2024
MEETING
PROGRAM

SOCIETY FOR SOCIAL NEUROSCIENCE

S4SN

JAPAN

March 25–28, 2024

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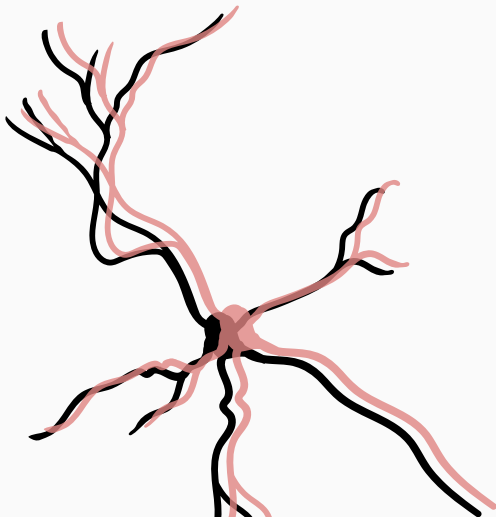

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INTRODUCTION

Welcome to S4SN 2024!
Our first ever multi-day international Meeting in Tsukuba, Japan!

I am extremely happy that so many skilled social neuroscientists from all over the world have made it to S4SN 2024. From the start, our organisation has promoted diversity both in terms of geographical locations and at the level of research approaches and model organisms.

At this year's meeting, we will hear about interbrain communication, dynamics of naturalistic social interactions, empathy, and many other exciting topics from speakers based in **13 different countries across 4 continents**. In addition, we have a record high number of poster presentations, with approximately even numbers presenting work from human and non-human animals.

Drawing parallels across species and exploiting the unique possibilities offered by different model systems is a great strength of the S4SN community. We encourage all scientists to bear in mind the diversity of our conferences attendees and their research approaches. Don't hesitate to ask questions, and remember that a simpler, less technical explanation will likely help your audience understand why *your* research question is *the coolest ever*.

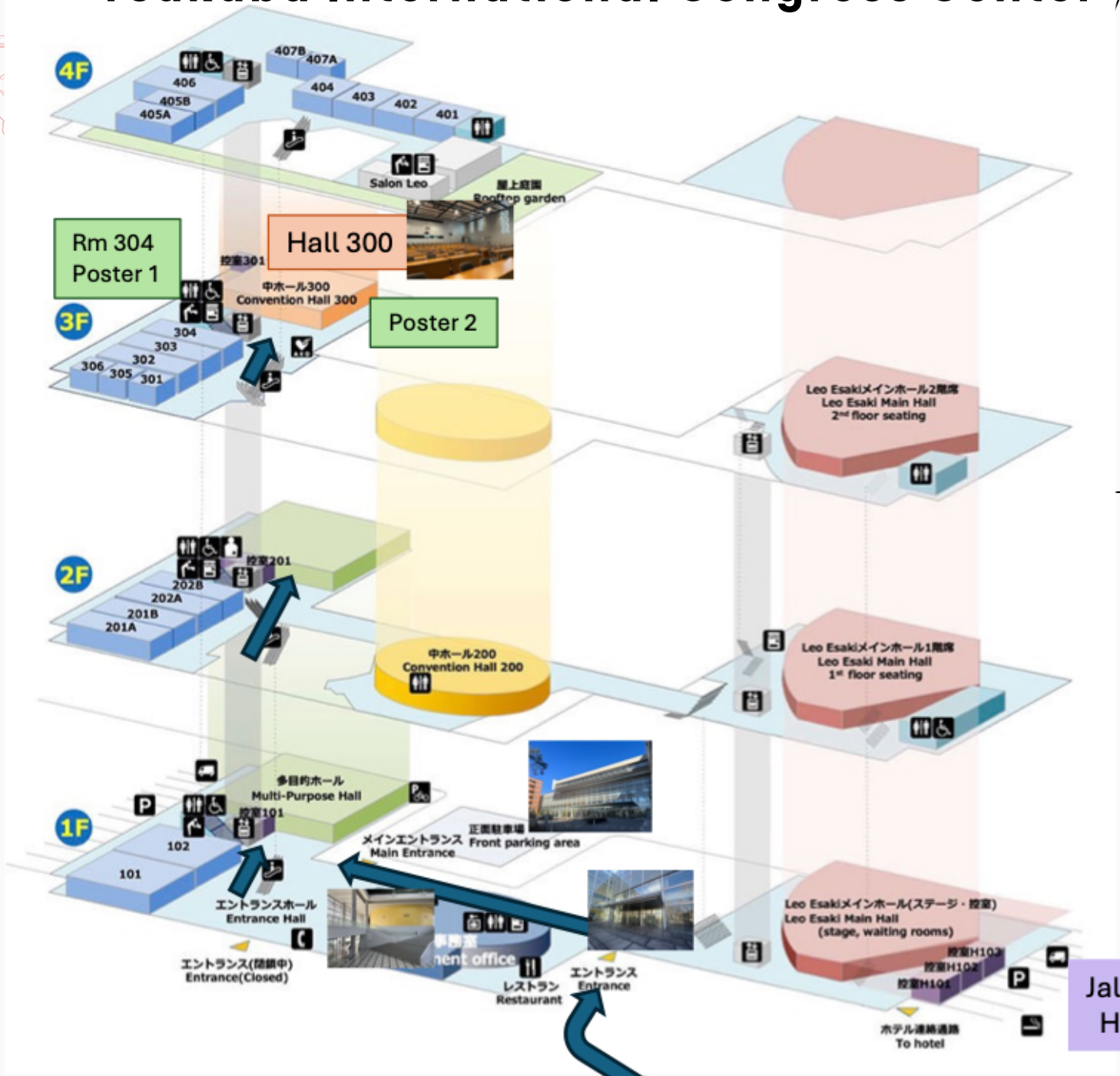
We are also so excited to launch our first-ever Mentoring program! We have 33 students, 13 postdocs, and 36 faculty signed up! We hope that this will allow our trainees to build community, seek support, and gain access to invaluable insight from their mentors!

I hope you will enjoy every moment of S4SN 2024: the talks, discussions, poster sessions, coffee breaks and excursions, and that you will come away energised and ready to push the social neuroscience field forward!

Sincerely,
Siri Leknes
S4SN President

VENUE MAP

Tsukuba International Congress Center



From
TX Tsukuba Station
Tsukuba Center Bus Terminal

For more venue information and information about the area, please see the Travel and Information booklet!

SCAN ME

SIMPLE SCHEDULE

Monday 3-25		Tuesday 3-26		Wednesday 3-27		Thursday 3-28	
		8:30 - 9:00	Coffee, snacks	8:30 - 9:00	Coffee, snacks	8:30 - 9:00	Coffee, snacks
9:00 - 10:00	Coffee, snacks & mingle Mentor-Mentee Meet Up	9:00 - 10:50	**Session 4** *Innate social behavior (aggression, sexual behavior, parental behavior)*	9:00-10:50	**Session 5** *A cross-species perspective on how the emotional state of others influences the state and decisions of observers*	9:00-10:50	**Session 8** *Outside of the ordinary Social Neuroscience - diverse species*
10:00 - 10:05	Introduction	10:50 - 11:10	Coffee/snacks	10:50 - 11:10	Coffee/snacks	10:50 - 11:10	Coffee/snacks
10:05-11:45	**Symposia 1** *Neural mechanisms underlying social behaviour across species and across the lifespan*	11:10 - 11:40	**Keynote** *Masaki Isoda*	11:10 - 11:40	**Keynote** *Shihui Han*	11:10-12:00	**Session 9** *(10 min short talks)*
		11:45 - 12:10	**Award Talk** *Nancy Padilla*	11:45 - 12:10	**Award Talk** *Emilie Caspar*		
11:45 - 12:00	GROUP PHOTO						
12:00 - 1:30	Lunch + Poster Session 1	12:10 - 12:20	Open Science Award Presentation	12:10 - 1:30	Lunch + Poster Session 2	12:00 - 1:30	Lunch
1:30 - 3:10	**Session 2** *Neural, psychological, and computational mechanisms of social motivation and reward*		Organized Excursions or Social gathering at the conference venue	1:30-3:10	**Session 6** *Social and physical pain and emotions*	1:30-3:10	**Session 10** *Understanding the Behavioral and Neural Dynamics of Naturalistic Social Interactions*
3:10 - 3:30	Coffee/snacks			3:10 - 3:30	Coffee/snacks	3:10 - 3:15	Closing remarks
3:30-5:10	**Session 3** *Interbrain communication in dyadic social interaction in health and disease.*			3:30-5:10	**Session 7** *Oxytocin and social cognition – relevance for mental health*		
5:10 - 5:30	Break, Happy Hour			5:10 - 5:30	Break, Happy Hour		
5:30 - 5:40	Data Blitz			5:30 - 5:40	Data Blitz		
5:40 - 7:30	Poster Session 1 Drinks, Happy Hour			5:40 - 7:30	Poster Session 2 Drinks, Happy Hour		

Note - meals are not included with the conference, only coffee and snacks. There will be organized "meet up" locations to connect with other conference attendees for meals.

Keynote

Tuesday, March 26, 11:10 am

MASAKI ISODA, PHD

Masaki Isoda is a professor at the National Institute for Physiological Sciences, Japan. He investigates the neural mechanisms underlying social cognition and behavior at the cellular and global network levels using macaque monkeys. He uses a variety of behavioral tasks designed for two monkeys facing each other, multisite and multielectrode neural recording methods, and dual viral vector techniques for pathway-selective blockade. He has identified cortico-cortical and cortico-subcortical pathways that are crucial for social action and reward monitoring. He was awarded the Tsukahara Nakaakira Memorial Award in 2017. For more information about Dr. Isoda, please visit: https://www.nips.ac.jp/eng/research/group/post-48/

PROBING THE SOCIAL MIND WITH ELECTRODES

Primates, including humans, are social by nature; their success as biological entities depends on how well they can deal with other individuals. The key to survival from a long-term perspective is to monitor the behavior of others, extract context-relevant information, and organize one's own behavior in socially appropriate manners. My laboratory has been investigating the neural mechanisms underlying behavioral monitoring, reward valuation, and their motivational impact in social contexts at the single neuron and global network levels. In this talk I show, using multi-site electrophysiological recording and circuit-selective intervention techniques in monkeys, that such social cognitive function is mediated by functionally interconnected cortical and subcortical structures.

Early Career Award Talk

Tuesday, March 26, 11:45 am

NANCY PADILLA-COREANO, PHD

Nancy Padilla-Coreano, Ph.D. is a Neuroscientist and Assistant Professor at the University of Florida in Gainesville. Her research explores how the brain enables humans and animals to navigate complex social dynamics and how this ability is disrupted in disease states. Dr. Padilla-Coreano uses behavioral assays, multi-site electrophysiology, and machine learning analyses to identify the neural circuit dynamics behind social competency in mouse models. She is a L'Oreal for Women in Science Fellow and was recently awarded the inaugural Henry Grass, M.D. Rising Stars in Neuroscience award. For information more about Dr. Padilla-Coreano, please visit: https://www.padillacoreanolab.com/

NEURAL CIRCUITS FOR SOCIAL COMPETENCE

Social interactions are essential for the survival of social animals. Across species the medial prefrontal cortex (mPFC) has been identified as a hub of social cognition. In mouse models we can dissect the neural circuits and dynamics underlying the role of mPFC in specific social behaviors. Combining novel behavioral assays, optogenetics, machine learning and wireless electrophysiology in mice, we demonstrate a role for the mPFC-hypothalamic pathway in driving social competition. We also discuss unpublished work regarding prefrontal and subcortical network interactions that change with competitive success. Finally, we explore the interrelations of social memory and social rank encoding in the mPFC.

Keynote

Wednesday, March 27, 11:10 am

SHIHUI HAN, PHD

Dr. Shihui Han is a professor at the School of Psychological and Cognitive Sciences and a principle investigator at PKU-IDG/McGovern Institute for Brain Research, Peking University, China. He investigates how sociocultural experiences shape neural mechanisms underlying social cognition and emotion and affect social decision-making and behavior. He proposes a Culture-Behavior-Brain loop model of human development to characterize cultural influences on brain and behavior and an asymmetric race processing model of racial ingroup favoritism in social emotion and behavior. He has published over 230 research articles and a book titled "The Sociocultural Brain". He is the founding chief editor of the journal "Culture and Brain" and an associate editor of "Social Cognitive and Affective Neuroscience" and “Neuroscience Bulletin”.

PSYCHOLOGICAL AND NEURAL NATURE OF RACE IN FACE PERCEPTION

People catch others’ racial identities by a glimpse of their faces. Perceived racial identities generate serious impacts on cognition, emotion, and behavior, resulting in substantial social consequences. Based on behavioral and brain imaging findings, I’ll discuss four principle cognitive components involved in race perception, including processes of perceived interracial difference, intraracial similarity, intraracial variation, and observers’ own racial identifications. These cognitive processes are associated with dynamic activities in distinct neural circuits covering the occipitotermporal cortices and anterior temporal/prefrontal cortices. These neurocognitive processes provide a basis of racial ingroup biases in social emotions and decision-making. Finally, I’ll discuss the implications of these social neuroscience findings for potential interventions of racial discrimination in social emotion and behaviors.

Early Career Award Talk

Wednesday, March 27, 11:45 am

EMILIE CASPAR, PHD

Emilie Caspar is a professor at Ghent University, Belgium, where she leads the Moral and Social Brain Lab. She specializes in social neuroscience, striving to uncover the neural mechanisms underlying moral and immoral decision-making. Her main research areas focus on obedience and how restricting one's autonomy and choice options impacts the brain. She works with various populations worldwide, including former genocide perpetrators in Rwanda and Cambodia, as well as inmates and military personnel. She has received numerous awards for her research, notably the prestigious ERC Starting Grant and she recently published a trade book that explores how obeying orders affects the brain, integrating her findings with testimonies from genocide perpetrators. She also collaborates with several NGOs worldwide to provide science-based tools that could assist citizens in resisting undue inducement.

THE NEUROSCIENCE OF (DIS)OBEDIENCE

It is no longer necessary to establish that human beings can follow orders, even in cold blood. As Howard Zinn pointed out, "historically, the most terrible things - war, genocide, and slavery - have resulted not from disobedience, but from obedience" (Zinn, 1997). Beyond historical events, experimental research has also highlighted the human tendency to obey orders that could cause serious harm to others (Milgram, 1963). Decades after Stanley Milgram's foundational studies, a neuroscientific perspective on obedience has emerged, aiming to understand how obeying orders can pave the way for moral transgressions and antisocial behavior towards others. Highlighting recent research using electrophysiological techniques and neuroimaging, paralleled with interviews conducted with former genocidaires in Rwanda and Cambodia, the main findings indicate that obedience to orders modifies cognitive and affective processes compared to freely decided actions. These studies aim to provide an understanding of the neural mechanisms associated with moral transgressions under the influence of authority, and how the brain makes the switch to resist immoral orders.

DAY 1 AT A GLANCE

Monday 3-25	
9:00 - 10:00	**Coffee, snacks & mingle** **Mentor-Mentee Meet Up** (registration 9-12)
10:00 - 10:05	**Introduction**
10:05-11:45	**Symposia 1** *Neural mechanisms underlying social behaviour across species and across the lifespan*
10:05 - 10:30	Patricia Lockwood, University of Birmingham UK
10:30 - 10:55	Ziv Williams, Harvard Medical Centre, USA
10:55 - 11:20	Inbal ben Ami Bartal, Tel-Aviv University, Israel
11:20 - 11:45	Wouter van den Bos, University of Amsterdam, Netherlands
11:45 - 12:00	**GROUP PHOTO**
12:00 - 1:30	**Lunch + Poster Session 1**
1:30 - 3:10	**Symposia 2** *Neural, psychological, and computational mechanisms of social motivation and reward*
1:30 - 1:55	Matthew Apps, University of Birmingham, UK
1:55 - 2:10	Hikaru Sugimoto, RIKEN Center for Advanced Intelligence Project, Japan
2:10 - 2:35	Jo Cutler, University of Birmingham, UK
2:35 - 3:10	Steve Chang, Yale University, USA
3:10 - 3:30	**Coffee/snacks**
3:30-5:10	**Session 3** *Interbrain communication in dyadic social interaction in health and disease.*
3:30 - 3:55	Francesco Papaleo, Istituto Italiano di Tecnologia, Italy
3:55 - 4:20	Guillaume Dumas, Université de Montréal, Canada
4:20 - 4:45	Weizhe Hong, UCLA, USA
4:45 - 5:10	Eunee Lee, Yonsei University, Korea
5:10 - 5:30	**Break, Happy Hour**
5:30 - 5:40	**Data Blitz**
5:40 - 7:30	**Poster Session 1** **Drinks, Happy Hour**

DETAILED SCHEDULE: DAY 1

MONDAY, MARCH 25, 2024

9-12 **Registration**

9-10 **Coffee, Breakfast**
Come early and mingle in the main lobby

9-10 **Mentor-Mentee Meet-up**
Have a coffee and get to know your mentor/mentee. Meet by the registration desk in the main lobby

10-10:05 **Introduction**
Address from Siri Leknes, Society President

SYMPOSIA I

10:05-11:45 **NEURAL MECHANISMS UNDERLYING SOCIAL BEHAVIOUR ACROSS SPECIES AND ACROSS THE LIFESPAN**

10:05-10:30 *Neurocomputational basis of how and when to help others*
Patricia Lockwood, University of Birmingham UK

10:30-10:55 *Studying social cognition across animal species*
Ziv Williams, Harvard Medical School, USA

10:55-11:20 *To help or not to help? neurobiological mechanisms of prosocial decisions in rats*
Inbal ben Ami Bartal, Tel-Aviv University, Israel

11:20-11:45 *Uncertainty and Social Learning in Social Networks in Adolescence*
Wouter van den Bos, University of Amsterdam, Netherlands

11:45-1:30 **LUNCH BREAK**

DETAILED SCHEDULE

MONDAY MARCH 25, 2024

SYMPOSIA II

1:30-3:10 **NEURAL, PSYCHOLOGICAL, AND COMPUTATIONAL MECHANISMS OF SOCIAL MOTIVATION AND REWARD**

1:30-1:55 *Computational, anatomical, and neuromodulatory mechanisms of exerting effort to help others*
Matthew Apps, University of Birmingham, UK

1:55-2:10 *Neural mechanisms underlying the enhancement of memory and cognition by social reward and motivation*
Hikaru Sugimoto, RIKEN Center for Advanced Intelligence Project, Japan

2:10-2:35 *Human ventromedial prefrontal cortex is necessary for prosocial motivation*
Jo Cutler, University of Birmingham, UK

2:35-3:10 *Frequency Modules of Social Reward*
Steve Chang, Yale University, USA

3:10-3:30 COFFEE BREAK

SYMPOSIA III

3:30-5:10 **INTERBRAIN COMMUNICATION IN DYADIC SOCIAL INTERACTION IN HEALTH AND DISEASE**

3:30 - 3:55 *Inter-brain circuits of emotion recognition*
Francesco Papaleo, Istituto Italiano di Tecnologia, Italy

3:55 - 4:20 *From inter-brain connectivity to inter-personalized psychiatry*
Guillaume Dumas, Université de Montréal, Canada

4:20 - 4:45 *Neural basis of prosocial behavior*
Weizhe Hong, UCLA, USA

4:45 - 5:10 *Inter-brain connectivity between mPFCs in Shank2 mutant animal model of autism spectrum disorder*
Eunee Lee, Yonsei University, Korea

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:10–5:30 BREAK, HAPPY HOUR

5:30–5:40 DATA BLITZ TALKS

REM sleep-active hypothalamic neurons contribute to hippocampal social memory consolidation

Han Qin, Chongqing Institute for Brain and Intelligence

Sex differences in neural representations of social and nonsocial reward in the medial prefrontal cortex

Jennifer Isaac, Emory University

The role of prenatal exposure to climate-related disasters on auditory brainstem responses in newborns in high-risk neighborhoods.

