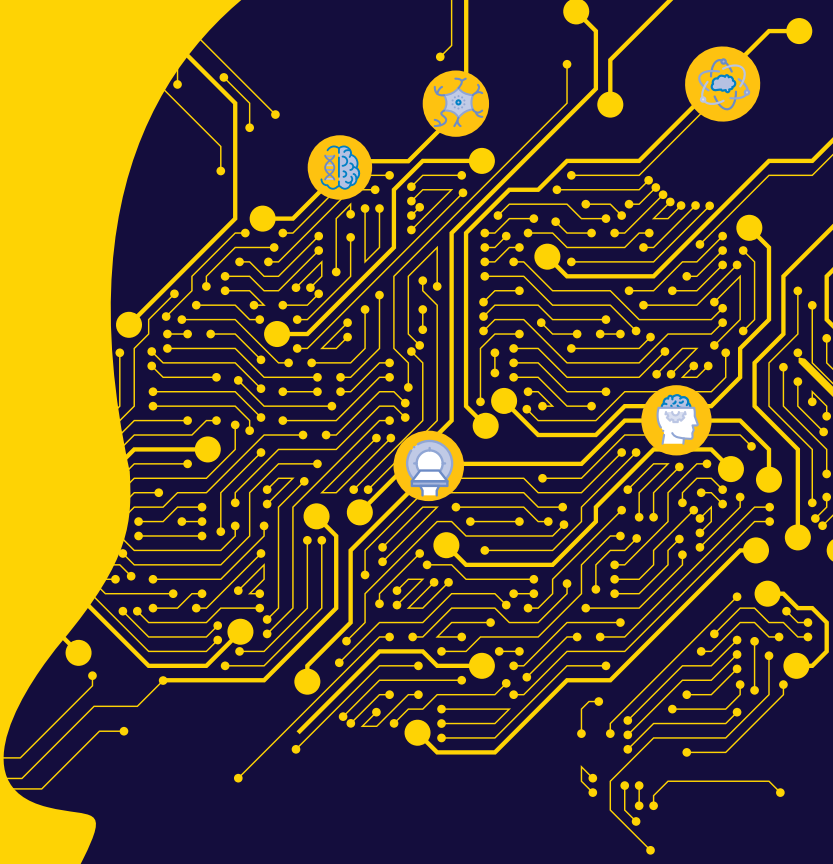

CNIR Symposium

Exploring Natural intelligence: Perspectives on brain evolution, development and organization

Program Book

2023. 7. 19 (수) 09:00 ~ 18:00

성균관대학교 자연과학캠퍼스 N센터 86120호

ibs 기초과학연구원 Institute for Basic Science

CNIR 뇌과학이미징연구단 Center for Neuroscience Imaging Research

CNIR SYMPOSIUM

Exploring Natural intelligence: Perspectives on brain evolution, development and organization

When 2023. 7. 19 (수) 9:00~18:00 Where 성균관대학교 자연과학캠퍼스, N센터 86120호

Time	Contents	Speaker
09:00 - 09:30	Registration	
09:30 - 09:35	Opening ceremony	Seng Bum Michael Yoo (SKKU/CNIR)
Session 1 Chiar : Seng Bum Michael Yoo (SKKU/CNIR)		
09:40 - 10:30	Rethinking behavior in the light of evolution	Paul Cisek (University of Montreal)
10:35 - 11:30	Abstract thought, two ways: The development of natural intelligence	Moira Dillon (New York University)
11:35 - 12:30	Learning with certainty in childhood	Celeste Kidd (University of California,Berkeley)
12:35 - 12:50	Panel Discussion 1	
12:50 - 14:00	Lunch Time	
14:00 - 14:20	Poster Presentation (2023 CNIR Summer school)	
Session 2 Chiar : Seok Jun Hong (SKKU/CNIR)		
14:30 - 15:25	Closing the mechanistic gap: The Value of Microarchitecture for Understanding Human Cognition	Casey Paquola (Max Planck Institute)
15:30 - 16:25	Spontaneous Emergence of Functional Circuits in the Brain	Se-Bum Paik (KAIST)
16:30 - 17:25	Diving into Darwin's Dreamponds to understand how behaviour evolves	Alex Jordan (Max Planck Institute of Animal Behavior)
17:30 - 17:50	Panel Discussion 2	
17:50 - 18:00	Closing remarks	Seok Jun Hong (SKKU/CNIR)

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Rethinking behavior in the light of evolution

