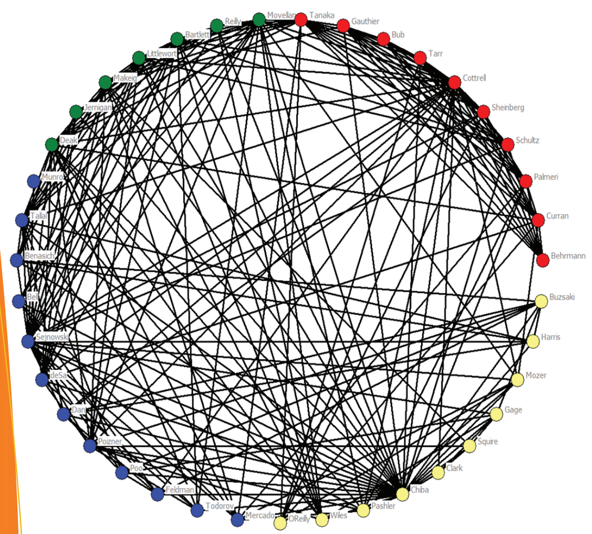

Our Mission

As one of six Science of Learning Centers funded by the National Science Foundation, our mission is to create a new science of the temporal dynamics of learning in which we achieve an integrated understanding of the role of time and timing in learning, across multiple scales, brain systems, and social systems. We aim to use this understanding to inform K-12 educational practice. To do so, we created a new collaborative research structure, the network of networks to transform the practice of science.

INNOVATIVE NETWORK-OF-NETWORKS ORGANIZATION

Answering questions about the role of time and timing in learning cannot emerge from a single line of inquiry, so TDLC's research model has been collaborative and interdisciplinary from the beginning. TDLC is a community of scientists who break down disciplinary and institutional barriers in pursuit of a common set of research questions. Researchers focus on each set of issues from multiple perspectives, and synchronize their research by running parallel experiments in animal, human, and theoretical models.

TDLC is organized as a network of networks to focus on four major aspects of learning: Sensori-Motor Learning, Interactive Memory Systems, Perceptual Expertise, and Social Interaction Systems. Each network is composed of multiple Principal Investigators, often from different partner institutions, and with crosscutting resources available to researchers in all the networks: Brain dynamics, data sharing and motion capture facilities, and an education and outreach center. The TDLC collaborative multi-disciplinary model effectively and efficiently builds relationships between researchers, educators, students and the general public in order to generate new, transformational ideas.

worldwide interdisciplinary team

TDLC SCIENCE DISCIPLINES INCLUDE:

- MACHINE LEARNING
- BIOLOGY
- NEUROSCIENCE
- BRAIN IMAGING
- MOLECULAR GENETICS
- COGNITIVE SCIENCE
- PSYCHOLOGY
- ROBOTICS
- BIOPHYSICS
- MATHEMATICS
- COMPUTATIONAL MODELS OF LEARNING AND EDUCATION

> ***Over 40 Principal Investigators***
> ***More than 150 Trainees - undergraduate through post-doc***
> ***At 18 partner research institutions***
> ***Located in four countries***

(U.S., Canada, England, Australia)

questions we ask

Timing is critical for learning at every level, from learning the precise temporal patterns of speech sounds, to learning appropriate sequences of movements, to optimal training and instructional schedules for learning, to interpreting the streams of social signals that reinforce learning in the classroom or the boardroom. TDLC initiatives address fundamental research questions such as:

- *How is temporal information about the world learned and how do the temporal dynamics of the world influence learning?*
- *How do the intrinsic temporal dynamic properties of brain cells and circuits facilitate and/or constrain learning and behavior?*
- *How can the temporal features of learning be used to enhance education?*
- *What are the best theoretical ways to conceive the temporal dynamics of learning in the brain and between brains?*
- *What are the temporal structures for body movements and sampling the environment and how are they learned?*

translation

TDLC is dedicated to the integration of scientific discoveries into everyday life. Understanding the temporal dynamics of learning can transform how children and adults learn, work, receive treatment, and interact with novel technologies.

TECHNOLOGIES:

Creating groundbreaking computer games to help autistic children read faces; Developing group musical training methods and technologies to improve attention and learning in children.

TRAINING:

Developing robots to help in schools: RUBI, a social robot, has taught colors and shapes to preschoolers using California standards; In the future, Diego-San, a robot-baby, may provide special needs children with unique therapeutic opportunities.

IN THE CLASSROOM:

Inventing tutoring systems that adapt according to the user's facial expressions during learning; Writing computer models that help students schedule study sessions for optimal learning; Developing cognitive and literacy skills training to improve basic writing skills.

COLLABORATIVE RESEARCH NETWORKS

TDLC's new model fosters the training of young scientists through four Collaborative Research Networks:

INTERACTING MEMORY SYSTEMS NETWORK

IMS examines precisely how brain systems work together to code memories. They also examine how and when information should be present and practiced in order to promote enduring memory. These lines of inquiry can lead to the development of algorithms for scheduling learning episodes and biometrics for performance allowing us to understand and augment learning and memory in the case of the typical learner and in cases when difficulties are encountered.

PERCEPTUAL EXPERTISE NETWORK

PEN explores how "different" brains approach object recognition. This applies to neurotypical individuals, but also people with visual deficits or autism and even to non-human primates and computer models. The study of plasticity in the brain and of the changes in perceptual strategy when people become experts reveals the dynamics of learning in a variety of domains, such as face recognition, reading music or recognizing bird species.

SENSORIMOTOR NETWORK

SMN investigates sensorimotor control and learning at multiple spatial and temporal scales. Non-invasive brain-computer interfaces and interactive immersive virtual environments can enable educational strategies tailored to the individual, advance the design of robotic devices, create new therapeutic avenues for individuals with language or motor impairment, and open up entirely new possibilities for understanding the cortical substrates of cognition.

SOCIAL INTERACTION NETWORK

SIN discovers and maps the brain systems and motor mechanics involved in social interactions that contribute to learning and memory. Employing innovative computer-based interventions and social machine learning platforms, such as robots, can improve individual and social group behavioral, abstract thinking and learning dynamics. They are also examining social conventions and cultural traditions, such as music, and their value to learning and well-being.