Yoko Nomura, Queens College

Social attention in the wild - Interactive effects of oxytocin and naltrexone on social attention in ASD during a naturalistic interaction

Raimund Buehler, University of Vienna

5:40–7:30 POSTER SESSION I & HAPPY HOUR

POSTER #	TITLE, AUTHOR INFO

1 **Distinct subset of ventromedial hypothalamic neurons encode a conspecific-tuned, sex-specific behavioral state that modulates social investigation**
S.C. Lin, H.J. Lee, Y. Hsu, A. Su, S.B. Yang. National Taiwan University, Academia Sinica, National Ilan University

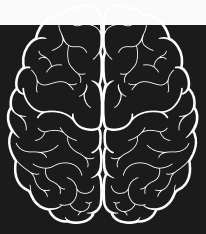
2 **When the brain says "No!": An MRI study on the neural correlates of resistance to immoral orders**
L. Tricoche, A. Rovai, S. Lo Bue, X. De Tiège, E. Caspar. Ghent University

3 **Neurocomputational components of trust**
X. Wu, N. Bürgi, G. Aydogan, C. C. Ruff. Beijing Normal University, University of Zurich

4 **Distinct neural encoding of culturally the own and alien stimuli**
Y. Pu, Q. Wang, S. Han. Peking University

5 **Differential inhibitory impact of the deep cerebellar nuclei on two distinct types of social interaction behaviors in male mice**
Y. T. Lin, W. S. Lai. National Taiwan University

DETAILED SCHEDULE



MONDAY, MARCH 25, 2024

5:40–7:30 POSTER SESSION I

POSTER #	TITLE, AUTHOR INFO

6 **Ego involvement and intrinsic motivation: Threats to perceived competence enhance neural reward processing during interpersonal competition, but thwart it when competition has ended.**
J. Barch, J. Carlson, E Nieman. Northern Michigan University

7 **Neurocomputational mechanisms of self-benefitting vs pro-environmental behavior**
B. Todorova, K. C. Doell, R. Sladky, C. Lamm. University of Vienna, Austria

8 **A Novel Electroencephalography-Based Paradigm to Measure Intergroup Prosociality**
G.P. Pech, E.A. Caspar. Université Libre de Bruxelles / Ghent University

9 **The impact of dark factor on cooperation in married and stranger dyads: a fNIRS-based hyperscanning study**
M. Makarova, N. Meloyan, I. Evdokimova, A. Upravitelev, A. Kurpatov, N. Volkova
HSE University, University of Trento, SBER

10 **An essential oxytocin circuit in the hypothalamus controls social avoidance in mice**
Y. Jiang, R. Yan, R. Tabuchi, L. Dayu. New York University

11 **Prefrontal modulation of collective response to environmental challeng**
T. Raam, Q. Li, L. Gu, K. Lim, G. Elagio, S. Correa, W. Hong. University of California, Los Angeles

12 **Initiation of male aggressive behaviors in mice: Pivotal role of adult hippocampal neurogenesis**
M. Tsuda, T. Akoh-Arrey, J. Mercurio, D. Lukasz, A. Rucker, M. Airey, H. Jacobs, H. Cameron. National Institute of Mental Health

13 **Optogenetic Activation of the Lateral Hypothalamus-Dorsal Raphe Nucleus Projection: Influences on Male Mice Aggression**
K. Mitsui, A Takahashi. University of Tsukuba

14 **Oxytocin receptor role for emotional contagion in Anterior cingulate or Amygdala**
Y.Saito, K.Mogi, T.Kikusui. Azabu University, School of Veterinary Medicine

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:40–7:30 POSTER SESSION I

POSTER #	TITLE, AUTHOR INFO

15 **Effect of prior recognition of social information on emotional attribution bias - Relationship with autism spectrum and social anxiety tendency-**
Y. Hirayama. Unversity of Senshu

16 **The pain facilitatory role of Oprm1-expressing brainstem to spinal cord-projecting neurons**
Q. Wang, G. Nachtrab, M. Mohr, J. Xiong, L. Yuan, X. Chou, J. V. L. King, M. A. Horowitz, X. Chen. Stanford University

17 **Neural encoding of emotional valence similarity**
S. Mei, S. Han. Peking University

18 **"The Farmer and the Snake": Neural Mechanisms of Social Feedback Modulation on Empathy**
X. Chen, S. Han. Peking University

19 **Distinct psychological and neural constructs of nationalism and patriotism**
G. Zheng, S. Han. Peking University

20 **Cognitive neural mechanism of the modulation of facial racial categorization by emotional expressions**
T. Huo, S. Han. Peking University

21 **Identifying tingle-eliciting properties of pleasant, calming and potentially socially relevant audiovisual stimuli: the Autonomous Sensory Meridian Response (ASMR)**
M. Jones, A. Daniels, K. Igelström, J. Suvilehto and I. Morrison

22 **Empathy-like behaviors in rats toward conspecifics with nausea**
M. Toyoshima, R. Tachihara, T. Xiong, K. Igarashi, M. Hori, K. Yamada. University of Tsukuba

23 **Factors that are involved in social instigation-heightened aggression in male mice**
T. Nagai, B. Hu, A. Takahashi. University of Tsukuba

24 **The neural mechanisms of consolation behavior in the anterior cingulate cortex**
R. Saito, D. Kumar, H. Funato, M. Yanagisawa, A. Aiba. The University of Tokyo, University of Tsukuba, Toho University

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:40–7:30 POSTER SESSION I

POSTER #	TITLE, AUTHOR INFO

25 **The role of dorsomedial striatal cholinergic interneurons in social hierarchy formation in male mice**
M.-T. Hsu, K. Tanaka, J. Wickens. Okinawa Institute of Science and Technology Graduate University

26 **A cingulate to septal circuit modulates peer group preference in a sex-specific manner in a communally breeding mammal**
A.M. Kelly, B.A. Fricker. Emory University

27 **REM sleep-active hypothalamic neurons contribute to hippocampal social memory consolidation**
H. Qin, L. Fu, X. Wang, X Chen. Chongqing Institute for Brain and Intelligence

28 **Hippocampal contributions to dynamic social memory in prairie voles**
W. Sheeran, K. Winther, J. Temple, Z. Donaldson. University of Colorado, Boulder

29 **Neural mechanisms underlying the effect of prediction errors in facial attractiveness between masked and unmasked faces on face memories in young and older adults**
M. Mihara, A. Kamo, T. Tsukiura. Kyoto University

30 **Neural mechanisms underlying memories for others whose impressions of trustworthiness were updated**
D. Kurihara, T. Nishioka, M. Mihara, S. Iwata, P. Park, T. Tsukiura. Kyoto University, Hirosaki University

31 **Roles of the social brain network and emotion network in memory for other persons with trustworthy impressions generated from social interaction**
A. Kamo, M. Mihara, T. Tsukiura. Kyoto University

32 **Social memory formation controlled by noradrenaline and microglia-mediated synaptic modulation in the medial prefrontal cortex**
H. Omi, M. Tajiri, T. Sawada, S. Yagishita. The University of Tokyo

33 **The social transmission of empathy relies on observational reinforcement learning**
Y. Zhou, S. Han, P. Kang, P. N. Tobler, G. Hein. Chinese Academy of Sciences, University of Würzburg

34 **Social neuroscience of the behavioral immune system: fMRI insights into collectivism and infection responses**
J. Choi, M. Sugiura. Tohoku University

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:40–7:30 POSTER SESSION I

POSTER #	TITLE, AUTHOR INFO

35 **Differential effects of intraperitoneal injections of oxytocin receptor antagonist, L-368,899, on social rank and other social behavior in mice**
S. Matsushima, D. Nasukawa, K. Yamada, Y. Ujihara, H. Hirakata, R. Tamura, S. Yatagai, K. Hayashi, K. Toda. Keio University, University of Tokyo, University of Tennessee Health Science Center

36 **Distal regulatory sequences contribute to diversity in brain oxytocin receptor expression patterns and social behavior**
Q. Zhang, L. Young. University of Tsukuba

37 **A cortical mechanism for integrating social information with estrous states to regulate sociosexual interest**
Y. Wang,* X. Song,* X. Chen,* Y. Zhou1,* J Ma,* F. Zhang,* L. Wei, G. Qi1, N. Yadav, Y. Yan, G. Yuan, D. Mi, P. Rajasethupathy, I. Ibañez-Tallon, X Jia, N. Heintz, K. Li. DG/McGovern Institute for Brain Research at Tsinghua, Tsinghua University. Tsinghua-Peking Joint Center for Life Sciences. Rockefeller University, Peking University

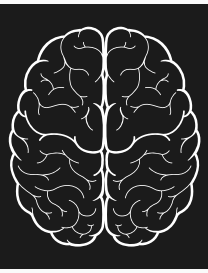
38 **Modulation of the behavioral and endocrine response to an aggression challenge by the neuropeptides isotocin and vasotocin in the Siamese fighting fish**
D. Goncalves, B. Fusani, A. Ramos, S. Cardoso. University of Saint Joseph, Instituto Gulbenkian de Ciencia, ISPA – Instituto Universitario

39 **Novel aromatase-flox mice show the behavioural relevance of locally produced estrogens in the hypothalamus**
N. Vasudevan, D. Davis, J. Dovey, K. Thaweepanyaporn, S. Sagoshi, H. Takahashi, M. Nakata, S. Ogawa. University of Reading, University of Tsukuba

40 **The neural mechanism regulating psychological stress-induced sweet taste modification**
M. Tanaka, R. Nawarat, S. Okamoto, Y. Minokoshi, T. Misaka, K. Nakajima. University of Tokyo, National Institute for Physiological Sciences, Nagoya University, Ryukyu University

41 **Understanding the neural nechanisms for repetitive behaviors: A role for hypothalamic endocannabinoids**
G. Petrie1, G. Balsevich, H. Yau, R. Aukema, M. Van Der Stelt, J. Bains, L. Mayo, M. Hill, Hotchkiss Brain Institute, University of Calgary, Leiden University

DETAILED SCHEDULE



MONDAY, MARCH 25, 2024

5:40-7:30 POSTER SESSION I

POSTER # TITLE, AUTHOR INFO

42 **Intergenerational transmission of maternal behavioral traits in mice and the involvement of microbiota in this transmission**
K. Mogi, U. Akiyama, N. Futagawa, K. Tamura, M. Kamiya, M. Mizuta, M. Yamaoka, I. Kamimura, S. Kuze-Arata, T. Kikusui. Azabu University

43 **Investigating neurotransmitter systems, neural networks, and social behavior using non-traditional animal models**
A. Hinojosa, E. Alaniz, F. Dominguez, G. Padilla, I. Perez, B. Barnes, A. Mar, J. L. VandeBerg, M. Gil. University of Texas Rio Grande Valley

44 **An application of Parametric Empirical Bayes (PEB) on social neuroscience**
T. Asamizuya, H. Saito, R. Higuchi, g. Naruse, S. Ota, J. Kato. Hitotsubashi University, The University of Tokyo, Meiji University

45 **The physical and mental health benefits of touch interventions: A comparative systematic review and multivariate meta-analysis**
J. Packheiser, H. Hartmann, K. Fredriksen, V. Gazzola, C. Keysers, F. Michon Netherlands Institute for Neuroscience, University Hospital Essen

46 **The neural bases of how dogs and humans navigate their social environment**
M. Boch, C. Völter, R. B. Mars, L. Huber, C. Lamm. University of Vienna, University of Oxford, University of Veterinary Medicine Vienna, Max Planck Institute for Evolutionary Anthropology

47 **Repetition suppression effects reveal distinct time courses of spontaneous categorization of elderly and young faces**
N. Zhou, S. Han. PKU-IDG/McGovern Institute for Brain Research, Peking University

48 **Neural representation of natural human conversation**
J. Cai, A. Hadjinicolaou, A. Paulk, D. Soper, T. Xia, Z. Williams, S. Cash Massachusetts General Hospital, Harvard Medical School

49 **MDMA modulates sensorimotor and affective pathways in the human cortex during affective touch**
G. Novembre, H. Molla, L. Handlin, I. Perini, I. Morrison, H. de Wit. Linköping University, University of Chicago, University of Skövde

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:40-7:30 POSTER SESSION I

POSTER #	TITLE, AUTHOR INFO

50 **Exploring pupil response typicality during naturalistic viewing of social and non-social videos**
M. Wilf, M. Zamberg-Elad, M. Ramot. Weizmann Institute of Science

51 **Impact of oxytocin receptor mutation on social distancing in male medaka fish mediated by visual familiarity recognition**
A. Yamaguchi*, J. Zou*, R*. Umeda, T*. Seki, K. Mizukuchi, S. Ansai, H. Takeuchi. Tohoku University, Kyoto University

52 **The role of prenatal exposure to climate-related disasters on auditory brainstem responses in newborns in high-risk neighborhoods**
Y. Nomura, D. Deingeniss, S.Y. Siel, A. Gordon, P. Kittler, H. Phan. Queens College, City University of New York, New York State Institute for Basic Research in Developmental Disabilities

53 **Effects of intraperitoneal injection of a non-competitive NMDA receptor antagonist, MK-801, on social and non-social behavior in male mice.**
H. Kasahara, R. Tamura, Y. Ujihara, M. Yamamoto, S. Matsushima, Y. Tamai, D. Nasukawa, K. Hayashi, K. Yamada, M. Tanaka, K. Toda. Keio University, University of Tennessee Health Science Center, University of Tübingen Medical Center, Japan Society for Promotion of Science, University of Tokyo, Waseda University

54 **Disentangling the impact of substance use in offenders with antisocial personality disorder - a resting state fMRI study**
C. C. Stein, C. Kärgel and B. Schiffer. Ruhr-University Bochum

55 **Nucleus accumbers oxytocin mediates social isolation-induced anxiety-like behaviors in female prairie voles**
Y. Liu, F. Duclot, M. Kabbaj, Z. Wang. Florida State University

56 **Social attention in the wild - Interactive effects of oxytocin and naltrexone on social attention in ASD during a naturalistic interaction**
R. Buehler, G. Silani, U. Ansorge, M. Willeit. University of Vienna, Medical University Vienna

57 **Neuroticism associated with the activities in left ventrolateral prefrontal cortex and motor cortical area during emotional imagery task**
S. Irie, M. Watanabe, A. Tachibana, N. Tokuda, A. Matsuo. Dokkyo Medical University, The University of Tokyo

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:40-7:30 POSTER SESSION I

POSTER # TITLE, AUTHOR INFO

58 **The regulation of social facilitation by monoaminergic system**
T. Furukawa, T. Fujiwara. Saitama Medical University

59 **Neural signature of disrupted sociality: Understanding the inter-brain neural relationship across the brains of socially interacting Shank2 mutant mice**
E.Hwang, W.Kim, H-G. Yoon, S.Shin, S.Lee, E.Kim, E.Lee. Yonsei University, Korea Advanced Institute of Science & Technology

60 **The power of music: Enhancing predictive ability in children with autism through music therapy**
A. U. Kocan, A. Groessing, A. Guran, N. Mikus, C. Gold, G. Silani. University of Vienna, Norwegian Research Centre (NORCE)

61 **Link between broad and detailed aspects of social perception in children, adolescents and adults with typical development and with autism spectrum disorders: an eye-tracking study**
A. A. Saitovitch, E. Rechtman, A. Vinçon-Leite, H. Lemaître, K. Aljabali, A. Fabre, J. Boisgontier, L. Fillon, N. Boddaert, M. Zilbovicius. Imagine Institute, INSERM U1163/U1299, Necker-Enfants Malades Hospital, AP-HP, Université Paris Cité,

62 **Embodiment in Virtual Reality (VR) influences the neural processes of face gender categorization and improves empathy**
H. Zheng, S. Han. Peking University

63 **Increased dyadic social interaction by lipopolysaccharide-induced inflammatory reactions in male but not female mice**
M. Yamamoto, K. Hayashi, M. Kanayama, S. Matsushima, H. Inoue, H. Kasahara, K. Toda. Keio University, Tokyo Medical and Dental University

64 **Sex-dependent modulation of neuronal circuits in object recognition through pair bonding**
H. Iwai, C. Ohtsuki, R. Noguchi, A.Totsuka, E. Kamura, S. Mitsui. Gunma University Graduate School of Health Sciences

65 **Pair bonding has sex-dependently an impact on neuronal circuits that respond to fear conditioning in monogamous prairie voles**
R. Noguchi, H. Iwai, A. Totsuka, S. Mitsui. Gunma University Graduate School of Health Sciences

DETAILED SCHEDULE

MONDAY, MARCH 25, 2024

5:40-7:30 POSTER SESSION I

POSTER # TITLE, AUTHOR INFO

66 **Sex differences in neural representations of social and nonsocial reward in the medial prefrontal cortex**
J. Isaac, S. Karkare, H. Balasubramanian, N. Schappaugh, J. Javier, M. Rashid, M. Murugan
Emory University

67 **Simultaneous tracking of autonomic nervous activity and home cage behavior in mouse mothers during pregnancy to lactation**
K. Shimizu, S. Kuze-Arata, Takefumi Kikusui, Kazutaka Mogi
Azabu university

68 **On the relationship between self-regulation problems in parents and their children: An ERP study**
K. Wiecheć, J. Bączek, M. Krystkowiak-Kowalska, P. Stodolna, J.M. Michałowski
University SWPS, Poznań Laboratory of Affective Neuroscience

69 **Investigating the role of oligodendrocytes in regulating pair bonding and the responses to loss in prairie voles**
J. Sadino, Z. Donaldson. University of Colorado Boulder

70 **Developmental onset of pair bonding behavior in prairie voles**
L. C. Hiura, C. A. Schaepe, J. A. Noe. University of Colorado Boulder

71 **Social connectedness in the context of stress: role of endogenous opioids**
G. Løseth, S. Leknes. University of Oslo, Oslo University Hospital

72 **Roles of the default mode network modulated by levels of the sense of agency during future thinking and autobiographical memory retrieval**
K. Ohkubo, Y. Masuda, M. Mihara, A. Kamo, W. Teramoto, T. Tsukiura
Kyoto University, Japan Society for the Promotion of Sciences, Kumamoto University

73 **Neurocomputational mechanisms of affected beliefs**
S. Krach, N. Czekalla, A.V. Mayer, A. Schröder, D.S. Stolz, F.M. Paulus, L. Müller-Pinzler
Social Neuroscience Lab, Department of Psychiatry and Psychotherapy, Lübeck University

74 **Transcendent thinking counteracts longitudinal effects of mid-adolescent exposure to community violence in the anterior cingulate cortex**
X.-F. Yang, K. Hilliard, R. Gotlieb, M. H. Immordino-Yang. University of Southern California, University of California Los Angeles

75 **Effects of a mixed mind-body and psychosocial intervention model on mental health indicators, prosociality and hearth rate variability. A study with a Venezuelan migrant population in Colombia.**
J.C. Caicedo, M. Serna, J. Kolacz, L. Otálora, N. Quiñonez, M.A. López, J. Martínez, D.M. Aponte. Universidad Externado de Colombia, Ohio State University and Dunna Corporation

NEURAL MECHANISMS UNDERLYING SOCIAL BEHAVIOUR ACROSS SPECIES AND ACROSS THE LIFESPAN

NEUROCOMPUTATIONAL BASIS OF HOW AND WHEN TO HELP OTHERS

Patricia Lockwood, University of Birmingham UK

Many of our decisions affect other people. Our choices can decelerate climate change, stop the spread of infectious diseases, and directly help or harm others. Prosocial behaviours ‚Äì decisions that help others , could contribute to reducing the impact of these challenges, yet their computational and neural mechanisms remain poorly understood.

I will present recent work that examines the neurocomputational basis of prosocial learning, how we learn to benefit other people and when we decide to act. I will show that prosocial learning depends on medial prefrontal regions using computational modelling, functional neuroimaging and voxel-based lesion-symptom mapping. However, when we decide to act to help is also substantially affected by the environment we find ourselves in. When we believe the reward rate of the environment is poor, we are more willing to act to help than when we are in a rich environment, and this ecological influence is stronger than when we make similar decisions that only benefit ourselves. These findings have potential implications for understanding learning and decision-making to help others as environments change.

STUDYING SOCIAL COGNITION ACROSS ANIMAL SPECIES

Ziv Williams, Harvard Medical School, USA

Social behavior pervades many aspects of our lives, and deficit in social behavior is a prominent feature of many neurocognitive conditions such as major depression and autism spectrum disorder. Yet, despite its importance, the single-neuronal basis and causal underpinnings of interactive social behavior remain not well understood. The talk will briefly discuss use of genetic, neurophysiologic and neuromodulatory techniques for studying social cognitive processes across species. Using rodent, non-human primate and human experiments, the talk will cover some of the neuronal processes involved in social interaction, group behavior, theory of mind and communication. It will also cover emerging new methods for treating social behavioral disorders and suggest a comprehensive approach for studying social cognition across animal species.

NEURAL MECHANISMS UNDERLYING SOCIAL BEHAVIOUR ACROSS SPECIES AND ACROSS THE LIFESPAN

TO HELP OR NOT TO HELP? NEUROBIOLOGICAL MECHANISMS OF PROSOCIAL DECISIONS IN RATS

Inbal ben Ami Bartal, Tel-Aviv University, Israel

What are the neural processes that lead to a decision to approach a distressed conspecific and act for their benefit? Multiple factors weigh in on this decision, in particular the social identity of the individual in need. To determine this, and explore how empathy, the capacity to recognize and share others,Äô affective states, promote prosocial behavior, we use a rat helping behavior test. During the test a rat may help a distressed conspecific by releasing it from a trap. Rats typically learn to help after a few sessions, without any previous training or reward. Once they learn how to open the restrainer, they repeat the behavior on subsequent sessions quickly and reliably. This goal-directed behavior is motivated by the trapped rats,Äô distress, and help is only offered to in-group members. Neural activity involved in this process can be examined and manipulated. The brain-wide neural circuitry involved in this behavior is outlined using Brainways, our automated software for registration and quantification of fluorescence. We found the helping test is associated with a dispersed network which includes regions involved in empathy in humans, and reward-related regions. The role of the nucleus accubmens is investigated, both for social and prosocial reward. Neural activity in the empathy network reveals that activity in empathy related regions does not predict helping, and that while the accumbens does predict helping, it isn,Äôt necessary for helping to occur. We suggest instead that the decision to help may depend on coding of the value of helping in the OFC.