Paul Cisek
University of Montreal

In psychology and neuroscience, the brain is usually described as an information processing system that encodes and manipulates representations of knowledge to produce plans of action. This view leads to a decomposition of brain functions into putative processes such as object recognition, memory, decision-making, action planning, etc., inspiring the search for the neural correlates of these processes. However, neurophysiological data does not support many of the predictions of these classic subdivisions. Instead, there is divergence and broad distribution of functions that should be unified, mixed representations combining functions that should be distinct, and a general incompatibility with the conceptual subdivisions posited by theories of information processing. In this talk, I will explore the possibility of resynthesizing a different set of functional subdivisions, guided by the growing body of data on the evolutionary process that produced the human brain. I will summarize, in chronological order, a proposed sequence of innovations that appeared in nervous systems along the lineage that leads from the earliest multicellular animals to humans. Along the way, functional subdivisions and elaborations will be introduced in parallel with the neural specializations that made them possible, gradually building up an alternative conceptual taxonomy of brain functions. These functions emphasize mechanisms for real-time interaction with the world, rather than for building explicit knowledge of the world, and the relevant representations emphasize pragmatic outcomes rather than decoding accuracy, mixing variables in the way seen in real neural data. I suggest that this alternative taxonomy may better delineate the real functional pieces into which the human brain is organized, and can offer a more natural mapping between behavior and neural mechanisms.

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Abstract thought, two ways: The development of natural intelligence

Moira Dillon
New York University

Humans are the best knowers and learners of the natural world. In this talk, I will delineate two types of abstract thought that underlie humans' awesome cognitive achievements. First, from infancy, we have abstract concepts that support common sense in our daily lives about people, places, and things. This foundational abstract thought is our evolutionary cognitive inheritance and lies between perception and deliberation. Second, through development, we become capable of abstract thought that goes beyond what we directly experience in daily life. This abstract thought is unique to humans and can be called upon for formal learning. I will show how, together, these two ways in which humans think abstractly: inspire technological advances, like artificial intelligence that might one day represent and reason about the minds of others like we humans do; inform cultural productions, like our use of pictures; and give rise to formal systems of thought, like Euclidean geometry.

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Learning with certainty in childhood

Celeste Kidd
University of California, Berkeley

Learners use certainty to guide learning. They maintain existing beliefs when certain, but seek further information when they feel uninformed. Here, we review developmental evidence that this metacognitive strategy does not require reportable processing. Uncertainty prompts nonverbal human infants and nonhuman animals to engage in strategies like seeking help, searching for additional information, or opting out. Certainty directs children's attention and active learning strategies and provides a common metric for comparing and integrating conflicting beliefs across people. We conclude that certainty is a continuous, domain-general signal of belief quality even early in life.

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Closing the mechanistic gap: The Value of Microarchitecture for Understanding Human Cognition

Casey Paquola
Max Planck Institute

Cognitive neuroscience has highlighted "where" in the cortex neural activity is linked to certain behaviours. This research program leaves open important questions about the mechanisms of "how" brain activity in these regions contribute to cognition. We aim to fill this gap by explicitly integrating macro-scale functional neuroimaging with detailed accounts of the microarchitecture of the brain. In particular, I will discuss our recent work on the unique and heterogenous microarchitecture of the default mode network. We discovered a set of anatomical features that allow the default mode network to contribute to multiple cognitive states in an abstract manner. Such multi-scale neuroanatomical approaches provide potential solutions for how the brain engages in complex thought and can lay out a road map for how to build biologically inspired systems for artificial general intelligence.

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Spontaneous Emergence of Functional Circuits in the Brain

Se-Bum Paik

Korea Advanced Institute of Science and Technology

The ability to perform various cognitive functions is often observed in naïve animals, and this raises questions about the origin of innate brain functions. Particularly, a mechanism of how visual recognition in the brain arises initially is still unclear – whether it requires supervised or unsupervised learning, as in artificial neural networks. In this talk, I will introduce our findings that early functional circuits and cognitive functions in the brain can emerge spontaneously, in the complete absence of training. First, I will show how the regularly structured cortical maps can arise spontaneously from simple local interactions between individual cells, implying that evolutionary variation of physical parameters may induce development of distinct functional circuitry in the brain. Second, I will show higher cognitive functions such as number sense and primitive object detection can emerge spontaneously in untrained neural networks. We found that neurons tuned to stimulus features arise in untrained random feedforward networks, and these neurons also showed single- and multi-neuron characteristics of the types observed in biological brains, such as Weber-Fechner law. These results imply that the random feedforward connections in early brain circuits may be sufficient for initializing primitive cognitive functions, providing new insight into the origin of functional circuits in the brains.