UNCERTAINTY AND SOCIAL LEARNING IN SOCIAL NETWORKS IN ADOLESCENCE

Wouter van den Bos, University of Amsterdam, Netherlands

Adolescence is a period of social re-orientation in which we are generally more prone to peer influence and the updating of our beliefs based on social information, than in any other stage of our life. One of the reasons that adolescents are more sensitive to social information is because of their uncertainty associated with their new environment of development. Here I will present a Bayesian reinforcement learning framework that incorporates uncertainty and social learning. With agent based models I will demonstrate that uncertainty of adolescence by itself can incerase both exploratory behavior and social learning, with a natural deciline towards adulhood. I will show how uncertainty will drive both information search and information use. Finally, I will then substantiate this framework alongside recent results from a neuroimaging (fMRI) study in which we investigated individual differences in the assessment of uncertainty and how this leads to differences in social information use.

NEURAL, PSYCHOLOGICAL, AND COMPUTATIONAL MECHANISMS OF SOCIAL MOTIVATION AND REWARD

COMPUTATIONAL, ANATOMICAL, AND NEUROMODULATORY MECHANISMS OF EXERTING EFFORT TO HELP OTHERS

Matthew Apps, University of Birmingham, UK

Prosocial behaviours, actions that benefit others, are central to individual and societal well-being. Although the mechanisms underlying the financial and moral costs of prosocial behaviours are increasingly understood, this work has often ignored a key influence on behaviour: effort. Many prosocial acts are effortful, and people are averse to the costs of exerting them. But are they more averse to effort when it is self-benefitting, or when it helps others? and what neural mechanisms that underlie prosocial effort? I present a series of studies where people made decisions about whether to exert different amounts of effort to obtain financial rewards. On half of the trials they earn the rewards through effort (self), on other half they must exert the effort but the money is delivered to another person (prosocial). We demonstrate that people are more willing to exert effort for their own benefit than for others. Using fMRI and computational modelling we identified a unique neural signature of effort in the anterior cingulate gyrus (ACCg) for prosocial act. This signal of effort was absent for self- benefiting behaviours. Moreover, the more strongly a representation of effort was specific to prosocial acts in the ACCg, the higher a person, as level of empathy. In addition, we show that dopamine withdrawal in Parkinson, as Disease impacts only prosocial motivation and not on the willingness to exert effort for self-benefit. These results highlight the importance of effort in prosocial behaviour, and the key frontal cortex and dopaminergic mechanisms driving it.

NEURAL MECHANISMS UNDERLYING THE ENHANCEMENT OF MEMORY AND COGNITION BY SOCIAL REWARD AND MOTIVATION

Hikaru Sugimoto, RIKEN Center for Advanced Intelligence Project, Japan

People can be motivated by interactions with others. Motivation and affect can influence cognitive performance, but little is known about the neural mechanisms underlying how memory and cognition are enhanced or suppressed during social interaction. Social comparison refers to the process of making comparisons between oneself and others. This fundamental psychological process is thought to play a pivotal role in the evaluation of the self in terms of abilities and opinions. The neurocognitive literature on social comparison has focused on ability-based social comparison and has shown that brain regions involved in the process of primary and secondary reward are also recruited when people outperform others in a task, whereas those involved in the process of physical and monetary punishment respond to feedback informing them that they have performed worse than others. These findings suggest that victory and defeat may have a rewarding or punishing value in a social context. Based on this idea, my colleagues and I have conducted several fMRI studies to investigate the neural mechanisms of how victory in competition, i.e. social reward, enhances episodic memory and how memory performance is improved by social motivation in the context of competition. We have also used a multimodal MRI approach to investigate the neural substrate that can be altered by an orientation towards opinion-based social comparison. In this symposium, I will present our recent publications on neuroimaging studies that have investigated these issues.

NEURAL, PSYCHOLOGICAL, AND COMPUTATIONAL MECHANISMS OF SOCIAL MOTIVATION AND REWARD

HUMAN VENTROMEDIAL PREFRONTAL CORTEX IS NECESSARY FOR PROSOCIAL MOTIVATION

Jo Cutler, University of Birmingham, UK

The ventromedial prefrontal cortex (vmPFC) has long been considered vital for decision-making. Functional neuroimaging suggests important contributions of the vmPFC to processing rewards and effort costs, while a parallel stream of work suggests vmPFC is involved in prosocial behaviour. However, the necessity of the vmPFC for these functions is unknown. Here we dissociated the causal contribution of vmPFC to prosocial behaviour (decisions causing real beneficial outcomes for another person), effort, and reward with a decision-making task that manipulates these factors independently. A large group of patients with rare focal vmPFC lesions (n=25) was compared to patients with lesions elsewhere (n=15), and healthy age and gender-matched controls (n=40). Participants chose either to rest, or to exert effort, to gain rewards, for themselves or another person. Computational modelling quantified how prosocial and self-benefitting rewards were devalued by effort. vmPFC damage decreased prosociality across several measures. Patients with lesions here earned less, were more reluctant to exert effort, and physically exerted less force when another person would benefit, compared to both control groups. Voxel-based lesion mapping revealed a striking dissociation between medial and lateral subregions of vmPFC. Whilst medial damage led to antisocial behaviour, more lateral damage was associated with increased prosocial motivation, relative to patients with damage elsewhere. Patients with vmPFC lesions also showed reduced sensitivity to effort but not reward overall, although lesion mapping identified vmPFC subregions that reduced reward sensitivity as well. These findings reveal multiple, specific, causal contributions of vmPFC sub-regions to prosocial behaviours, effort processing, and reward sensitivity.

FREQUENCY MODULES OF SOCIAL REWARD

Steve W. C. Chang, Yale University, USA

The “social brain” refers to a collection of cortical and subcortical brain areas that are often recruited by a wide array of social behaviors. However, it remains unclear how different areas in the social brain are coordinated to transmit and process social variables to guide learning and decision-making. This talk will describe our recent findings from studying the primate medial prefrontal-amygdala circuits during social decision-making involving pairs of rhesus macaques. As monkeys expressed context-dependent prosocial and antisocial preferences concerning the reward received by a conspecific monkey, we investigated neuronal interactions between the basolateral amygdala and the rostral anterior cingulate gyrus. First, we found that the coordination between the two neural populations was enhanced for expressing a prosocial preference but suppressed for expressing an antisocial preference. This coordination occurred in selective frequency channels depending on the area contributing the spikes and showed a specific directionality of information flow for expressing the prosocial preference. Moreover, at the time of reward delivery, we noticed unique coherence patterns for vicarious reward in comparison to experienced reward. These patterns also differed from those observed when expressing social preferences. The reward-related coordination again occurred in specific frequency channels with selective directionality. Based on these findings, we suggest that there are directionally selective ,Äòfrequency modules,Äô that convey socially relevant decision variables. More broadly, these findings support the importance of network-level controls in the social brain.

INTERBRAIN COMMUNICATION IN DYADIC SOCIAL INTERACTION IN HEALTH AND DISEASE

INTER-BRAIN CIRCUITS OF EMOTION DISCRIMINATION

Francesco Papaleo, Istituto Italiano di Tecnologia, Italy

Social interactions imply dynamic and synergic feedback loops in which actions, reactions, and internal cognitive processes of each partner are modulated by the others. Pioneering discoveries show that brains working together, couple together, through interbrain synchrony. However, it is unclear whether interbrain dynamics change in the context of altered emotions, and if they might be causative for driving social interactions. Combining microendoscopic Ca2+ imaging in the anterior cingulate cortex, area 24, with a behavioral task for emotion recognition in mice, we are finding that somatostatin-expressing (SOM+) neurons synchronize when a mouse interact with a stressed mouse, but not with mice in a neutral state. Conversely, data suggests that pyramidal neuron activity is correlated only among mice in a neutral state. This provides a first indication of cortical inhibitory neurons involvement in social interbrain neural dynamics in the context of altered emotions.

FROM INTER-BRAIN CONNECTIVITY TO INTER-PERSONALIZED PSYCHIATRY

Guillaume Dumas, Université de Montréal, Canada

This presentation integrates multi-brain neuroscience and precision psychiatry to better understand social cognition in interactive contexts, in both health and disease. Utilizing hyperscanning technologies, we explore inter-brain connectivity (IBC) and its implications in neural synchronization during social interactions. We will discuss the uncovered neural mechanisms underlying social interaction and their disruptions in psychiatric conditions. By merging these findings with computational models, we introduce: inter-personalized psychiatry. This approach, rooted in precision medicine, leverages the dynamic neural interplay among individuals to develop personalized psychiatric treatments taking the interpersonal dimension seriously. Our work exemplifies how integrating multi-brain neuroscience with computational methodologies can lead to innovative diagnostics and therapeutic strategies in mental health, emphasizing the importance of considering social and neural interactions in psychiatric care.

INTERBRAIN COMMUNICATION IN DYADIC SOCIAL INTERACTION IN HEALTH AND DISEASE

NEURAL BASIS OF PROSOCIAL BEHAVIOR

Weizhe Hong, UCLA, USA

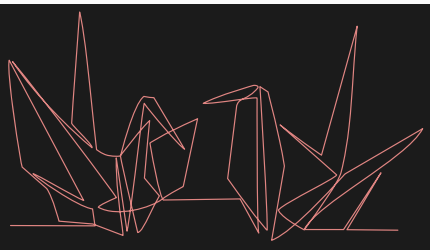
While it is evolutionarily logical for individuals to behave in ways that benefit themselves and maximize an individual,Äôs own survival and reproduction, humans and other animals also engage in empathy and compassion-related behaviors that benefit others. In humans, the ability to understand and support the emotions or needs of others is crucial to creating a more cohesive, compassionate, and successful society. Spanning the evolutionary spectrum, animals exhibit diverse prosocial behaviors, including comforting, helping, and resource sharing, to support others,Äô emotions, goals, and/or material needs. Our research aims to understand various forms of empathic and prosocial behaviors and the underlying neural mechanisms. We establish behavioral paradigms in mice to study prosocial comforting and helping behaviors. Using these paradigms, combined with molecular genetics and computational approaches, we identify the molecularly and anatomically defined neural pathways in the amygdala and the prefrontal cortex that specifically encode and control these behaviors. Beyond studying how neural circuits and the underlying computation regulate social behavioral decisions within a single brain, we are also interested in investigating how emergent inter-brain neural properties arise from social interactions between individuals.

INTER-BRAIN CONNECTIVITY BETWEEN MPFCS IN SHANK2 MUTANT ANIMAL MODEL OF AUTISM SPECTRUM DISORDER

Eunee Lee, Yonsei University, Korea

What happens in the brains of socially interacting individuals? This key question in social neuroscience has generated decades of research, especially from neuroscientists studying autism spectrum disorder(ASD). Patients diagnosed with ASD are often incapable of engaging in a typical social interaction and show a lack of social interest or motivation. Yet, the unique characteristics of the neural activities in ASD patients that may lead to this pronounced social deficit remain elusive. Recent literature highlights the existence of a synchronized brain activity between socially interacting individuals. This inter brain synchrony has been studied in not only humans but also in animals such as mice and bats. While the presence of the phenomenon itself has been investigated in multiple studies using fMRI, EEG, and Ca2+ imaging, a comprehensive study on the specific intrinsic features of this phenomenon has yet to be conducted. Moreover, the direct relationship between social interaction and interbrain synchrony remains unknown. In this study, we explore the inter brain relationship between the brains of socially interacting mice, with a particular focus on inter brain synchrony or inter brain similarity. We conducted simultaneous in vivo electrophysiology recordings in the medial prefrontal cortex (mPFC) of freely socially interacting mice, a brain region that has been found to play an essential role in social behaviors. We employ two types of mice, Shank2 gene knockout mice (Shank2 KO), a well-established animal model of ASD and Shank2 wild type mice (Shank2 WT). We present behavioral findings, and results from single neuron neuronal correlates analysis, and local field potential analysis. Preliminary results suggest genotype-specific neural activities in the mPFC of socially interacting mice and decreased inter brain synchrony between two interacting ASD model mice.

DAY 2 AT A GLANCE



Tuesday March 26, 2024	
8:30 - 9:10	**Coffee, snacks** (registration 8:30-12)
9:10 - 10:50	**Session 4** *Innate social behavior (aggression, sexual behavior, parental behavior)*
9:10 - 9:35	Lisa Stowers, The Scripps Research Institute, USA
9:35 - 10:00	Kumi Kuroda, RIKEN Center for Brain Science, Japan
10:00 - 10:25	Julia Sliwa, CNRS, France
10:25 - 10:50	Sonoko Ogawa, University of Tsukuba, Japan
10:50 - 11:10	**Coffee/snacks**
11:10 - 11:40	**Keynote** **MASAKI ISODA** *Probing the social mind with electrodes*
11:45 - 12:10	**Award Talk** **NANCY PADILLA CORENO** *Neural circuits for social competence*
12:10 - 12:20	**Open Science Award Presentation**
	Organized Excursions **or** **Social gathering at the conference venue**

DETAILED SCHEDULE: DAY 2

TUESDAY, MARCH 26, 2024

8:30-12 **Registration**

8:30-9:10 **Coffee, Breakfast**

Come early and mingle in the main lobby

SYMPOSIA IV

9:10-10:50 **INNATE SOCIAL BEHAVIOR: AGGRESSION, SEXUAL BEHAVIOR, PARENTAL BEHAVIOR**

9:10 -9:35 *Leveraging olfaction to study social behavior in the mouse*
Lisa Stowers, The Scripps Research Institute, USA

9:35 - 10:00 *Filial attachment in common marmosets: Its ontogeny and the relevant brain regions*
Kumi Kuroda, Tokyo Institute of Technology, RIKEN

10:00 - 10:25 *Comparing human and monkey neural circuits for processing visual social scenes*
Julia Sliwa, CNRS, France

10:25 - 10:50 *Estrogen receptor beta neuronal network in the regulation of social behaviors in mice*
Sonoko Ogawa, University of Tsukuba, Japan

10:50-11:10 Coffee

DETAILED SCHEDULE: DAY 2

TUESDAY MARCH 26, 2024

KEYNOTE: MASAKI ISODA

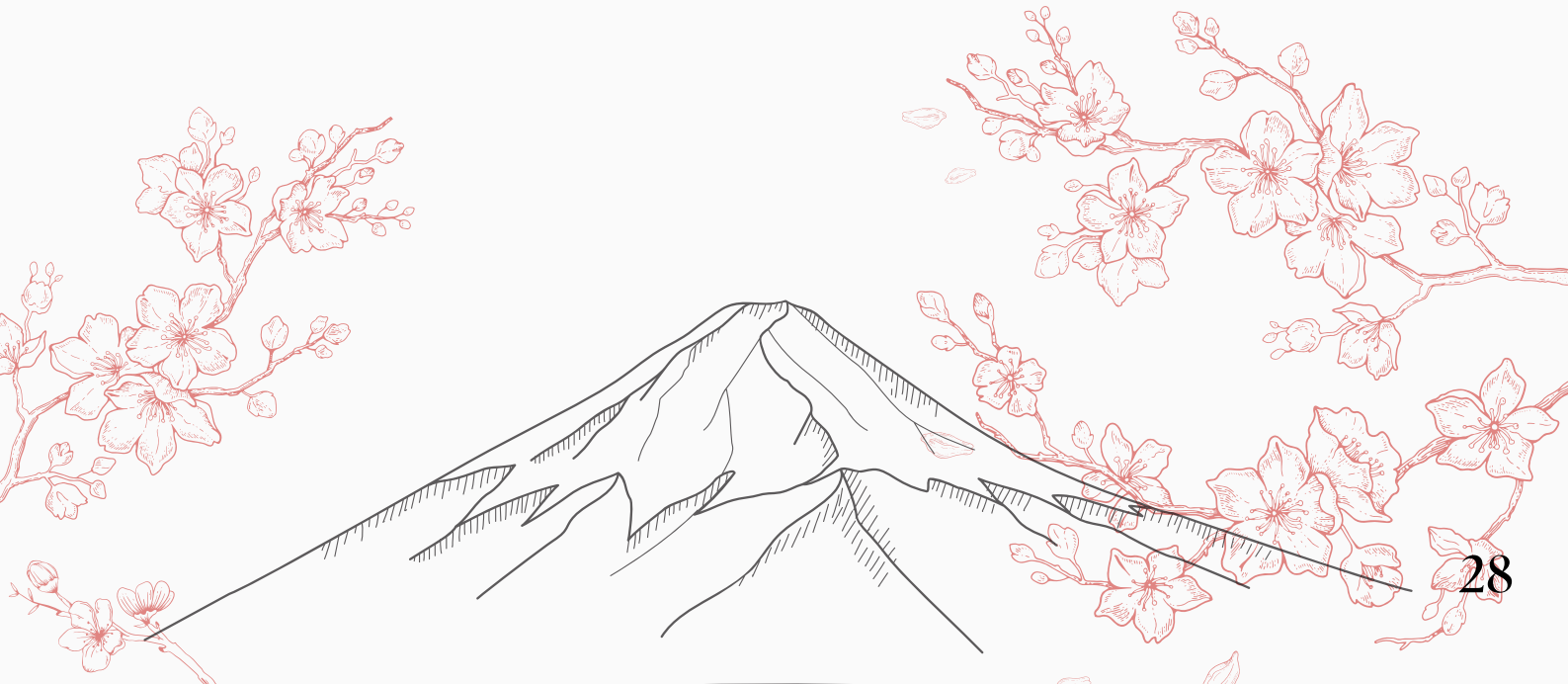
11:10-11:45 **PROBING THE SOCIAL MIND WITH ELECTRODES**

EARLY CAREER AWARD: NANCY PADILLA COREANO

11:45-12:10 **NEURAL CIRCUITS FOR SOCIAL COMPETENCE**

12:10-12:20 **OPEN SCIENCE AWARD ANNOUNCEMENT**

12:20- ON **FREE AFTERNOON |** CHECK OUT THE RECOMMENDED EXCURSIONS IN THE TRAVEL INFO BOOKLET



INNATE SOCIAL BEHAVIOR: AGGRESSION, SEXUAL BEHAVIOR, PARENTAL BEHAVIOR

LEVERAGING OLFACTION TO STUDY SOCIAL BEHAVIOR IN THE MOUSE

Lisa Stowers, The Scripps Research Institute, USA

The Stowers Lab is studying the logic of the olfactory system to perform sensation while leveraging the stereotypy, simplicity, and robustness of olfactory-promoted courtship behavior to identify corresponding neural circuits and mechanisms. Though the behavior is relatively simple, these circuits display characteristics of more complex behaviors including state-dependency, decision-making, emotion, and learning. How does olfaction guide behavior? Much of our understanding of how olfaction works in mice is based on highly controlled artificial stimulus and response parameters. This has allowed us to make great progress to understand concentration thresholds, mixture perception, and sensation dynamics to create a solid foundation of what the system is capable of sensing. Other research is identifying the ,Äòmeaning, of sensation by focusing on behavioral responses to odor cues and studying the coding logic of downstream circuits. These studies are largely blind to sensation dynamics. Currently, we are missing a complete picture of how odor cues are being sensed to guide behavior during free investigation of natural scenes. We are applying mini-endoscopes that do not interfere with natural movement, so that vomeronasal sensation can be measured and studied as the individual navigates towards, interacts with, and responds to a wide variety of simple, complex, and social stimuli. This enables us to identify when, what, and how chemosensation is being used during natural behavior. The dynamics are quite different from inspiration-driven sense of smell and are likely to inform behavior on unknown timescales. We expect that combining the study of real-time sensation with the activity observed during social behavior of downstream circuits will reveal unexpected features of social dynamics.

FILIAL ATTACHMENT IN COMMON MARMOSETS: ITS ONTOGENY AND THE RELEVANT BRAIN REGIONS

Kumi Kuroda, Tokyo Institute of Technology, RIKEN, Japan

The parent (primary caregiver) is the lifeline of mammalian infants. Thus, infants memorize and selectively follow their primary caregiver and signal their distress (crying). These behaviors are collectively called attachment behaviors. We previously found that in mice and humans, when caregivers carry the infants, infants reduce their crying, voluntary movement, and heart rate immediately. This phenomenon, , the Transport Response,Äù facilitates the parental transport of the offspring and thus is a primitive component of the infant attachment system.

New World Monkeys common marmosets live in family and share carrying care of their infants among both parents and older siblings. We found that infants cry vigorously when being rejected by the current carrier or being isolated, and halt crying as soon as the next family member starts carrying them. Infants also tune their attachment behaviors according to the parenting style of each caregiver: infants are anxious during carry by intolerant caregivers, and physically avoid intolerant or insensitive caregivers. Such an efficient attachment system develops in the average-expectable rearing environment of this species; if the infants are separated from their family in infancy, they avoid any caregivers while showing age-disproportionate separation distress. Paradoxically negative reactions toward inherently rewarding stimuli are extended to adulthood and exhibited even toward non-social rewards.

To identify the brain regions relevant to infant attachment behaviors, we are performing the ,brief isolation and reunion,Äù experiments of infant marmosets. Although the analyses are still ongoing, we would like to show our current results and appreciate any input from the session participants

INNATE SOCIAL BEHAVIOR: AGGRESSION, SEXUAL BEHAVIOR, PARENTAL BEHAVIOR

COMPARING HUMAN AND MONKEY NEURAL CIRCUITS FOR PROCESSING VISUAL SOCIAL SCENES

Julia Sliwa, CNRS, France

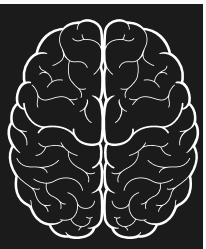
Recognizing agents, their actions, and their interactions is essential for understanding the world around us. Using functional Magnetic Resonance Imaging, we discovered in the macaque monkey brain a network of areas centered on the medial and ventrolateral prefrontal cortex that is selectively engaged in social interaction analysis. Its extent and location suggest that this function is an evolutionary forerunner of human mind-reading capabilities. A comparative fMRI investigation in humans additionally revealed which neural strategies adapted to the needs of each species, and emphasized human interest in understanding actions of our peers directed towards objects. Together these studies show how our primate brains continuously decode the complex visual scenes unwinding in front of us: both the nature of material entities, such as individuals and objects, and their immaterial interactions.

ESTROGEN RECEPTOR BETA NEURONAL NETWORK IN THE REGULATION OF SOCIAL BEHAVIORS IN MICE

Sonoko Ogawa, University of Tsukuba, Japan

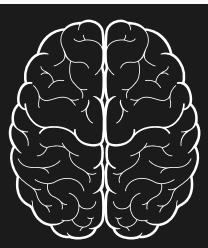
We have been studying the neuroendocrine mechanisms of social behavior by focusing on the role of the two types of estrogen receptors, ERa and ERb. In a series of knockout and knockdown studies, we have concluded that the two types of ERs are differentially involved in the estrogenic regulation of social behavior in both sexes. In contrast to ERa-dependent action, the neuronal mechanisms of ERb action are still not well understood. Our analysis in the ERb-RFPtg mouse line revealed a differential distribution of ERb from ERa at the ‚Äúcellular level‚Äù in each of the ERb-rich brain regions in the social behavior neural network, such as the medial amygdala (MeA), lateral septum, and midbrain dorsal raphe nucleus (DRN). Therefore, we have investigated the functions of ERb-expressing neurons with the use of chemogenetic manipulation as well as fiber photometry recording of neuronal activity in newly developed ERb-iCre mice. A series of studies for the establishment of sexual preference in male mice identified differential regulation of receptivity-based and sex-based preference by ERb-expressing neurons in the posterodorsal MeA (MeAPD) as well as the principal part of the bed nucleus of the stria terminalis as a primary projection site of MeApd-ERb-positive neurons. A separate line of investigation in female ERb-iCre mice revealed that ERb-expressing cells in the DRN may be involved in the inhibitory regulation of female sexual behavior induced by ERa-mediated estrogen action. These findings collectively suggest that ERb-expressing neurons in the social behavioral neural networks play a significant role in the adaptive expression of social behavior in both male and female mice

DAY 3 AT A GLANCE



Wednesday March 27, 2024	
8:30 - 9:10	**Coffee, snacks** (Registration 8:30-12)
9:10-10:50	**Session 5** *A cross-species perspective on how the emotional state of others influences the state and decisions of observers*
9:10 - 10:00	Valeria Gazzola and christian Keysers, Netherlands Institute for Neuroscience, Netherlands
10:00-10:25	Yasushi Kiyokawa, University of Tokyo, Japan
10:25 - 10:50	Rui Oliveira, ISPA Instituto Universitário, Portugal
10:50 - 11:10	**Coffee/snacks**
11:10 - 11:40	**Keynote** *Shihui Han*
11:45 - 12:10	**Award Talk** *Emilie Caspar*
12:10 - 1:30	**Lunch + Poster Session 2**
1:30-3:10	**Session 6** *Social and physical pain and emotions*
1:30 - 1:55	Rei Akaishi, RIKEN, Japan
1:55 - 2:20	Marco Venniro, University of Maryland, USA
2:20 - 2:45	Xiaohong Xu, Institute of Neuroscience, China
2:45 - 3:10	Ann Meulders, Maastricht University, Netherlands
3:10 - 3:30	**Coffee/snacks**
3:30-5:10	**Session 7** *Oxytocin and social cognition – relevance for mental health*
3:30 - 3:55	Valery Grinevich, Heidelberg University, Germany
3:55 - 4:20	Christine Stubbendorff, Istituto Italiano di Tecnologia, Italy
4:20 - 4:45	Mary R. Lee, National Institutes of Health, USA
4:45 - 5:10	Adam Guastella, University of Sydney, Australia
5:10 - 5:30	**Break, Happy Hour**
5:30 - 5:40	**Data Blitz**
5:40 - 7:30	**Poster Session 2** **Drinks, Happy Hour**

DETAILED SCHEDULE: DAY 3



WEDNESDAY, MARCH 27, 2024

8:30-9:10 **Coffee, Breakfast**

Come early and mingle in the main lobby

SYMPOSIA V

9:10-10:50 **A CROSS-SPECIES PERSPECTIVE ON HOW THE EMOTIONAL STATE OF OTHERS INFLUENCES THE STATE AND DECISIONS OF OBSERVERS**

9:10-10:00 *A cross-species approach to the neural bases of emotional contagion and prosociality*

Valeria Gazzola and Christian Keysers, Social Brain Lab, Netherlands Institute for Neuroscience, KNAW, The Netherlands; Brain & Cognition, Department of Psychology, University of Amsterdam, Amsterdam, The Netherlands

10:00-10:25 *Social buffering of conditioned fear responses in rats: Relief provided by conspecifics*

Yasushi Kiyokawa, University of Tokyo, Japan

10:25-10:50 *Social transmission of alarm states in zebrafish: mechanisms and evolutionary perspectives*

Rui Oliveira, ISPA Instituto Universitário, Portugal

10:50-11:10 Coffee

DETAILED SCHEDULE: DAY 3

WEDNESDAY MARCH 27, 2024

KEYNOTE: SHIHUI HAN

11:10-11:45 **PSYCHOLOGICAL AND NEURAL NATURE OF RACE IN FACE PERCEPTION**

EARLY CAREER AWARD: EMILIE CASPAR

11:45-12:10 **THE NEUROSCIENCE OF (DIS)OBEDIENCE**

12:10-1:30 **LUNCH BREAK**

SYMPOSIA VI

1:30-3:10 **SOCIAL AND PHYSICAL PAIN AND EMOTIONS**

1:30-1:55
Expanding relevant computational scales for human brains in society
Rei Akaishi, RIKEN, Japan

1:55-2:20
Norepinephrine mediates volitional reciprocal social interactions
Marco Venniro, University of Maryland, USA

2:20-2:45
Esr1 sculpts the brain circuitry for aggression in male mice
Xiao-Hong Xu, Shanghai Center for Brain Science and Brain-Inspired Intelligence Technology,, China

The effect of social context on experimental pain and pain-related fear learning
Ann Meulders, Maastricht University, Netherlands

DETAILED SCHEDULE: DAY 3

WEDNESDAY MARCH 27, 2024

3:10-3:30 Coffee

SYMPOSIA VII

3:30-5:10 **OXYTOCIN AND SOCIAL COGNITION – RELEVANCE FOR MENTAL HEALTH**

3:30-3:55 *Oxytocin facilitates social behavior through axo-axonic interneurons in the rat prefrontal cortex*
Valery Grinevich, Heidelberg University, Germany

3:55-4:20 *Social cognition in 22qll.2 schizophrenia mouse model – does oxytocin play a role?*
Christine Stubbendorff, Istituto Italiano di Tecnologia, Italy

4:20-4:45 *Targeting the oxytocin system in monkeys and humans: evidence for oxytocin as a potential treatment for addiction*
Mary R. Lee, National Institutes of Health, USA

4:45-5:10 *TBA*
Adam Guastella, University of Sydney, Australia

5:10-5:30 BREAK, HAPPY HOUR

5:30-5:40 DATA BLITZ TALKS

Ventromedial prefrontal neurons represent self-states shaped by vicarious fear in mice.
Ziyan Huang, University of Tokyo

Change in the foraging strategies in freely moving rhesus monkey dyads
Ayuno Nakahashi, German Primate Center

Neural computations underlying pragmatic reasoning in referential communication
Shanshan Zhen, City University of Hong Kong

A comparative analysis of theory of mind computations in large language models and single neurons in the human brain.
Mohsen Jamali, Harvard Medical School

DETAILED SCHEDULE: DAY 3

WEDNESDAY, MARCH 27, 2024

5:40-7:30 POSTER SESSION II & HAPPY HOUR

POSTER # TITLE, AUTHOR INFO

1 **Propensity to revenge: a fNIRS study on forgiveness and dark factors of personality**
A. Upravitelev, M. Makarova, M. Petrov, E.Shugarova, N. Meloyan, A. Kurpatov, N. Volkova. HSE University, University of Trento, SBER

2 **An Integrative Model of Information Sharing Decisions: Semantic features, neural correlates, and affective experience**
B. Dore, S. Balny D'Avricourt. McGill University

3 **Neural coordination underlying altruistic behavior in the social brain**
A. Mazza, A. Valvo, I. Mirlisenna, N. A. Fagan, S. W. C. Chang, O. Dal Monte
University of Turin, Yale University

4 **Insula and anterior prefrontal cortex mediates emotional and reasoning processes respectively in moral decision-making**
Y.Liu, M.Sugiura. Tohoku University

5 **Adaptation of the Carbon Emission Task to fMRI settings**
M. Wierzba, D. Zaremba, B. Kossowski, M. Wypych, K. Jednoróg, J. Michałowski, C.A. Klöckner, A. Marchewka. Nencki Institute of Experimental Biology, University SWPS, Norwegian University of Science and Technology

6 **Change in the foraging strategies in freely moving rhesus monkey dyads**
Z. Ahmed, I. Lacal, A. Nakahashi, A. Gail. German Primate Center, Leibniz Science Campus Primate Cognition, University of Göttingen, Bernstein Center for Computational Neuroscience

7 **Effects of Interoceptive Brain Processing on Moral Decision-Making**
S. Cui, and T, Nakano. Osaka University, Center for Information and Neural Networks

8 **Socially influenced preference revaluation: Insights from rat studies**
J. Dören, S. Schäble, S. Troßbach, C. Korth, T. Kalenscher. Heinrich Heine University Düsseldorf

9 **Neural Mechanisms Underlying the Enhanced Cooperation Induced by Multicultural Experience**
Lingyu Meng. University of Sheffield

DETAILED SCHEDULE: DAY 3

WEDNESDAY, MARCH 27, 2024

5:40–7:30 POSTER SESSION II & HAPPY HOUR

POSTER # TITLE, AUTHOR INFO

10 **Neural signatures underlying dilemma moral judgment and non-dilemma moral evaluation**
R. Yu. Hong Kong Baptist University

11 **The formation of free-riders from mouse groups in a reward-threat conflict situation is related to their mPFC-BLA-NAc activity**
Jaehyun Lee, Gyu-Hwan Lee, Seoyoung Kim, Jaehoon Kim, Jee Hyun Choi
Korea Institute of Science and Technology, Seoul National University; Korea Development Institute

12 **Possible Involvement of Familiarity in Collective Decision-making in Response to Visual Threat Signal in Medaka Fish**
R. Nakahata, H. Takeuchi. Tohoku University

13 **Functional role of prediction in empathy for pain**
Y. Deng, S. Han. Peking University

14 **Do we empathize humanoid robots and humans in the same way?**
T. Wu, S. Han. Peking University

15 **Individual Differences in Neurophysiological Correlates of Moral Transgression**
S. C. Kao, C. Y. Chen, Y. T. Fan, Y. C. Chen, Y. W. Cheng. National Yang Ming Chiao Tung University, Taipei Medical University, Yuan Ze University, National Taiwan University of Sport

16 **Disentangling the physiological and cognitive pathways of fear and anxiety**
LZ. Gruber, M. Wilf, M. Ramot. Weizmann institute of Science, Rehovot, Israel

17 **Brain Responses to Emotional Climate Change Stories**
D. Zaremba, B. Kossowski, M. Wypych, K. Jednoróg, J. M. Michałowski, C.A. Klöckner, M. Wierzba, A. Marchewka. Nencki Institute of Experimental Biology. University SWPS . Norwegian University of Science and Technology

18 **Ventromedial prefrontal neurons represent self-states shaped by vicarious fear in mice**
Z. Huang, M. Chung, K. Tao, A. Watarai, M.Y. Wang, H. Itoh, T. Okuyama. University of Tokyo

DETAILED SCHEDULE: DAY 3

WEDNESDAY, MARCH 27, 2024

5:40-7:30 POSTER SESSION II & HAPPY HOUR

POSTER # TITLE, AUTHOR INFO

19 **Selective inhibition of oxytocin receptor expressing neurons in anterior cingulate cortex disrupts consoling in male and female prairie voles**
S.A. Blumenthal, K. Horie, K. Inoue, L.J. Young. Emory University

20 **Imminence of predator threat detected through the accessory olfactory system in mice**
Q. A. T. Nguyen, A. Rocha, Y. Yamashita, R. Chhor, C. Stadler, C. Pontrello, S. Haga-Yamanaka. University of California, Riverside

21 **Functional connectivity in emotional ambiguity processing: a multimodality perspective and clinical implication**
S. Sun, H. Yu, R. Yu, S. Wang. Tohoku University, University of California Santa Barbara, Hong Kong Baptist University, Washington University in St. Louis

22 **Inhibitory parvalbumin neurons in the insular cortex process the information of social behavior**
S. Fujima, M. Sato, N. Nakai, Toru Takumi Kobe University

23 **A genome-wide association study for subjective well-being in Japanese population**
K. Ishii, S. Nogawa, S. Takahashi, M. Matsunaga, Y. Noguchi, H. Yamasue, Y. Ohtsubo. Nagoya University, Genequest Inc., Genequest Inc., Aichi Medical University, Kobe University, Hamamatsu University School of Medicine, University of Tokyo

24 **Avatar versus human in pain: effects of state empathy on socially induced hypoalgesia using immersive virtual reality**
J. Clark, C. Bellei-Rodriguez, Y. Wang, L. Watson, JM. Heagerty, S. Li, B. Brown, A. Varshney, R. Shafir, L. Colloca. University of Maryland Baltimore, University of Maryland College Park

25 **Involvement of Anterior Cingulate Cortex in emotional contagion in mice, measured using functional Ultrasound Imaging**
F. Nelissen, C. Qin, R. Waasdorp, A. Lotfi, C. Rojas, L. De Angelis, P. Kruizinga, D. Maresca, C. Keysers, B. Heiles V. Gazzola. Netherlands Institute for Neuroscience, University of Amsterdam, Delft University of Technology, Erasmus Medical Centre

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5:40–7:30 POSTER SESSION II & HAPPY HOUR

POSTER # TITLE, AUTHOR INFO

26 **Secondary teachers' neural and heart-rate dynamics while evaluating their own students' versus other students' academic work**
X.-F. Yang, C. Kundrak, C. Moliterni, M. H. Immordino-Yang. University of Southern California

27 **Development of a system enabling a detailed behavioral tracking during the naturalistic communication among animals**
M. Fujibayashi, K. Abe. Tohoku University

28 **Effects of group-based operant task experience on dominance hierarchy in male mice**
R. Iwabuchi, T. Setogawa, M. Nakata. University of Tsukuba, University of Toyama

29 **Socially Induced Placebo Effects Are Blocked by Naloxone - A Mixed Experimental Approach**
N. Raghuraman, L. Colloca. University of Maryland

30 **Implicit racial bias moderates the impact of self-reported race/ethnicity on socially induced placebo analgesic effects**
C.-É. Belleï-Rodriguez, N. Raghuraman, J. N. White, L. Watson, R. Shafir, Y. Wang, L. Colloca. University of Maryland

31 **Pre-registration: Endogenous opioid modulation of threat and safety learning in healthy humans**
I.M. Meier, A. Willems, J. Haaker, B. Vervliet, S. Leknes. Oslo University Hospital, KU Leuven, University Hospital Hamburg Eppendorf, University of Oslo

32 **Memory misattribution between self and other**
X. He. Tohoku University

33 **Conditional knockout of Shank3 by in vivo genome-editing in the ventral CA1 impairs social memory**
M. Chung, K. Imanaka, Z. Huang, A. Watarai, M.-Y. Wang, K. Tao, H. Ejima, T. Aida, G. Feng, T. Okuyama. The University of Tokyo, Massachusetts Institute of Technology

34 **The representation of conspecific sex in ventral hippocampal social memory**
K. Tao, A. Watarai, T. Okuyama. The University of Tokyo

35 **Social and Non-social Reward Representations in the Basolateral Amygdala**
J. L. Javier, J. Isaac, M. Murugan. Emory University

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5:40–7:30 POSTER SESSION II & HAPPY HOUR

POSTER # TITLE, AUTHOR INFO

36 **Estrogen receptor beta positive neurons in the medial amygdala regulates male preference towards receptive female odors**
S. Takenawa S. Ogawa. University of Tsukuba

37 **Excitation of estrogen receptor β-expressing neurons in the lateral septum inhibits social anxiety in male mice**
K. Hasunuma, M. Nakata, S. Ogawa. University of Tsukuba

38 **Estrogen receptor β in the medial amygdala is necessary for mate preference but not for lordosis in female mice**
L. Kogure, T. Murakawa, T. Hatsukano, S. Takenawa, M. Morishita, H Ishii, M Nakata S. Ogawa. University of Tsukuba

39 **Estrogen receptor β expressing neurons in the dorsal raphe nucleus serve as an inhibitory regulator on the brain network for female receptivity**
T. Murakawa, L. Kogure, K. Hata, S. Ogawa. University of Tsukuba

40 **Vasopressin neurons control mating behavior in zebrafish**
F. Zhi Chua, M.-Y. Chou. National Taiwan University

41 **Immunohistochemical Localization of Oxytocin in the Monodelphis domestica Brainand Relevance to Field of Social Neuroscience**
E. Alaniz, I. Perez, C. Botello, A. Hinojosa, F. Dominguez, J. VandeBerg, M. Gil. University of Texas Rio Grande Valley

42 **Functional Reorganization in the mPFC-BLA-A1 Circuit of Mice following Acute Oxytocin Administration**
Da-Young Jung, Jungyoung Kim, Hio-Been Han, Robert C. Froemke, Jee Hyun Choi. Korea Institute of Science and Technology, Massachusetts Institute of Technology, New York University, Seoul National University

43 **Amygdala Neurons Differentiating Unfamiliar and Familiar Mice to Establish Social Novelty Preferences**
S. Soya, K. Toda, K. Sakurai1, Y. Cherassel, Y. Saitol, M. Abe, K. Sakimura, T. Sakurai. International Institute for Integrative Sleep Medicine (WPI-IIIS), University of Tsukuba, Keio University, Niigata University

44 **Neural correlates of resilience under different operational definitions: A resting-state fMRI study**
A. P. L. Tai, X. Geng, M. Leung, W. K. W. Lau. The Education University of Hong Kong

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POSTER # TITLE, AUTHOR INFO

45 **Searching for Dedicated Social Cognition Network**
M. Zamberg Elad, M. Ramot. Weizmann Institute of Science

46 **The influence of contextual factors and rater reliability on the quantification of social behavior of Monodelphis domestica, a non-traditional animal model for neuroscience research**
A. Ramirez, G. Padilla, F. Dominguez, J.L. Vandeberg, M. Gil. University of Texas Rio Grande Valley

47 **Interpersonal Neural Synchronization during Mutual Prediction in Ball Catching Task**
Y. Kurihara, R. Ohkuma, A. Tsuchiya, S. Franklin, D. Franklin, and R. Osu. Waseda University, Technical University of Munich

48 **Perceptual crossing paradigm as a method to study second-person neuroscience: an EEG hyperscanning study**
F. Putri, L. Zapata-Fonseca, S. Lerique, S. Estelle, S. Hayashi, T. Morrissey, B. Morrissey, T. Froese. Okinawa Institute of Science and Technology.