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Diving into Darwin's Dreamponds to understand how behaviour evolves

Alex Jordan

Max Planck Institute of Animal Behavior

Understanding how selection acts on and shapes behaviour remains an enduring challenge in evolutionary biology. Unlike relatively stable morphological traits, behaviour is extremely flexible in space and time, and leaves no fossil record. Moreover, while many physical traits can be easily measured and quantified, behaviour is often described in qualitative terms, making comparison among and within species almost impossible. Here I will present our research into the evolution of social behaviour in Lake Tanganyikan cichlid fish, a species flock representing one of the world's most incredible behavioural radiations. With a combination of field-based research, underwater videography, machine-learning based analyses and decomposition of behaviour, cognitive assays, and neuroanatomical studies, we aim to uncover the evolutionary pathways that lead to complex forms of behaviour. In this talk I will present our research in this system, discussing conserved behavioural toolkits, behavioural exaptation, and neuroanatomical evolution.

교내식당 안내

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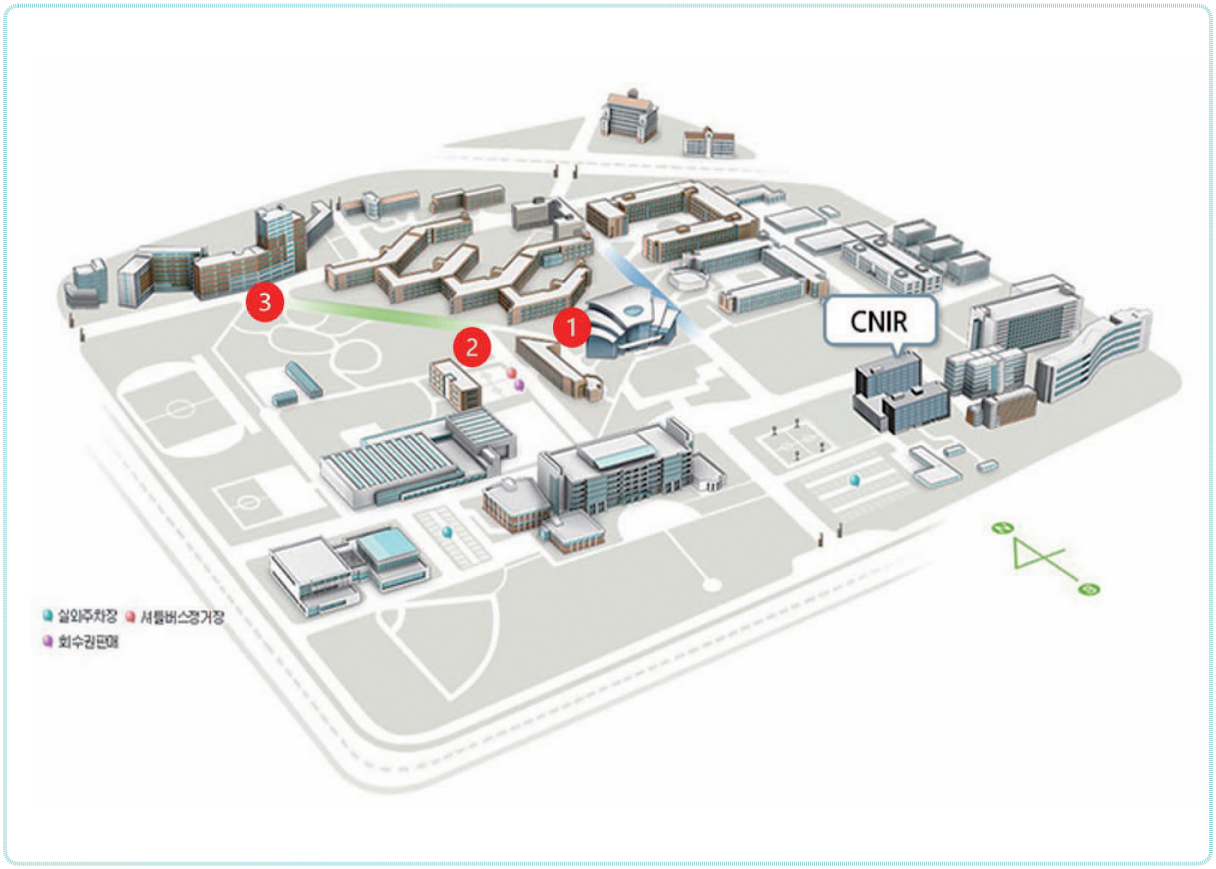

지 도	식당/편의점	위 치
1	학생식당(행단골)	학생회관 1층
	써브웨이	학생회관 2층
2	GS편의점	복지회관 1층
	교직원식당(구시재)	복지회관 3층
3	뉴욕버거	기숙사 신관 1층

WIFI 안내

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- WIFI : SKKU_SEMINAR
- 학술세미나 참석(Guest) 클릭
- Key: seminar20230608 (전부 소문자)

※ PC, Mobile 모두 사용 가능