49 **The effects of cleft lip/palate and subsequent repair on the neural processing of infant faces**
A.C. Hahn, R. Kee, K.J. Jantzen. California Polytechnic Institute Humboldt, Western Washington University

50 **Pain sensitivity is decreased during heavy metal music festival**
L. Schneider, T. Fritz. Max Planck Institute for Human Cognitive and Brain Sciences

51 **Tactile discrimination is associated with social touch preference in two cross-cultural cohorts**
H. Powell, J. He, K. Magnani, R. Bessler, N. Puts. King's College London

52 **Effects of interaction with virtual dogs on negative mood and oxytocin secretion**
H. Goto, A. Yoshimura, A. Li, M. Wang, H. Tanaka, A. Shimotomai, F. Krueger, H. Takagishi. Senshu University, Tamagawa University, Senshu University, George Mason University

53 **Rapid and Remarkably Plastic Body Coloration Changes in Oryzias celebensis as a Social Signal Influenced by Environmental Background**
R. Ueda, S. Ansai, H. Takeuchi. Tohoku University, Kyoto University, Tohoku University

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POSTER # TITLE, AUTHOR INFO

54 **The modulation of pupil size and facial mimicry in response to social stimuli requires conscious awareness**
C. Dapor, D. Ruzzante, F. Meconi, I. Sperandio. University of Trento

55 **The relationship among subjective hyperacusis responses, sensory issues, sensitivity to reward and punishment, and anxiety in adults**
N. Nagahama, M. Nakata. University of Tsukuba

56 **The relationship between attention deficit hyperactivity disorder (ADHD) traits and fatigue induced by daily life activities in adults**
Sou Koshimizu, Naano Nagahama, Tsuyoshi Setogawa, Mariko Nakata. University of Tsukuba, University of Toyama

57 **Alexithymia, not autism, modulates atypical cognitive modulation of pain experience**
E. Ichijo, MP. Coll, C. Catmur, G. Bird. University of Oxford, University of Edinburgh, Université Laval, King's College London

58 **Oxytocin-induced increases in cytokines and clinical effect on the core social symptoms of autism**
T. Wakuda, S. Benner, Y. Uemura, T. Nishimura, M. Kojima, M. Kuroda, K. Matsumoto, C. Kanai, N. Inada, T. Harada, Y. Kameno, T. Munesue, J. Inoue, K. Umemura, A. Yamauchi, N. Ogawa, I. Kushima, S. Suyama, T. Saito, J. Hamada, Y. Kano, N. Honda, S. Kikuchi, M. Seto, H. Tomita, N. Miyoshi, M. Matsumoto, Y. Kawaguchi, K. Kanai, M. Ikeda, I. Nakamura, S. Isomura, Y. Hirano, T. Onitsuka, N. Ozaki, H. Kosaka, T. Okada, H. Kuwabara, H. Yamasue. Hamamatsu University, National Institute for Environmental Studies, National Center for Global Health and Medicine, The University of Tokyo, Kanazawa Institute of Technology, Wayo Women's University, Teikyo University, Kanazawa University, Nagoya University, Hokkaido University, Tohoku University, Osaka University, Kyushu University, University of Miyazaki, University of Fukui

59 **Cultural contexts in neurodegenerative disorders: Exploring associations between living conditions, social factors, and biomarkers among Hispanic subgroups**
I. Perez, L. Pena Márquez, C. Botello, E. Alaniz, F. Domínguez, M. Gil, N. Alliey-Rodriguez. University of Texas Rio Grande Valley

60 **Psychiatric symptoms are associated with poor performance and enhanced metacognition in computationally complex decisions**
X. Lu, K. Keidel, U. Ettinger, C. Murawski, S. Suzuki. The University of Melbourne, University of Bonn, Hitotsubashi University

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POSTER # TITLE, AUTHOR INFO

61 **Measuring stress in fish: the light/dark test in marine medaka Oryzias melastigma**
D. Goncalves, A. Lebel. University of Saint Joseph

62 **Behavioral assessment and biomarker development for characterization of a marmoset model of autism spectrum disorder**
M. Nakamura, A. Nakagami, M. Yasue, T. Sato, N. Kawai, N. Ichinohe
National Institute of Neuroscience, Tokyo University of Agriculture and Technology, Nagoya University

63 **Preregistration: Impact of childhood social stress on drug effects in young people entering residential treatment for substance use problems**
M. Carlyle, H. Aasterud, E. Falkenberg Kjøde, S. Leknes, L. Hides. University of Queensland; University of Oslo

64 **Social stimulus generalization in animal models for schizophrenia**
K. Oshima, T. I. Shiramtsu, H. Takahashi. The University of Tokyo

65 **The brain structural difference related to grandparenting in healthy seniors : The interaction with biological sex**
J. Kang, Y. H. Hwang, S.G. Lee, S. Kim, C. Shin. Korea University, Empathy Research Institute

66 **Sex-specific differences in behaviour after exposure to microplastics in the marine medaka Oryzias melastigma**
S. D. Cardoso, I. H. Lau, D. Gonçalves. Institute of Science and Environment, University of Saint Joseph

67 **Calcium signaling in the nucleus accumbens during social interactions in male and female Syrian hamsters**
J.M. Borland, P.E. Rothwell, R.L. Meisel. University of Minnesota

68 **Transcriptional bases of different social bonds**
L. Brusman, A. Fultz, R. Dowell, M. Allen, Z. Donaldson. University of Colorado Boulder

69 **Loneliness Syndrome of Youth : Concept Mapping**
E. Lee, J. Kim. Duksung Women's University

70 **A single 60-minute exposure to alcohol impairs the social behavior of adult zebrafish**
S.Hurst, M. Rampersad, M. Mofle, Y. Fernandes. University of South Dakota

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WEDNESDAY, MARCH 27, 2024

5:40–7:30 POSTER SESSION II & HAPPY HOUR

POSTER # TITLE, AUTHOR INFO

71 **Neurocircuitry of the oxytocin-oxytocin receptor system in rats facilitating attachment formation to human hands**
H. Hayashi, H. Sakamoto. Okayama University

72 **A comparative analysis of theory of mind computations in large language models and single neurons in the human brain**
M. Jamali, Z. Williams, J. Cai. Massachusetts General Hospital, Harvard Medical School

73 **Neural computations underlying pragmatic reasoning in referential communication**
Shanshan Zhen, Mario Martinez-Saito, Rongjun Yu. City University of Hong Kong, National University of Singapore, Hong Kong Baptist University

74 **Predictability alters information flow during action observation in human electrocorticographic activity**
C Qin , F Michon , Y Onuki , Y Ishishita , K Otani , K Kawai , P Fries , V Gazzola, C Keysers
Netherlands Institute for Neuroscience, Jichi Medical University, Ernst Strüngmann Institute (ESI) for Neuroscience in Cooperation with Max Planck Society, Donders Institute for Brain, University of Amsterdam

75 **Observer-agent kinematic similarity modulates neural activity in regions of the action observation network**
K. Oshima, T. I. Shiramtsu, H. Takahashi. The University of Tokyo

76 **Social stimulus generalization in animal models for schizophrenia**
B.A. Schuster, Y. Kurihara, A. Tsuchiya, K. Nakagawa, Y. Okamoto, R. Osu
Waseda University, University of Vienna

76 **Representation of behaviour of other idividuals: A novel task in preschool children**
T. Nekovarova, P. Eretova, P. Skalnikova. National Institute of Mental Health, Klecany, Czech Republic

77 **Introducing an open dataset to examine single-dose intranasal oxytocin effects in healthy younger and older adults**
M. Horta, R. Polk, N.C. Ebner. University of Florida

78 **Validation of an innovative task to assess decision making in bribery situations**
E. Oviedo-Rodriguez, A. Reyes-Aguilar, Barrios-Álvarez, F. National Autonomous University of Mexico

A CROSS-SPECIES PERSPECTIVE ON HOW THE EMOTIONAL STATE OF OTHERS INFLUENCES THE STATE AND DECISIONS OF OBSERVERS

A CROSS-SPECIES APPROACH TO THE NEURAL BASES OF EMOTIONAL CONTAGION AND PROSOCIALITY

Valeria Gazzola and Christian Keysers, Social Brain Lab, Netherlands Institute for Neuroscience, KNAW, The Netherlands; Brain & Cognition, Department of Psychology, University of Amsterdam, Amsterdam, The Netherlands

In this interactive talk, we will ask how does our brain make us feel what others feel? How does it motivate us to help others? We will start from the observation that in humans, the somatosensory, insular and cingulate cortices are activated both when experiencing pain and while witnessing other do so. Through a series of human and rodent examples we will then ask whether such vicarious activations have causal influences on sharing the emotions of others and on deciding to help them. We will leverage invasive methods to show that signals in the human insula indeed quantitatively represent the pain of others, and that in the rodent cingulate cortex, neurons responding to the animal's own pain become reactivated when witnessing the pain of others. In the light of these findings in rodents and humans, and the homologies in their brain circuitry, we will suggest that emotion sharing is an evolutionarily conserved mechanism that allows animals and humans to better prepare for yet unseen dangers by tuning into the state of those that have already detected them. Finally, we will present work on psychopathic criminals and healthy volunteers that highlights that although these circuits may be biologically pre-wired, we have control on how much we use them.

SOCIAL BUFFERING OF CONDITIONED FEAR RESPONSES IN RATS: RELIEF PROVIDED BY CONSPECIFICS

Yasushi Kiyokawa, University of Tokyo, Japan

Social variables are known to influence neural, endocrine, and immune outcomes in animals. One example is social buffering, the phenomenon in which the presence of affiliative conspecifics mitigates stress responses. We conducted a series of studies in rats to examine social buffering. When the fear-conditioned subjects were exposed to the conditioned stimulus (CS) alone, conditioned fear responses, including freezing, were observed. However, the presence of an unfamiliar same-sex rat (associate) completely blocked these responses by inhibiting the lateral amygdala, suggesting that social buffering ameliorates conditioned fear responses. Investigation of the characteristics of social buffering revealed that not all rats provided buffering effects to the Wistar subjects. Specifically, Wistar rats and the descendants of Wistar rats acted as social buffers, whereas rats established independently from Wistar rats were found to be non-buffers. We also investigated the signal that mediates social buffering. Because the body odor of the social buffers alone was sufficient to induce social buffering, we searched for the responsible chemical in the odor. Subsequent analyses revealed that 2-methylbutyric acid alone was sufficient to induce social buffering in both laboratory rats and wild brown rats. Recently, we have started to investigate the neurochemical that mediates social buffering. Preliminary data suggest that opioids, rather than oxytocin and other neurochemicals, are important for social buffering. We believe that the accumulation of materialistic evidence enables us to understand social buffering from a cross-species perspective, which would support the notion that there are subjective feelings in rats (relief provided by particular strains of rats).

A CROSS-SPECIES PERSPECTIVE ON HOW THE EMOTIONAL STATE OF OTHERS INFLUENCES THE STATE AND DECISIONS OF OBSERVERS

SOCIAL TRANSMISSION OF ALARM STATES IN ZEBRAFISH: MECHANISMS AND EVOLUTIONARY PERSPECTIVES

Rui Oliveira, ISPA Instituto Universitário, Portugal

Using social information to survey the presence of danger in the environment and adjust the behavior and internal state accordingly is an highly adaptive social ability that group living animals are expected to evolve. Using zebrafish as a model to study the presence of such social abilities in a vertebrate divergent evolutionary branch from that of tetrapods, we have shown that both social buffering and social contagion of alarm responses are present in this species. Using mutants for the ligand of the fish oxytocin nonapeptide and both of its receptors we showed that: (1) oxytocin is both necessary and sufficient for observer zebrafish to copy the alarmed/relaxed behavior of conspecific demonstrators; (2) a ventral forebrain circuit is associated with emotional contagion and buffering in zebrafish that receives direct oxytocinergic projections from the pre-optic area; and (3) social transmission of fear in zebrafish is based on emotional contagion rather than motor mimicry. Together these results suggest an evolutionary conserved role of oxytocin on social fear transmission. Finally, using artificial selection we were successful to create a highly social zebrafish line only after 3 generations, and we have shown that this line has enhanced social contagion, indicating a rapid evolutionary response of this social ability to selection for sociality.

SOCIAL AND PHYSICAL PAIN AND EMOTIONS

EXPANDING RELEVANT COMPUTATIONAL SCALES FOR HUMAN BRAINS IN SOCIETY

Rei Akaishi, RIKEN, Japan

We, humans, lives in society by shaping the environment and by being shaped by the environment. The intricate interactions with the social and non-social have been recognized to be an important factor to understand our mind and the brain. However, the relevant scales of time, space, and social aspects of the environment for human brains still remains uncertain. In this talk, I will present the efforts of expanding the scales of computations in the human brain, exploring with its relevant social scales. I will specifically talk about the studies of the issues of trust and wellbeing with the concept of relational mobility and its implementations in the experimental fMRI studies with network-based prisoner's dilemma tasks. The results of the experiments revealed that people become more cooperative with increasing group size in the context of flexible social structure. Careful analysis with computational models showed that people used more tolerant strategies with increasing groups size as a result of interaction between stable cooperative tendency and dynamic reciprocal strategies and these mechanisms are implemented in the brain regions integrating computations at multiple time scales.

NOREPINEPHRINE MEDIATES VOLITIONAL RECIPROCAL SOCIAL INTERACTIONS

Marco Venniro, University of Maryland, USA

Human social behavior is a multifaceted phenomenon. When we engage in interactions with others, our actions are motivated and reciprocal, as we continually observe and interpret social cues, adjusting our responses accordingly. The exploration of social behaviors through animal models has emerged as a prominent research area. However, in many existing models, the social interactions are controlled and initiated by either the experimenter or a designated experimental animal, with the social partner playing a passive role. Here, we developed a model wherein both resident and partner rats achieve social interaction by voluntarily coordinating a series of actions. Independent of sex or effort requirements rats consistently exhibited reciprocal engagement in social interactions. Furthermore, norepinephrine selectively mediated reciprocal social interactions. Our findings highlight the significance of exploring the underlying mechanisms that enable reciprocal social interactions to facilitate the translation of this knowledge into promoting healthy interactions and understanding disruptive social behaviors.

SOCIAL AND PHYSICAL PAIN AND EMOTIONS

ESR1 SCULPTS THE BRAIN CIRCUITRY FOR AGGRESSION IN MALE MICE

Xiao-Hong Xu, Shanghai Center for Brain Science and Brain-Inspired Intelligence Technology, China

Developmental estrogen signaling instructs male-typical aggression patterns, yet the underlying neural circuit mechanisms remain unclear. Utilizing a newly developed mouse line, we selectively eliminated estrogen receptor 1 (Esr1) from attack-promoting neurons in the ventromedial hypothalamus (VMH) while mapping the connectivity of Esr1-deleted cells. We found that developmental Esr1 deletion has sex-specific effects on synaptic inputs from aggression-relevant brain areas onto VMH attack-promoting neurons. Our analysis revealed the posterior intralaminar thalamic nucleus (PIL) as an previously overlooked attack-promoting site upstream of VMH. Moreover, VMH neurons in Esr1-deleted males exhibit significantly reduced intrinsic excitability, hindering their ability to drive attacks. Conversely, perinatal estrogen treatment in females masculinized the connectivity and firing rates of VMH neurons, enabling these cells to promote male-like attack behavior toward intruders upon stimulation. This study sheds light on estrogen's pivotal role in sculpting male aggression circuitry, advancing our understanding of sex-specific neural circuit development in mammals.

THE EFFECT OF SOCIAL CONTEXT ON EXPERIMENTAL PAIN AND PAIN-RELATED FEAR LEARNING

Ann Meulders, Maastricht University, Netherlands

Pain is ubiquitous, subjective, and exceedingly complex. From early in life, we experience acute pain (injuries, vaccinations). By adolescence, chronic pain affects 1 in 5 individuals, disrupting nearly every domain of development and functioning. While the etiology of chronic pain is unknown, the biopsychosocial model has dominated the field with research disproportionately focusing on neurobiological factors, to a lesser extent, psychological factors, but largely ignoring the social dimension. Yet, we are a social species: others are around when we experience pain, and we learn from others about pain (social/ observational learning). In this talk, I will (1) review our previous work on the effect of social threat on pain experience, pain expression, pain-related fear learning, and interpersonal dynamics using experimental pain paradigms, (2) present a study investigating the effect of observing others in high vs. low pain during high-frequency electrical stimulation (HFS) on subsequent pain experience during HFS and pinprick mechanical hypersensitivity, (3) present new data on the buffering effect of digital social support (or online social interaction) on pain intensity, unpleasantness, pain tolerance and recovery in a cold pressor task.
Findings suggest that: (1) social threat increases pain reports and pain-related fear, and decreases facial pain expression, (2) observing others in high pain increases pain-related fear and pain ratings during HFS, slightly increases the perceived intensity of the mechanical pinprick stimulus, but not the unpleasantness or the length of the area, (3) (digital) social support may decrease pain intensity, increase pain tolerance, and speed up recovery during acute pain.

OXYTOCIN AND SOCIAL COGNITION – RELEVANCE FOR MENTAL HEALTH

OXYTOCIN FACILITATES SOCIAL BEHAVIOR THROUGH AXO-AXONIC INTERNEURONS IN THE RAT PREFRONTAL CORTEX

Valery Grinevich, Heidelberg University, Germany

The neuropeptide oxytocin (OT) has attracted great attention of the general public, basic neuroscience researchers, psychologists and psychiatrists due to its profound pro-social and anxiolytic effects. During the last decade, substantial progress has been achieved in understanding the complex neurobiology of the brain oxytocin system. However, the picture of oxytocin actions remains far from being complete, and the central question remains: How does a single neuropeptide exert such pleotropic actions? In my talk, I will tackle this question, demonstrating the anatomical divergence of oxytocin neurons, their multiple central projections, and distinct oxytocin-sensitive cell types in different brain regions, primarily focusing on the medial prefrontal cortex (mPFC). More specifically, I will demonstrate the direct axonal projections of OT-neurons originating in the hypothalamus to the mPFC in adult female rats. Next, I will show the existence of two types of OT receptor (OTR) expressing neurons, which are intrinsically activated during social interaction. Further I will show that opto- or chemogenetic activation of the largest population of OTR+ neurons in the mPF , axo-axonic interneurons ,Äì increases social interactions as well as induces the shift in preference of rats from appetitive stimuli towards social subjects. The work in progress suggests that OTR+ axo-axonic cells exerts biased inhibition of PFC principle neurons projecting to the basolateral amygdala and in turn potentially reducing anxiety level. Due to the fact that OTRs are predominantly expressed in cortical interneurons, the mechanism of their biased modulation of principle cells projecting to subcortical social, reward or anxiety related areas may explain the coherent prosocial action of OT via the mPFC.

SOCIAL COGNITION IN 22QLL.2 SCHIZOPHRENIA MOUSE MODEL – DOES OXYTOCIN PLAY A ROLE?

Christine Stubbendorff, Istituto Italiano di Tecnologia, Italy

Schizophrenia is associated with impairment of social cognition and social function. Medial prefrontal cortex (mPFC) is crucial for processing of social cues and regulation of social behaviour. 22q11.2 deletion syndrome is one of the largest known genetic risk factors for developing schizophrenia and is associated with impairments to social recognition and emotion processing. Oxytocin (OXT) is pivotal to social recognition and social function and inactivation of mPFC OXT receptors impairs social recognition in mice comparable to social cognition deficits in schizophrenia. The 22q11.2 deletion mouse model (LgDel) displays impairments to social memory and emotion recognition and mice display altered mPFC neuronal activity patterns during cognitive tests and brain OXT levels are lower in LgDel compared to wild type mice. These findings suggest that social cognitive deficits in schizophrenia could be caused by altered OXT availability within mPFC. To examine this, WT and LgDel mice were injected with a novel OXT biosensor in mPFC and OXT fluctuations were recorded during social cognitive tasks. In my talk, I will present our preliminary data on this ongoing study.

OXYTOCIN AND SOCIAL COGNITION – RELEVANCE FOR MENTAL HEALTH

TARGETING THE OXYTOCIN SYSTEM IN MONKEYS AND HUMANS: EVIDENCE FOR OXYTOCIN AS A POTENTIAL TREATMENT FOR ADDICTION

Mary R. Lee, National Institutes of Health, USA

Preclinical studies suggest that central endogenous signaling of the nine amino acid peptide, oxytocin (OT) is altered in drug and alcohol addiction. There are preliminary preclinical and clinical studies indicating that administration of OT reduces addiction-related behaviors such as self-administration, conditioned place preference and withdrawal symptoms. As such, OT may represent a novel treatment for alcohol and drug dependence. However, there are still many unanswered questions that limit further clinical development of this promising treatment. The interaction between OT and drugs of abuse on dopamine signaling in mesocorticolimbic pathways where addictive substances exert their reinforcing effects is unknown. It is important to examine effect of OT on drug seeking in primate models of addiction as the brain OT receptor distribution in primates is different from that in rodents. Lastly, the endogenous OT system is altered in substance dependence and these alterations are poorly understood in primate species. We conducted an [11C] raclopride positron emission tomography (PET) study in male rhesus macaques to investigate the effect of systemically delivered OT on [11C] raclopride binding potential in the striatum after an IV methylphenidate (MP) challenge. There was a significant MP X OT interaction such that OT reduced MP-stimulated dopamine concentrations in the dorsal striatum. We also conducted a study of the effect of OT on alcohol consumption in a baboon model of binge drinking, where OT significantly reduced alcohol consumption. Lastly, in a human post-mortem proteomics analysis we found upregulation of OTergic pathways in individuals with alcohol use disorders (AUD), highlighting the potential of OT as a treatment for AUD.

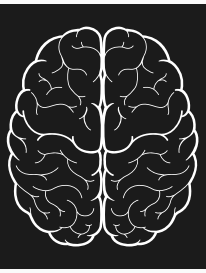
TBA

Adam Guastella, University of Sydney, Australia

DAY 4 AT A GLANCE

Thursday March 28, 2024	
8:30 - 9:10	**Coffee, snacks**
9:10-10:50	**Session 8** *Outside of the ordinary Social Neuroscience - diverse species*
9:10 - 9:35	Matt Lovett Barron, UCSD, USA
9:35 - 10:00	Zoe Donaldson, University of Colorado Boulder, USA
10:00 - 10:25	David Omer, Hebrew University of Jerusalem, Israel
10:25 - 10:50	Kimberley Doell, University of Vienna, Austria
10:50 - 11:10	**Coffee/snacks**
11:10-11:50	**Session 9** *(10 min short talks)*
	Shawn Rhoads, Mount Sinai, USA
	Wataru Toyokawa, University of Konstanz, Germany
	Tara Raam, UCLA, USA
	Malavika Murugan, Emory University, USA
11:50 - 1:30	**Lunch**
1:30-3:10	**Session 10** *Understanding the Behavioral and Neural Dynamics of Naturalistic Social Interactions*
1:30 - 1:55	Yina Ma, Beijing Normal University, China
1:55 - 2:10	Cory Miller, UCSD, USA
2:10 - 2:35	Jumpei Matsumoto, University of Toyama, Japan
2:35 - 3:10	Weikang Shi, Yale University, USA
3:10 - 3:15	**Closing remarks**

DETAILED SCHEDULE: DAY 4



WEDNESDAY, MARCH 28, 2024

8:30-9:10 **Coffee, Breakfast**

Come early and mingle in the main lobby

SYMPOSIA VIII

9:10-10:50 **OUTSIDE OF THE ORDINARY SOCIAL NEUROSCIENCE - DIVERSE SPECIES**

9:10-9:35 *Neurobiology of collective behavior in schooling fish*
Matt Lovett-Barron, UCSD, USA

9:35-10:00 *Filial attachment in common marmosets: Its ontogeny and the relevant brain regions*
Zoe Donaldson, University of Colorado Boulder, USA

10:00-10:25 *The naming of non-human primates*
David Omer, Hebew University of Jerusalem, Israel

10:25-10:50 *Can social neuroscience contribute to the fight against climate change?*
Kimberley Doell, University of Vienna, Austria

10:50-11:10 Coffee

11:10-11:50 **SHORT TALKS**

DETAILED SCHEDULE: DAY 4

WEDNESDAY, MARCH 28, 2024

SHORT TALKS

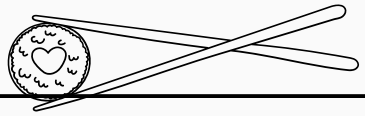
11:10-11:20 *Intracranial neural signatures of social inference and cooperation in human dyads*
Shawn Rhoads, Mount Sinai, USA

11:20-11:30 *Self-organised collective intelligence emerging from conformity*
Wataru Toyokawa, University of Konstanz, Germany

11:30-11:40 *Prefrontal modulation of collective response to environmental challenge*
Tara Raam, UCLA, USA

11:40-11:50 *Approach or avoid ? Deciding what to do with a conspecific*
Malavika Murugan, Emory University, USA

11:50-1:30 **LUNCH BREAK**



SYMPOSIA IV

1:30-1:55 **UNDERSTANDING THE BEHAVIORAL AND NEURAL DYNAMICS OF NATURALISTIC SOCIAL INTERACTIONS**

1:30-1:55 *Intracranial Recording of Interacting Brains Reveal Neurocognitive Dynamics of Human¬†Cooperation*
Yina Ma, Beijing Normal University, China

1:55-2:10 *Representing the dynamics of natural marmoset vocal behaviors in frontal cortex*
Cory Miller, UCSD, USA

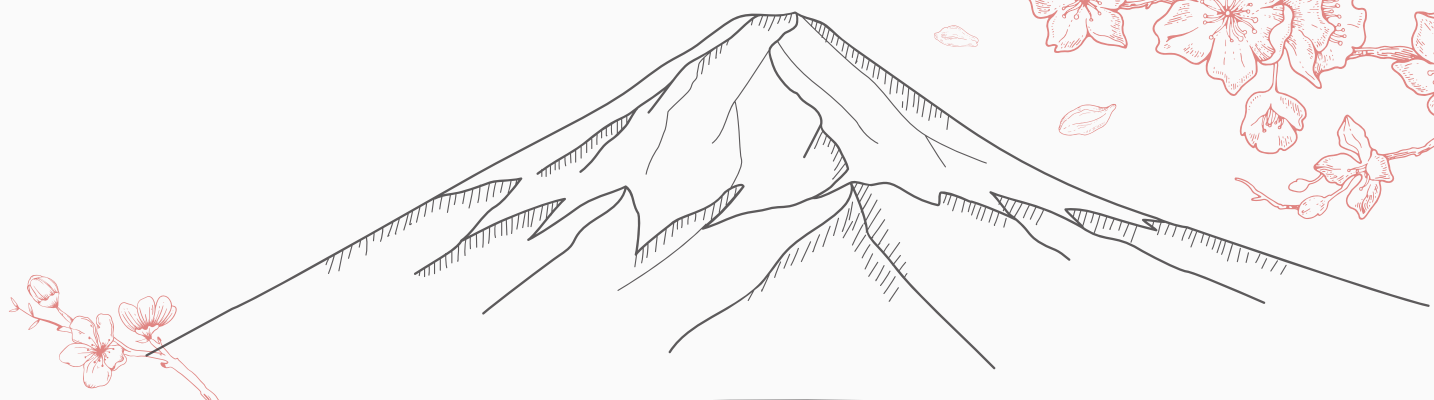
2:10-2:35 *Three-dimensional Markerless Motion Capture of Multiple Freely Behaving Monkeys for Automated Characterization of Social Behavior*
Jumpei Matsumoto, University of Toyama, Japan

2:35-3:10 *Exploring Behavioral and Neural Dynamics in Cooperative Interactions Among Marmoset Dyads*
Weikang Shi, Yale University, USA

DETAILED SCHEDULE: DAY 4

THURSDAY MARCH 28, 2024

3:10–3:15 | CLOSING REMARKS



OUTSIDE OF THE ORDINARY SOCIAL NEUROSCIENCE DIVERSE SPECIES

NEUROBIOLOGY OF COLLECTIVE BEHAVIOR IN SCHOOLING FISH

Matt Lovett-Barron, UCSD, USA

Many animals move in groups, where collective behavior emerges from the interactions amongst individuals. These social interactions produce the coordinated movements characteristic of bird flocks and fish schools, but little is known about their neurobiological basis. Here I will discuss my lab's efforts to characterize the visually-based schooling behavior of the micro glassfish (Danionella cerebrum), whose small size and optical accessibility allow for brain-wide functional imaging of fish engaged in social virtual reality.

TRANSCRIPTIONAL BASES OF LONG-TERM BONDS

Zoe Donaldson, University of Colorado Boulder, USA

Relationships are shaped by reciprocal interaction and feedback between individuals. As relationships mature, pairs share common goals, improve their ability to work together, and experience coordinated emotions. However, the neural underpinnings responsible for this unique, pair-specific experience remain largely unexplored. We used single nucleus RNA-sequencing to examine the transcriptional landscape of the nucleus accumbens (NAc) in socially monogamous prairie voles in long-term peer or mating-based relationships. We identified cell type-specific transcriptional differences between relationship types, including proportional differences in subpopulations of medium spiny neurons and module-based gene expression differences in interneurons. We also identified five gene modules correlated with different facets of social preference behavior across individuals. Finally, we show that, regardless of relationship type, prairie vole pairs exhibit transcription-based synchrony at the level of individual cells. Together, our results are consistent with a model in which a subset of gene expression changes promote relationship type-appropriate behaviors, while other non-overlapping gene expression changes support the social behaviors that are common across affiliative relationships.

THE NAMING OF NON-HUMAN PRIMATES

David Omer, Hebrew University of Jerusalem, Israel

Humans and dolphins are the only known species which vocally label their conspecifics. Until recently, it remained unclear whether non-human primates shared this language-based ability. In our study, we recorded spontaneous 'phee call' dialogues between pairs of marmoset monkeys. We discovered that marmosets utilize these calls to indicate their location and to vocally label other conspecifics. Moreover, they respond more consistently and correctly to calls that are specifically directed at them. Analysis of calls from various monkeys highlighted family group structures, with members of the same family using similar acoustic feature patterns to address others and perform vocal learning. This finding sheds light on the complexities of social vocalizations among non-human primates and suggests that marmoset vocalizations may provide a model for understanding human language, thereby offering new insights into the evolution of social communication.

OUTSIDE OF THE ORDINARY SOCIAL NEUROSCIENCE DIVERSE SPECIES

CAN SOCIAL NEUROSCIENCE CONTRIBUTE TO THE FIGHT AGAINST CLIMATE CHANGE?

Kimberley Doell, University of Vienna, Austria

Can social neuroscience contribute to the fight against climate change? Collectively, human decisions and actions cause climate change, which threatens to significantly degrade our living conditions. Social neuroscience can provide unique insights into understanding why people behave as they do, especially when combined with interdisciplinary multi-method approaches. In this talk, I will first give an overview of how (social) neuroscience can be leveraged in this domain. Then I will present the results from a multi-method experiment (N=62) that combined a social-reward-based functional imaging paradigm, with web-based measurements of psychological antecedents (e.g., biospheric values), to predict the frequency of real-world environmentally relevant positive and negative behaviours measured via ecological momentary assessment. Brain regions responsible for the consumption of appetitive rewards (e.g. the striatum and prefrontal cortex) were not only more active when participants won money for themselves (as opposed to a control condition), but activity in these regions correlated with the frequency in which participants then committed negative environmental behaviours (e.g., taking a long hot shower) in the real world. Conversely, activity in brain regions that have been implicated in the processing of social rewards and salience detection (i.e. the amygdala and precuneus) positively correlated with the frequency of positive environmental behaviours (e.g., eating a vegan meal). These results support the notion that the mechanisms that drive people to engage in ‚Äúgood‚Äù environmental behaviours are not necessarily the same as the mechanisms that drive them to engage in ‚Äúbad‚Äù behaviours while also highlighting the utility of adopting a social neuroscience approach in the context of sustainable decision making. Overall, we shed light on the individual-level dispositions to act to protect, or not to protect, the environment.

SHORT TALK ABSTRACTS

INTRACRANIAL NEURAL SIGNATURES OF SOCIAL INFERENCE AND COOPERATION IN HUMAN DYADS

Shawn Rhoads, Mount Sinai, USA

TBD

SELF-ORGANISED COLLECTIVE INTELLIGENCE EMERGING THROUGH CONFORMIST SOCIAL LEARNINGSELF-ORGANISED COLLECTIVE INTELLIGENCE EMERGING THROUGH CONFORMIST SOCIAL LEARNING

Wataru Toyokawa, RIKEN CBS, JAPAN

Conventional models of collective intelligence rely on individuals making unbiased, at least partially informed decisions. However, animal decision making through repeated experience may often be biassed due to the constraints in information sampling (so-called the hot stove effect). Considering the ubiquity of conformist social learning, a process widely considered to be bias-amplification, it seems paradoxical that improvements in decision-making performance under social influences still prevail. How can animals overcome the potentially suboptimal bias collectively? Here we show, through model analyses and large-scale interactive behavioural experiments with 585 human subjects, that conformist influence can indeed promote favourable risk taking in repeated experience-based decision making, even though many individuals are systematically biassed towards adverse risk aversion. Although strong positive feedback conferred by copying the majority's behaviour could result in unfavourable informational cascades, our differential equation model of collective behavioural dynamics identified a key role for increasing exploration by negative feedback arising when a weak minority influence undermines the inherent behavioural bias. This ‚Äúcollective behavioural rescue‚Äù highlights a benefit of collective learning in a broader range of environmental conditions than previously assumed and resolves the ostensible paradox of adaptive collective behavioural flexibility under conformist influences.

PREFRONTAL MODULATION OF COLLECTIVE RESPONSE TO ENVIRONMENTAL CHALLENGE

Tara Raam, University of California Los Angeles

Many species organize into social groups, in which the individual contributes to and benefits from the well-being of the whole. However, little is known about the neural basis of group behaviors in response to environmental stressors. To address this gap, I study how groups of four mice self-organize into huddles in response to thermal cold stress, using computer vision multi-animal pose estimation tools. I found that huddling behavior is modulated by group size--individual mice huddle more in groups than in pairs, suggesting that social groups have emergent properties not present in pairs. I next asked what decision-making strategies individual mice display to engage or disengage in huddles. I found that individual mice demonstrate active (self-initiated) and passive (partner-initiated) behavioral strategies to enter or leave huddles. Previous work suggests that medial prefrontal cortex (mPFC) is critical for regulating social behaviors, as well as decision making. Using cellular-resolution calcium imaging, I found distinct mPFC populations that encode active and passive decisions, but not generic locomotion. Finally, I used inhibitory chemogenetics to silence principal neurons in mPFC and found that silencing mPFC in two individuals within the group decreases active decisions in those animals. Remarkably, this also has a ripple effect on non-silenced animals in the group. Together, these data suggest a neural mechanism for how individuals take on flexible, adaptive roles within a group and present a novel avenue towards studying collective behavior.

APPROACH OR AVOID ? DECIDING WHAT TO DO WITH A CONSPECIFIC

Malavika Murugan, Emory University, USA

One of the most critical social decisions animals make is approaching or avoiding a conspecific based on the quality of previous interactions. Yet, how we recognize who we are interacting with and how that information is transformed to guide subsequent behavior remains relatively unknown. For instance, mice readily discriminate between novel and familiar conspecific, preferentially spending more time investigating a novel individual than a familiar individual. In rodents, optogenetic and imaging experiments have identified the ventral hippocampus to be causally involved in allowing the animals to distinguish between familiar and novel animals. However, how information about the conspecific identity thought to be primarily encoded in the ventral hippocampus (vHPC) is transformed to drive increased approach and investigation of a novel individual remains unknown. Through optogenetic and chemogenetic experiments we have mapped vHPC projections to the lateral septum (LS) as a potential site of this transformation. Combining optogenetic, chemogenetic, viral intersectional strategies and rabies tracing methods, we have identified a hippocampal-septal-ventral tegmental circuit that allows animals to discriminate novel from familiar animals and engage in social novelty-related approach behaviors. We currently use calcium imaging to understand how this transformation is reflected in the endogenous activity patterns of vHPC and LS neurons.

UNDERSTANDING THE BEHAVIORAL AND NEURAL DYNAMICS OF NATURALISTIC SOCIAL INTERACTIONS

INTRACRANIAL RECORDING OF INTERACTING BRAINS REVEAL NEUROCOGNITIVE DYNAMICS OF HUMAN¬†COOPERATION

Yina Ma, Beijing Normal University, China

Cooperative interactions play a pivotal role in the evolution of social animals and profoundly shape individual and collective behaviors. Successful cooperation requires dynamic tracking and synchronization between cooperating individuals to achieve the collective goal. However, the cooperative behavioral dynamics and neuronal mechanisms underlying cooperation within each individual brain and between interacting brains remain largely unknown. Here we simultaneously recorded intracranial electrophysiological signals from pairs of epilepsy patients who cooperated as teammates in a dynamic, real-time cooperation game. By analyzing the behavioral dynamics of these cooperating dyads, we quantify and dissect the distinct contributions of teammate coordination and collective goal pursuit to the cooperation dynamics. These components contribute predominantly to the initiation and maintenance of cooperation, respectively, with coordination crucial in initiating cooperation and supporting the achievement of collective goals. High-gamma activity in the amygdala and tempo-parietal junction (TPJ) distinguishes between initiation and maintenance cooperation states, and predicts transitions between cooperation states, with TPJ adaptively monitoring dominant cooperation components. High-gamma activity from distinct populations of neurons encoded teammate-coordination and goal-pursuit motives, with populations of TPJ (not amygdala) neurons preferentially tracking dominant motives of different cooperation states. Furthermore, the amygdala and TPJ high-gamma activity synchronizes across cooperating brains in a way that depends on cooperation states and predicts how teammates synchronize their coordination speed. Together, these findings offer insight into the cognitive and neuronal mechanisms underlying real-time, interactive human cooperation, providing a fine-grained understanding of cooperation dynamics as a state-dependent process with distinctive neurocognitive profiles in each state.

REPRESENTING THE DYNAMICS OF NATURAL MARMOSET VOCAL BEHAVIORS IN FRONTAL CORTEX

Cory Miller, UCSD, USA

Natural behaviors vary in their structure, timing, frequency and occurrence. This seemingly indomitable character of ethology has long been a key bottleneck to neuroscience because of the difficulty it poses to explicating the relationship between the sources of this variance and patterns of neural activity. Here we sought to apply a GLM based approach to test how neuronal ensembles throughout the primate frontal cortex ,Äì prefrontal and premotor (PMC) areas ,Äì govern naturally occurring conversations in freely-moving marmosets, a dynamic social interaction involving the coordinated exchange of social signals between pairs of conspecifics. Analyses revealed that our model-based analysis robustly outperformed more traditional PSTH based analyses, as it identified more neurons with significant vocal behavior related functions ,Äì i.e. hearing and producing calls in different social contexts - as well as captured state-related activity in neurons. Moreover, analyses revealed novel functional clusters in marmoset frontal cortex related to the different behavioral and state related properties of social communication distributed in an anatomically heterogenous organization that had not previously been observed in more traditional experiments. These results suggest that primate frontal cortex is intricately involved in governing nearly all facets of natural, continuous vocal behaviors through a distributed pattern of ensemble activity.

UNDERSTANDING THE BEHAVIORAL AND NEURAL DYNAMICS OF NATURALISTIC SOCIAL INTERACTIONS

THREE-DIMENSIONAL MARKERLESS MOTION CAPTURE OF MULTIPLE FREELY BEHAVING MONKEYS FOR AUTOMATED CHARACTERIZATION OF SOCIAL BEHAVIOR

Jumpei Matsumoto, University of Toyama, Japan

Given their high sociality and close evolutionary distance to humans, monkeys are an essential animal model for elucidating the biological mechanisms underlying human social behavior and the pathogenesis of diseases exhibiting abnormal social behavior. However, behavioral analysis of naturally behaving monkeys requires manual counting of various behaviors, which has been a bottleneck due to problems in throughput and objectivity. Here, we developed a three-dimensional markerless motion capture system that utilized multi-view data for robust tracking of individual monkeys and accurate reconstruction of the three-dimensional poses of multiple monkeys living in groups. Validation analyses in two groups of monkeys showed that the system can characterize individual social dispositions and relationships based on automatically detected various social events. Analyses of social looking facilitated the investigation of adaptive behaviors in a social group. These results suggest that the present motion capture system will significantly enhance our ability to analyze primate social behavior.

EXPLORING BEHAVIORAL AND NEURAL DYNAMICS IN COOPERATIVE INTERACTIONS AMONG MARMOSET DYADS

Weikang Shi, Yale University, USA

Social interactions are complex and dynamic, requiring effective communication, outcome evaluation, and adjustment for future interactions. Non-human primates utilize social gaze as a vital means to gather social information during interactions. To explore the significance of social gaze in cooperative interactions, we studied dyadic cooperative interactions in common marmosets (Callithrix jacchus), using a cooperative lever-pulling task in a naturalistic setting. In this task, the marmosets were placed in separate transparent boxes, each with access to a lever and a juice tube. To obtain the juice reward, the animals were required to pull the levers simultaneously in a cooperative manner. Throughout the task, we recorded their behaviors using multiple synchronized cameras. By employing a deep convolutional neural network, DeepLabCut, we tracked and analyzed specific facial parts, including the eyes, ear tufts, forehead, and mouth. This analysis allowed us to define the animals' head gaze direction and examine the dynamics of their gaze behaviors. We quantified the instances both when the marmosets engaged in looking at one another (social gaze,) and when they focused their attention on their own juice tube (reward gaze). With training, all three pairs of marmosets tested exhibited an increased frequency of social gaze, indicating their potential use of social information to successfully complete the cooperation task. Furthermore, we utilized a Dynamic Bayesian Network (DBN) model to investigate the behavioral dynamics encompassing gazes and lever-pulling behaviors. By quantifying the causal relationships between these factors, we discovered an augmented causal influence from social gaze to pulling over time. This result suggests that the marmosets gradually began utilizing social information to guide their cooperative pulling actions as they learned to work together. Interestingly, our analysis of the DBN models also demonstrated distinct behavioral dynamics among the different pairs of marmosets, implying that each pair may have employed unique strategies to achieve cooperation. By using advanced tracking algorithms and analytical models, these findings collectively shed light on the complex nature of social interactions among non-human primates and emphasize the role of social gaze in facilitating successful cooperative behaviors.

thank you

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Session: 1. Poster Board: 1

Distinct subset of ventromedial hypothalamic neurons encode a conspecific-tuned, sex-specific behavioral state that modulates social investigation

S.C. Lin, H.J. Lee, Y. Hsu, A. Su and S.B. Yang
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Keywords: Ventromedial hypothalamus, Calcium imaging, Social investigation

Proper choice of social behaviors during conspecific encounter is vital for survival and reproduction. Multiple hypothalamic nuclei encode social-behavior-driving internal states. The ventromedial nucleus of hypothalamus (VMH) is one of the most predominant hubs amidst the hypothalamic social network. The VMH could be subdivided into several neuronal subsets with unique molecular, anatomical, and functional profiles. In the dorsomedial VMH resides a subgroup of neurons expressing steroidogenic factor-1 (SF1). Studies have revealed that VMHSF1 neurons encode a fear-driving, predator-orientated defensive state. Nevertheless, neuroanatomical features suggested that the VMHSF1 neurons are interconnected with the social behavioral network, likely implying functional regulation of social interaction. To address how the VMHSF1 neurons sculpt social behaviors, we performed in vivo calcium imaging in freely-moving sf1-cre mice. We revealed that the VMHSF1 neurons were robustly activated by social stimuli, with a male-biased sex preference. In addition, conspecifics with different sexes recruited distinct VMHSF1 neural subsets, forming stable and decodable representation across days. Through selective ablation of particular olfactory transmitting pathway, male-biased populational responses of the VMHSF1 neurons was found to depend on pheromonal inputs, which are majorly transmitted from vomeronasal organ to hypothalamus through the bed nucleus of stria terminalis (BNST). Activating BNST axonal terminals in the VMH triggered robust inhibition in most of the imaged VMHSF1 neurons, implying the existence of GABAergic BNST innervation. Moreover, silencing the BNST-VMHdm pathway drastically reduced the male-preference of the imaged VMHdm neural population. Moreover, VMHSF1 neuronal activities were highly correlated with the occurrence of social investigative behaviors. Altogether, we proposed that VMHSF1 neurons encode conspecific social cues, and such a sex representation likely prompts animals' investigation upon encountering other mice, which facilitates optimal behavioral decision making via driving investigative behaviors for accessing essential sensory information.

Session: 1. Poster Board: 2

When the brain says “No!”: An MRI study on the neural correlates of resistance to immoral orders

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Keywords: prosocial disobedience, immoral orders, fMRI, sense of agency, empathy, cognitive conflict, guilt

People’s ability to resist immoral orders is a fundamental aspect of individual autonomy and of democratic societies. Milgram’s studies mostly described psychological and contextual components which make an individual to obey or disobey immoral orders, but the neuro-cognitive processes that prevent an individual from being coerced into causing pain to others have almost not been investigated. By using a new protocol developed by E.Caspar, in a fMRI study we explored the neural signature of disobedience to immoral orders in 57 young adults. At each trial, participants received the instruction by the experiment to send a shock or not to the victim's hand (a confederate). Participants should decide to obey or not by pressing a key among two keypresses. Through a camera, participants saw the victim's hand. If a shock was sent, participant saw a muscle twitch on the victim's hand. Based on previous studies (Caspar et al., 2020, 2021), we particularly focused on two key neuro-cognitive processes: sense of agency (SoA) and empathy for pain. In an exploratory fashion, we also targeted the feeling of guilt and cognitive conflict. Our results indicated that most individuals were able to refuse to send a shock, as more than 70% of them disobeyed in at least 10% of the trials where experimenter ordered to send a shock to a victim. When comparing obedience to send a shock with prosocial disobedience at brain level – on Cognitive conflict, SoA, Empathy and Guilt epochs – we found a temporally-increased involvement of regions associated to the social brain among with Angular Gyrus, Temporo-Parietal Junction, Supramarginal Gyrus, or Precentral areas. By conducting correlation analyses, we revealed that, in addition to this network, also median prefrontal regions were negatively associated with prosocial disobedience. Together, these results suggested that individuals need to mentally disengage from the experimenter’s order to switch from obedience to disobedience.

Neurocomputational Components of Trust

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Keywords: Trust, modeling, betrayal aversion, fMRI

Objective: People often assess others' trustworthiness based on past interactions, but existing research has typically focused only on single aspects of such experiences. What is lacking is a comprehensive model of how people decide to trust based on different aspects of past social interactions. Here we introduce such an experimental and modelling framework, which systematically evaluates how individuals decide to trust based on three key social experiences: Generosity, favoritism, and reward. This framework may be useful for studying individual differences and pathologies of trust. Methods: Investors and trustees played a modified trust game preceded by various rounds of laboratory interactions. The investors first had to complete various political and personal questionnaires that allowed us to build real social profiles of them. After 3-5 days, the trustees were shown pairs of the investors' social profiles and had to allocate varying amounts of money between them. After another 3-5 days, the investors were asked to play a trust game with the trustees during the scanning. In each round, investors were asked make the investment decision after they were showed the trustee's generosity (how much they shared with both investors), favoritism (how much they allocated to the investor), and reward (the final amount the investor received) in past interaction. In various classes of computational models, we investigated how the resulting trust decisions depended on these three types of social experiences, over and above general social preferences and betrayal aversion. Results: Participants increased their investment with larger rewards (linear mixed-effects model, $p<0.001$) and generosity ($p<0.001$). An interaction of generosity × favoritism ($p<0.001$) indicated specific trust if generous trustees previously favored the investor. Computational modeling showed that participants' decisions are best described by a model with social preferences and betrayal aversion. Subjective value from the betrayal aversion model is primarily represented in the dlPFC, Parietal Cortex, NAcc, and Precuneus (left panel). Generosity and Favoritism are differentially represented when making trust decisions. While Generosity is primarily represented in the left TPJ and right dlPFC, Favoritism, in addition to these regions, is also represented in reward areas such as the ventral striatum and anterior insula. Conclusion: People systematically evaluate and infer the social characteristics of others from previous interactions and use this information to guide their future behavior. Our new model formalizes how these past experiences overcome betrayal aversion to facilitate trust. The model predictions are validated by brain imaging to show that different past experiences are represented in distinct brain networks. Our paradigm and model extend the understanding of the cognitive components underlying trust and may inform interventions aimed at fostering trust in interpersonal interactions. The experimental and modelling approach may be useful for studying pathological alterations of trust in patient populations.

Session: 1. Poster Board: 4

Distinct neural encoding of culturally the own and alien stimuli

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Keywords: culture, categorization, EEG

People tend to simply separate the world into two cultural parts: Eastern and Western. A large number of objects, consequently, possess the attribute of culture belonging. We utilized the Rep-Alt paradigm in EEG recordings, which was created to detect the common neural processes shared by a group of stimuli, to identify whether the human brain was capable to spontaneously perceived the culture belonging of objects. The Chinese-representing stimuli with a large variation in shapes and functions, were contrasted with the Western stimuli. The ERP results found that at an early stage, about 110-150 ms after the stimulus onset, the Western stimuli displayed the significant repetition enhancement (RE) effect on the frontal-central N1 component. No significant effect went for the Chinese at this stage. In a later time course, about 250-300 ms, the Western stimuli exhibited the significant RE effect on the frontal-central N2 component. The Chinese stimuli, on the contrary, exhibited the reversed pattern, that is, the significant repetition suppression (RS) effect on the N2. These ERP results suggested that Chinese participants could perceive the attribute of culture belonging spontaneously, and moreover, the own and alien cultures were processed differently.

Session: 1. Poster Board: 5

Differential inhibitory impact of the deep cerebellar nuclei on two distinct types of social interaction behaviors in male mice

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Keywords: Social interaction, deep cerebellar nuclei, muscimol, in vivo electrophysiology

Social interaction is a dynamic process wherein individuals exert reciprocal influence on one another. This intricate process encompasses diverse types of behaviors, and yet these various social behaviors are infrequently delineated and examined distinctly. Moreover, while the quest for the social brain has mainly focused on the cerebrum, recent research has unveiled the potential engagement of cerebellar mechanisms in the regulation of social interactions. In this light, we microinfused muscimol (a GABAa receptor agonist) or saline into the deep cerebellar nuclei (DCN) of mice and measured their social behaviors in a modified version of three-chambered test. In this test, two types of social behaviors – social sniffing (SS) and nose-to-nose (N2N) interactions – are defined and recorded. Under the inhibitory effect of muscimol, mice spent less time in the N2N interaction compared to mice receiving saline microinfusion. However, there was no difference in the SS time between the two groups. To delve deeper into the electrophysiological mechanisms of the N2N interaction, we performed in vivo electrophysiological recordings from awake mice conjointly with either muscimol or saline microinfusion. Under saline microinfusion, firing rate of the DCN elevated during SS events. In contrast, the firing rate elevated shortly before N2N and maintained high throughout the events. Under muscimol microinfusion, DCN activity showed more diverse patterns, with less units responding specifically to social events. Our preliminary results suggest the involvement of the DCN in encoding social processes, revealing distinct encoding patterns across various types of social behaviors. Importantly, inhibition of DCN with muscimol resulted in disruption of social interactions. To facilitate the observation of social behaviors, we developed a new social task utilizing anesthetized mice as social stimuli. In comparison to the conventional three-chambered test, mice subjected to this new task showed increased time and events of the SS and N2N interactions. In sum, our findings suggest that the DCN is pivotally involved in social interactions, and our new social task proves to be useful for decoding its precise role in social behaviors.

Session: 1. Poster Board: 6

Ego involvement and intrinsic motivation: Threats to perceived competence enhance neural reward processing during interpersonal competition, but thwart it when competition has ended.

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Keywords: Intrinsic Motivation, Perceived Competence, EEG, Reward Processing

It is well known that supporting or thwarting perceived competence enhances or impairs intrinsic motivation, respectively. Less clear however, are the neural processes underlying these effects. Recent EEG studies have demonstrated the feedback-related negativity difference wave (dFRN), can serve as a neural representation of task engagement. Here, we used two studies where participants engaged in competitive trials with a confederate while EEG data was collected. Participants tried to be the closest to a precise number of seconds in a stop watch task with the target clock masked during the final second. In reality, feedback was a predetermined green 'WIN' or red 'LOSE' allowing random assignment to manipulated competence perceptions. Self-reported competence and intrinsic motivation (interest/enjoyment) were also collected after the EEG task. In the first study (N = 48), the data suggest effective manipulation of competence perceptions, which predict interest and enjoyment as expected. Counterintuitively, we found increased dFRN ($F = 16.83$, $p < .001$) during competitive trials for participants whose perceptions of competence were threatened ($n = 25$; $M = -2.34$, $SE = 0.37$) compared to those with enhanced competence ($n = 23$, $M = -0.16$, $SE = 0.38$). A second study (N = 31) was designed to replicate those results and gather pre/post-competition dFRN data as well. The competitive trial data replicated ($F = 6.72$, $p = .015$) with larger dFRN for incompetent ($n = 14$, $M = -2.37$, $SE = 0.46$) than competent ($n = 17$, $M = -0.75$, $SE = 0.42$). Further, there was a significant condition by time interaction ($F = 3.87$, $p = .029$). The dFRN between groups before competition was not different and was larger for the competence thwarted group during competition; then, as expected using Self-Determination Theory, the post-competition dFRN for those with supported competence shows enhancement of reward processing, while post-competition dFRN for those with thwarted competence does not. Analysis of P2 and P3 ERP components show feedback salience and odd-ball effects respectively and differ from the dFRN findings, which provides additional support for our Self-Determination Theory based conclusions.

Neurocomputational mechanisms of self-benefitting vs pro-environmental behavior

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Keywords: decision-making, effort, climate change

Climate change is one of the biggest challenges humanity has ever faced, but the fields of social and decision neuroscience have contributed surprisingly little to our understanding of pro-environmental behavior. Across two studies, we adapted a well-established paradigm developed to study effortful prosocial behavior to investigate pro-environmental behavior. In study one, 74 participants engaged in a decision-making task, where they could earn a varying amount of money for themselves or a pro-environmental organization by investing a varying amount of physical force (measured by a hand-grip device). Confirming our hypothesis, based on research on prosocial decision-making, the results show that participants devalue rewards for the environment more strongly than rewards for themselves. In study two, participants engage in the same decision-making task while undergoing fMRI with the goal of studying the neural underpinnings of the decision process. Data collection and analysis of the second experiment is still in progress and the results will be reported at the conference. Using region of interest analysis we will compare activation for areas associated with the tracking subjective value (e.g. anterior insula, ventromedial prefrontal cortex) for self vs environmental decisions. In addition, we will investigate how that activation relates to participants' real-life behavior, including everyday pro-environmental behavior and willingness to support climate policies. Adapting such a social neuroscience approach in the climate domain by combining neuroimaging and behavioral data helps us understand the neurocomputational processes underlying pro-environmental decision-making and identify barriers preventing people from engaging in more sustainable practices.

Session: 1. Poster Board: 8

A Novel Electroencephalography-Based Paradigm to Measure Intergroup Prosociality

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Keywords: intergroup biases, war-torn societies, transmission, prosociality, EEG

Experimental psychology aims to comprehend and forecast behaviors. Researchers typically measure volunteer behaviors, explicitly and implicitly. Yet, experimental design are time-intensive, often focusing on a single behavior type. Another approach involves assessing volunteers' intent using explicit reports, often reliant on questionnaires much more sensitive to social bias than implicit measurements. This study introduces a new method to gauge intended behaviors, explicitly and implicitly. It explores intended prosociality in the context of the Rwandese genocide. Participants had to choose recipients for their prosocial intentions from ingroup or outgroup representatives. We assessed the frequency of their selections and the cognitive conflict induced by each choice, measured via reaction times (RT) and mid-frontal theta activity (FMθ). Survivors and their children showed less inclination to select former perpetrators and their offspring. Opting for them resulted in greater cognitive conflict, evident in longer RT and higher FMθ, compared to choosing their ingroup. Former perpetrators more often selected outgroup individuals, potentially as a form of compensation. However, this choice generated higher cognitive conflict than selecting their ingroup. Crucially, we observed a similar intergroup prosociality bias in the children of survivors and former perpetrators as in their parents. These results shed light on how historical conflicts shape intergroup prosociality bias and its transmission to future generations. In summary, we presented a new EEG-based paradigm to measure intended behavior that can reveal dissociations between explicit and implicit measurements.

Session: 1. Poster Board: 9

The impact of dark factor on cooperation in married and stranger dyads: a fNIRS-based hyperscanning study

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Keywords: fNIRS, dark factors, hyperscanning, battle of sexes

The topic of interpersonal brain synchronization (IBS) in dyads has received significant attention from researchers in recent years. Utilizing functional near-infrared spectroscopy (fNIRS), we are planning to conduct a hyperscanning research to investigate the neurological effects of cooperation. 120 subjects will be divided into two distinct dyadic groups which are going to be examined in this study: married couples (30 dyads) and paired up total strangers (30 dyads). Both dyads are offered to be involved in two separate types of cooperation tasks. The initial trial assesses each participant's reaction time: members of dyads sit side-by-side, separated by a board and in front of a shared computer display, and press a button when they see green signal. In the second trial, an experimental design known as "Battle of Sexes" is employed, featuring a coordination game in which the participants must reach a consensus on how to allocate their evening. By the trial, each participant will run the Interpersonal Reactivity Index (IRI; Davis, 1980) to assess empathy across four main dimensions and the dark factors of personality (D) test, which refers to the general tendency to maximize one’s individual utility, accompanied by beliefs that serve as justifications. We seek to confirm the result of higher cooperation and IBS in married couples compared to strangers (Pan et al., 2017). Furthermore, we hypothesize that dyads characterized by diminished empathy and elevated dark factor traits will manifest markedly reduced cooperation levels in contrast to those with converse attributes.

An essential oxytocin circuit in the hypothalamus controls social avoidance in mice

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Keywords: social avoidance, oxytocin, hypothalamus

Many animals live in complex social groups. To survive, it is essential to know who to avoid and who to interact. Although naïve mice are naturally attracted to any adult conspecifics, a single defeat experience could elicit social avoidance towards the aggressor for days. The neural mechanisms underlying the behavior switch from social approach to social avoidance remains incompletely understood. Here, we identify oxytocin neurons in the retrochiasmatic supraoptic nucleus (SOR-OXT) and oxytocin receptor (OXTR) expressing cells in the anterior subdivision of ventromedial hypothalamus, ventrolateral part (aVMHvl-OXTR) as a key circuit motif for defeat-induced social avoidance learning. After defeat, aVMHvl-OXTR cells drastically increase their responses to aggressor cues. This response change is functionally important as optogenetic activation of aVMHvl-OXTR cells elicits time-locked social avoidance towards a benign social target whereas inactivating the cells suppresses defeat-induced social avoidance. Furthermore, OXTR in the aVMHvl is itself essential for the behavior change. Knocking out OXTR in the aVMHvl or antagonizing the receptor during defeat, but not during post-defeat social interaction, impairs defeat-induced social avoidance. aVMHvl-OXTR receives its private supply of oxytocin from SOR-OXT cells. SOR-OXT is highly activated by the noxious somatosensory inputs associated with defeat. Oxytocin released from SOR-OXT depolarizes aVMHvl-OXTR cells and facilitates their synaptic potentiation, and hence, increases aVMHvl-OXTR cell responses to aggressor cues. Ablating SOR-OXT cells impairs defeat-induced social avoidance learning whereas activating the cells promotes social avoidance after a subthreshold defeat experience. Altogether, our study reveals an essential role of "SOR-OXT"-"aVMHvl-OXTR" circuit in defeat-induced social learning and highlights the importance of hypothalamic oxytocin system in social ranking and its plasticity.

Session: 1. Poster Board: 11

Prefrontal modulation of collective response to environmental challenge

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Keywords: social decision making, group dynamics, calcium imaging, huddling

Many species organize into social groups, in which the individual contributes to and benefits from the well-being of the whole. However, little is known about the neural basis of group behaviors in response to environmental stressors. To address this gap, I study how groups of four mice self-organize into huddles in response to thermal cold stress, using computer vision multi-animal pose estimation tools. I found that huddling behavior is modulated by group size--individual mice huddle more in groups than in pairs, suggesting that social groups have emergent properties not present in pairs. I next asked what decision-making strategies individual mice display to engage or disengage in huddles. I found that individual mice demonstrate active (self-initiated) and passive (partner-initiated) behavioral strategies to enter or leave huddles. Previous work suggests that medial prefrontal cortex (mPFC) is critical for regulating social behaviors, as well as decision making. Using cellular-resolution calcium imaging, I found distinct mPFC populations that encode active and passive decisions, but not generic locomotion. Finally, I used inhibitory chemogenetics to silence principal neurons in mPFC and found that silencing mPFC in two individuals within the group decreases active decisions in those animals. Remarkably, this also has a ripple effect on non-silenced animals in the group. Together, these data suggest a neural mechanism for how individuals take on flexible, adaptive roles within a group and present a novel avenue towards studying collective behavior.

Session: 1. Poster Board: 12

Initiation of male aggressive behaviors in mice: Pivotal role of adult hippocampal neurogenesis

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Keywords: aggression, hippocampus, neurogenesis, social investigation

Adult hippocampal neurogenesis influences many rodent behaviors, but its role in social interactions has received little attention. Here, we ablated neurogenesis in adult male mice to investigate the role of adult-born neurons in the expression of aggressive behavior. Using our pharmacogenetic animal model to eliminate adult neurogenesis, CD-1 male transgenic mice expressing the herpes simplex virus thymidine kinase (TK) under the control of the glial fibrillary acidic protein (GFAP) promoter underwent treatment with the anti-viral drug valganciclovir. After 8 weeks of drug treatment, TK and wild-type (WT) littermate controls were single housed for one week and then tested for social investigation, social discrimination, and/or intermale aggression. TK male mice showed normal social investigation and social discrimination, suggesting no deficits in social interactions towards another male conspecific. In the resident-intruder test of aggression, TK residents displayed decreased offensive aggression towards a CD-1 male intruder relative to WT residents. As intruders, TK mice predominantly avoided fighting when attacked by the resident. However, TK residents showed normal aggression towards a nonaggressive, olfactory bulbectomized C57BL/6J male mouse, suggesting that TK mice avoid social confrontations unless they perceive a clear win. Furthermore, using the tube test to assess social dominance in WT and TK mice, we found that when WT and TK mice opposed each other in the tube, TK mice lost 75% of the trials, suggesting that ablation of adult hippocampal newborn neurons contributes to submissive-like behaviors. Taken together, adult hippocampal neurogenesis most likely plays an essential role during the instigation of intermale aggression in mice.

Session: 1. Poster Board: 13

Optogenetic Activation of the Lateral Hypothalamus-Dorsal Raphe Nucleus Projection: Influences on Male Mice Aggression

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Keywords: Aggressive behavior, optogenetics, mice

Aggression is an evolutionarily conserved instinctive behavior that is essential for survival and reproduction across animal species. The dorsal raphe nucleus (DRN) serves as a crucial role in regulating aggressive behavior and receives dense projections from the lateral hypothalamus (LH). We recently found that an aggressive interaction elevates c-Fos expression of DRN-projecting LH neurons (LH-DRN projection) in mice. In the current study, our objective was to examine the impact of stimulating the LH-DRN projection on aggressive behavior in male mice using optogenetics. To selectively activate the LH-DRN projection, we injected AAVretro-Cre into the DRN and Cre-dependent channelrhodopsin-2 (ChR2) expressing AAV into the bilateral LH. An optic fiber was inserted into the DRN and optogenetic stimulation was performed by irradiation at 470 nm laser light. To assess inter-male aggression, we placed a matured male intruder in the resident's home cage for 5 minutes in the resident-intruder (RI) test. As a result, we found that LH-DRN projection-selective excitation significantly increased attack bites in inter-male aggression. However, this activation did not affect other aggressive behavior such as threating behavior. Additionally, optical stimulation of the LH-DRN projection increased locomotion during the RI test. In conclusion, our data suggests that the LH-DRN projection plays a pivotal role in modulating specific forms of aggressive behavior, particularly in enhancing attack bites during inter-male aggression.

Session: 1. Poster Board: 14

Oxytocin receptor role for emotional contagion in Anterior cingulate or Amygdala

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Keywords: Oxytocin, DREADD, Chemogenetics, anterior cingulate cortex, amygdala, empathy, emotional contagion, mice

Emotional contagion is a primitive form of empathy and has several submodules. Neurons with oxytocin and its receptors in the brain, which are extensively involved in sociality, but the mechanism of action on emotional contagion remains unclear. I used the oxytocin receptor Cre mouse line to selectively introduce artificial receptors into oxytocin receptor-positive neurons. I then artificially activated these neurons using a chemogenetic approach. The sites of transduction were the amygdala and the anterior cingulate cortex, both of which are thought to be involved in empathy. The role of oxytocin receptors in these areas will be discussed in the course of this presentation.

Session: 1. Poster Board: 15

Effect of prior recognition of social information on emotional attribution bias
-Relationship with autism spectrum and social anxiety tendency-

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Keywords: emotion, bias, social cognition, autism spectrum tendency

Autism Spectrum Disorder (hereinafter "ASD") and Social Anxiety Disorder (hereinafter "SAD") often coexist, presenting overlapping symptoms that complicate clinical diagnosis. This study explores the cognitive processing mechanisms of anxiety in individuals with varying ASD tendencies, focusing on the specificity of emotion attribution biases. Prior research suggests differences in how individuals with and without ASD experience anxiety, especially about social anxiety tendencies and brain structure correlations.

We investigated how prior negative social information about others affects emotion attribution in individuals, and how ASD and SAD tendencies moderate the effect using behavioral experiments (e.g.emotion label task and emotion match task).

We found that individuals with higher SAD tendencies exhibited detection of emotion on face recognition of others becoming slow when they recognized negative information of others in advance, while those with lower SAD tendencies showed detection of emotion on face recognition of others becoming faster when they recognized the negative information of others. There was no such effect on ASD tendencies. The results indicate that there are different biases on ASD and SAD tendencies when inferring other's emotions.

This investigation is crucial for developing targeted interventions and improving diagnostic accuracy in co-occurring ASD and SAD. Future research should focus on refining experimental procedures and use a larger sample size to further understand emotion attribution biases in ASD and SAD and their impact on daily social anxiety.

Session: 1. Poster Board: 16

The pain facilitatory role of Oprm1-expressing brainstem to spinal cord-projecting neurons

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Keywords: Chronic pain, Brainstem, Opioid receptor

Persistent mechanical pain caused by inflammation or nerve injury is a debilitating clinical problem. Millions of people are using opioids for management of chronic pain, which paralleled with opioid overdoses and hospitalization. The chronic pain and opioid epidemics are two interdependent public health crises imposed multidimensional personal and societal challenges. Novel circuit and molecular targets would promote the development of non-addictive medication to lower the dependence on opioids for chronic pain management. The spinal cord-projecting neurons in the rostral ventromedial medulla (RVMSC neurons) play active roles in pain facilitation. However, the underlying circuitry and molecular mechanisms remain largely unknown. Using fiber photometry, we recorded robust calcium signals from OPRM1+ RVMSC neurons when animal respond to noxious stimuli. We then ablated OPRM1+ RVMSC neurons or chemogenetically inhibited these neurons in behaving mice and demonstrated their essential role in both initiation and maintenance of chronic mechanical pain caused by nerve injury and inflammation. Using retrograde transneuronal tracing, we identified presynaptic neurons that provide the excitatory input onto the OPRM1+ RVMSC neurons and examined their role in the onset and maintenance of mechanical hypersensitivity. Together, our results revealed that the activity of OPRM1+ RVMSC neurons is required for both initiation and maintenance of mechanical hypersensitivity in mouse models of inflammatory and neuropathic pain. Inhibition of Oprm1-expressing brainstem descending neurons also affected aversive memory associated pain-paired context. It has been suggested that re-experiencing social pain recruit overlapping neural circuits associated with affective aspects of pain. Therefore, it is possible that the brainstem descending pain modulating system is not only modulating the intensity and unpleasantness of physical pain, but also guiding the re-experiencing of the social pain.

Session: 1. Poster Board: 17

Neural encoding of emotional valence similarity

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Keywords: Emotion, Valence, Repetition suppression, Phase-locked activity, Non-phase locked activity

The perception of other's positive and negative emotions plays an important role in people's social decisions and their social interactions. Previous research focused on between-category differences of emotional valence and summarized under the observation that negative emotions elicited stronger brain responses than positive emotions. However, a recent study raised an alternative interpretation that positive information is more alike than negative information and this within-category similarity has not been tested in the studies of emotional valence. In the present electroencephalography (EEG) study, we address this question by examining repetition suppression (RS) of both phase-locked and non-phase-locked neural responses across two experiments. Specifically, participants viewed upright (Experiment 1) and inverted (Experiment 2) faces with positive (i.e., happy) or negative (i.e., sad) emotions that either one emotional valence was presented repeatedly in the same block of trials (repetition condition), or two emotions were presented alternately in the same block of trials (alternative condition). We found increased P3 amplitudes and theta power for the alternative compared to repetition conditions, and this RS effect (i.e., alternative vs. repetition) was observed for happy faces but not for sad faces. Our findings unravel the neural encoding of the within-category similarity of emotional valence and provide empirical evidence to support the perspective that positive information has higher similarity relative to negative information.

Session: 1. Poster Board: 18

"The Farmer and the Snake": Neural Mechanisms of Social Feedback Modulation on Empathy

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Keywords: Social feedback, Empathy, Neural mechanisms, Prosocial behavior

Aesop's fable "The Farmer and the Snake" narrates the story of a kind farmer who, in the harsh frozen conditions, rescues a snake from a pitiable situation, only to be repaid with harm by the snake in the end. This tale has been widely disseminated globally, serving as a cautionary tale to remind individuals to consider potential social repercussions before engaging in acts of kindness. Despite the fact that this cautionary fable was documented over 2000 years ago and continues to exert a profound influence, the psychological and neural foundations of social feedback modulation on empathy and prosocial behavior remain incompletely understood.

This study employed a laboratory simulation of the "repayment of kindness with enmity" paradigm and integrated electroencephalogram (EEG) measures to discover that experiencing negative social feedback effectively reduces subjective estimations of others' pain perception and diminishes the monetary decisions to help; EEG indicators revealed a neural response reduction within 200 ms after facial pain of the "enemy" following the repayment of kindness with enmity. Our research findings provide a cognitive foundation for understanding the regulatory effects of "The Farmer and the Snake" on empathy and prosocial behavior.

Session: 1. Poster Board: 19

Distinct psychological and neural constructs of nationalism and patriotism

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Keywords: Patriotism, Nationalism, fMRI, Brain

Patriotism and nationalism are two conceptions regarding people's positive or negative attitudes towards their own and other countries and have been used to account for human social behavior. However, these two terms are used interchangeably in ordinary speech and questionnaire measures of patriotism and nationalism are positively correlated. We sought to address the distinction between patriotism and nationalism by proposing an affective-cognitive framework and then examining their distinct psychological and neural constructs. Self-report and functional MRI measures of responses to affective and cognitive statements regarding patriotism and nationalism showed evidence for greater separation between affective and cognitive components of nationalism than patriotism in terms of their psychological constructs and neural underpinnings. Moreover, affective and cognitive components of nationalism but not patriotism predicted empathic neural responses to perceived pain of own-race faces and decision-making on distributions of COVID-19 vaccines to other countries. Patriotism predicted decreased own country benefits in the vaccine distributions. Our findings highlight distinct psychological and neural constructs between patriotism and nationalism which provide a basis for interpretation of nation-related social emotion, cognition and behavior.

Session: 1. Poster Board: 20

Cognitive neural mechanism of the modulation of facial racial categorization by emotional expressions

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Keywords: racial categorization, emotion, intraracial similarity, face perception, EEG

When the human brain processes faces spontaneously, socio-cultural data derived from divergent sources such as face race and emotion appear to interact in functionally interactive manners. Nevertheless, the impact of emotional expression on race perception lacks comprehensive investigation. Here, we scrutinize the impact of facial expression on the racial categorization in various multi-racial contexts utilizing both behavioral and electroencephalography measures. Our face similarity task in Study 1 elucidates that emotional expressions can diminish the perceived intraracial similarity and interracial distinction of faces. In Study 2-3, we replicated the racial categorization process of White faces when juxtaposed against Asian faces, and the modulating effect of facial expressions on the racial categorization of White faces. Moreover, Study 4-5 exhibit that the modulating effect of facial expression extends to different multi-racial contexts, further corroborating the modulation of facial expressions on the racial categorization and that this effect hinges on the interracial differences within the multi-racial environment, which was also echoed by the findings of time-series decoding analysis. Our findings propose that the racial categorization process can be reconfigured by emotional expressions and that this effect is susceptible to the specific multi-racial setting. Our findings endorse the hypothesis that the modulating effect of facial expressions on racial classification procedure is contingent on the chronologic sequence in which our brain distinguish between diverse expressions and racial categories. The current research offers insight into the category interaction between facial expression and racial identity during racial categorization process.

Session: 1. Poster Board: 21

Identifying tingle-eliciting properties of pleasant, calming and potentially socially relevant audiovisual stimuli: the Autonomous Sensory Meridian Response (ASMR)

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Keywords: Multisensory perception, affective processing, ASMR

Sensory information is central to social connection, though little is known about how the brain processes specific sensory stimuli in affective terms. Autonomous Sensory Meridian Response (ASMR) may provide clues as to how multisensory information acquires a social and affective character. ASMR is a phenomenon in which certain auditory and visual sensory inputs produce strong, subjectively salient positive affective responses. ASMR responders report increased relaxation and reduced stress, alongside “tingle” sensations which often begin in the head and spread to other parts of the body. In two online studies, we explore social and non-social features of tingle-eliciting audiovisual “trigger” stimuli in ASMR, assessed by self-reported tingle sensation frequency. This is a step towards investigating physiological and neural underpinnings of socioaffective sensory processing. ASMR responders in both studies reported a higher degree of tingles than controls, although with high variability in intensity and frequency of responses, reflecting heterogeneity. In study 1 (n=54) a combination of speech sounds and object manipulation were most effective for eliciting tingles, even when the videos were desynchronized. Study 2 (n=63) revealed that all ASMR stimuli in which higher and lower frequencies were filtered out were less effective than intact videos. The preference for gentle speech may speak for the importance of body-proximate and social-relevant information in ASMR, while the greater effectiveness of stimuli with intact high and low sound frequencies may also indicate an important role for proximity. However, no clear preference for social compared to non-social categories emerged in either study. Future research will use fMRI to investigate a potential role for temporo-prefrontal pathways in the integration of multisensory and affective information, to expand our knowledge of the social dimensions of ASMR experience.

Session: 1. Poster Board: 22

Empathy-Like Behaviors in Rats Toward Conspecifics with Nausea

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Keywords: Social Behavior, Empathy, Rats

Empathy is defined as any cognitive process influenced by or responds to the emotional state of others. Extensive empathy-like behaviors, including emotional contagion, empathic concern, and consolation, have been observed and preserved across various mammalian species, such as rodents. In this study, we established a novel experimental paradigm using the emetogenic agent lithium chloride (LiCl) to evaluate empathic behaviors in rats toward their distressed conspecifics. Firstly, we conducted an emotional discrimination test to confirm whether rats can recognize the nausea experienced by others. Rats showed a preference for LiCl-treated conspecifics over saline-treated ones, suggesting their ability to recognize the nausea state in others. Subsequently, we observed social behaviors toward LiCl-treated conspecifics. Rats exhibited increased grooming behavior toward partners treated with LiCl compared to those treated with saline, indicating a response to the nausea state of others. In this presentation, we will also discuss the results concerning relevant brain regions involved in empathy-like behaviors toward LiCl-treated conspecifics.

Session: 1. Poster Board: 23

Factors that are involved in social instigation-heightened aggression in male mice.

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Keywords: mice, aggressive behavior, social instigation, hierarchy

An encounter with a rival male (instigator) in a protected tube increases aggressive behavior of male mice in the following agonistic encounter, a procedure called social instigation. During social instigation, the test animal is unable to attack the instigator directly and is provoked by sensory information from the instigator. In this study, we aimed to examine 1) what kind of sensory information of the instigator induces aggression-escalating effect of social instigation, and 2) how social relationship between the instigator and test animal affects instigation-heightened aggression. Ten-week-old ICR male mice were housed individually at least one week prior to the beginning of behavioral tests. Baseline territorial aggression was examined by a 5-min resident-intruder (RI) test in the homecage of the test animal. In social instigation test, one of the following five stimulus types was presented for 5-min followed by a 5-min RI test: 1) an unfamiliar adult ICR instigator male in a perforated tube (regular social instigation), 2) an instigator male in a tube without holes (visual instigation), 3) a male urine-applied cotton ball (olfactory instigation), 4) a dominant male to the test animal from the previous encounters in a perforated tube (dominant instigation), 5) a subordinate male to the test animal in a perforated tube (subordinate instigation). The results indicated that olfactory instigation, but not visual instigation, increased aggressive behavior of male mice to the same extent as regular social instigation. When we examined how social hierarchy affects the effect of social instigation-heightened aggression, we found that, contrary to expectations, neither dominant nor subordinate instigation increased aggressive behavior.

The neural mechanisms of consolation behavior in the anterior cingulate cortex

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Keywords: Empathy, Consolation, anterior cingulate cortex

Empathy is the important ability to recognize and share the emotions of others, which plays a crucial role in social communications in daily life. Elucidating the neural basis of empathy-related behaviors is crucial for understanding the human mind and the neural mechanisms of prosocial behavior. Consolation behavior, which is one of the empathy-related behavior, is affiliative physical contact, for example, embracing to reduce pain or stress experienced by another individual. Rodents display increased allogrooming, a consolation-like behavior toward distressing members of the same species. Recent studies suggest that neural activity in the anterior cingulate cortex (ACC) is associated with consolation behavior mainly in monogamous rodents. However, the neural mechanisms of consolation behavior are poorly understood since few genetically modified monogamous rodents useful for molecular based research have been generated. In this study, we studied consolation-like behavior using non-monogamous C57BL/6 mice. We found that the number of c-Fos positive cells increased in the ACC of mice that displayed allogrooming towards injured others. This suggests that neural activity in the ACC is involved in the expression of consolation behavior. Furthermore, we are conducting calcium imaging and optogenetics manipulation of neural activity to analyze in detail the function of the ACC in consolation behavior. Our study will shed light on the neural basis of consolation behavior in understanding the human mind and the neural mechanisms of prosocial behavior.

Session: 1. Poster Board: 25

The role of dorsomedial striatal cholinergic interneurons in social hierarchy formation in male mice.

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Keywords: Social hierarchy, striatum, cholinergic interneurons

Social hierarchy is the ranking in a social group, which widely exists in social animals, such as rodents, non-human primates, and humans. However, the neural circuits of social hierarchy formation have yet to be fully understood. The overall aim of the thesis research is to investigate the role of dorsomedial striatal cholinergic interneurons in social hierarchy formation in male mice. Establishing a new social hierarchy involves three phases: decision-making (being a winner or loser), repetitive winning or losing experience, and stabilized winner/loser hierarchy. The tube dominance test provides a measure of decision-making, and experimentally induced winning or losing in this test can potentially influence subsequent behavior. Cholinergic interneurons in dorsomedial striatum (DMS) regulate the local neural circuits and play a critical role in set-shifting and behavioral flexibility. I hypothesize that cholinergic interneurons in DMS contribute to decision-making and social hierarchy formation. My results show that the tube dominance test can be used to establish a new social hierarchy in male mice, and that winning/losing in the external competition frequently alters the initial hierarchy. Thus, the winner/loser effect may induce a new social hierarchy. I found that a lesion of the cholinergic interneurons in DMS reduced the changes in the initial hierarchy caused by repetitive external competitions. Intriguingly, the lesion of cholinergic interneurons in DMS also reduced the prevalence of transitive hierarchies in male mice. This result indicates that cholinergic interneurons in DMS may play an important role in maintaining a social hierarchy. In conclusion, my study shows that the external winning/losing experience changes the initial hierarchy, and cholinergic interneurons in DMS play a causal role in a new social hierarchy formation in male mice.

Session: 1. Poster Board: 26

A cingulate to septal circuit modulates peer group preference in a sex-specific manner in a communally breeding mammal

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Keywords: grouping behavior, affiliation, lateral septum

Despite the prevalence of large group-living across the animal kingdom, relatively few studies have identified neural mechanisms that promote social behavior in a group context. Indeed, most studies examine dyadic interactions or preferences between single conspecifics. Further, studies almost exclusively examine behavior in reproductive contexts (i.e., mating opportunities or parent-offspring interactions). We know little about the mechanisms that drive animals to affiliate in groups or seek novel groups to join (a behavior required for successful dispersal in numerous group-living species). Thus, here we use the colonial spiny mouse (Acomys cahirinus) and a peer group size preference test to begin to understand how the brain facilitates the drive to affiliate with a group. We describe for the first time a neural circuit that modulates novel peer group preferences in a mammal. Using a combination of neural tracing techniques and immediate early gene studies, we first identified a circuit – neuronal projections from the anterior cingulate cortex (ACC) to the lateral septum (LS) – that is more responsive to a large than a small group of same-sex peers. Using chemogenetics, we then demonstrate that this circuit is necessary for both male and female group investigation preferences, but only the male spiny mouse preference to affiliate with larger peer groups. Together, our data demonstrate that the ACC-LS circuit is a critical component of mammalian peer group affiliation, at least in males.

Session: 1. Poster Board: 27

REM sleep-active hypothalamic neurons contribute to hippocampal social memory consolidation

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Keywords: social memory; memory consolidation; Supramammillary Nucleus; hippocampal CA2; REM sleep;

The hippocampal CA2 region plays a key role in social memory. The encoding of such memory involves afferent activity from the hypothalamic supramammillary nucleus (SuM) to CA2. However, the neuronal circuits required for consolidation of freshly encoded social memory remain unknown. In the present study, we combined optical Ca2+ recordings, single-cell electrophysiology and optogenetics in defined hypothalamic-hippocampal circuits during various behavioral conditions to explore the possible role(s) of non-rapid eye-movement (NREM) and rapid eye-movement (REM) sleep in mice for the consolidation of social memory. We demonstrate a surprisingly small group of CA2 projecting neurons in the hypothalamic SuM that is active exclusively during REM sleep but not during NREM sleep or quiet wakefulness. Optogenetic silencing experiments revealed an essential role for these neurons in consolidating social memory. By contrast, a distinctly different group of hypothalamic SuM neurons that project to DG, which is also highly active during REM sleep, selectively contributes to consolidating spatial but not social memory. Overall, our results decisively extend the understanding of the memory function of REM sleep and highlight the importance of surprisingly small clusters of hypothalamic neurons in the consolidation of content-specific hippocampal memories. Moreover, our data advance the knowledge of the functional roles of SuM, which has recently been shown to participate in wakefulness, detection of novelty signals, spike-timing coordination, locomotion, and neurogenesis.

Session: 1. Poster Board: 28

Hippocampal contributions to dynamic social memory in prairie voles.

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Keywords: social memory, hippocampus, calcium imaging, prairie vole, monogamy

Substantial work over the past decade has implicated the dorsal CA2 (dCA2)-to-ventral CA1 (vCA1) intrahippocampal circuit in processing social information and related memories. In mice, activity in both regions is necessary for hours-to-days-long social recognition memory. Both regions also contain neuronal ensembles whose activity discriminates between different conspecific identities. However, several critical questions about this circuit's role in social information processing remain unanswered. For example, how do neuronal dynamics in either region compare as a test animal recognizes conspecifics with fundamentally distinct relationships to itself, such as a peer or a mating partner? Additionally, how stable is coding for a conspecific if the test animal successfully remembers that individual after a long period of separation? Answering these questions requires an animal model that forms multiple distinct attachment relationships and exhibits long-term social memory. Unlike laboratory mice and rats, prairie voles develop same-sex affiliative relationships and opposite-sex pair bonds and remember these relationships even after weeks of separation. Using in vivo cellular resolution calcium imaging and manipulative methods, our preliminary results indicate that vCA1 is required for prairie voles to form new pair bonds. Additionally, distinct ensembles discriminating a partner from a novel animal exist in vCA1 before and after partner separation. We are continuing to record activity from and are planning to reversibly inhibit both regions throughout the time course of peer relationships and pair bonds.

Session: 1. Poster Board: 29

Neural mechanisms underlying the effect of prediction errors in facial attractiveness between masked and unmasked faces on face memories in young and older adults

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Keywords: reward prediction error, face memory, fMRI

The COVID-19 pandemic has forced people to predict facial attractiveness from partially covered faces. Given that facial attractiveness is processed as a social reward, differences between the predicted and observed facial attractiveness are defined as reward prediction error (RPE) in a social context. A previous fMRI study for healthy young adults (YA) demonstrated that the memory enhancement by face-based social RPE is involved in the interaction between RPE-related regions, including the ventral striatum and the ventral tegmental area/substantial nigra, and the hippocampus (HC). However, little is known about the age-related difference in neural mechanisms of the memory modulation by face-based social RPE. To elucidate this, using fMRI, we scanned healthy YA and older adults (OA) when they rated the predicted attractiveness of target faces covered except for around the eyes (prediction phase) and then rated the observed attractiveness of the faces without any cover (outcome phase). In the retrieval task after the rating task for learning target faces, participants recognized target faces. RPE was defined as the difference in ratings between the prediction and outcome phases. RPE was categorized into RPE+ (increased RPE from the prediction to outcome phases), RPE− (decreased RPE from the prediction to outcome phases), and RPE± (no difference in ratings between both phases). In both YA and OA, univariate activity in RPE-related regions exhibited a linear increase from RPE− to RPE+. In MVPA, activity patterns in RPE-related regions significantly discriminated between RPE+ and RPE− in YA but not in OA. In functional connectivity analysis for YA, RPE-related regions were functionally connected with HC in all RPE categories, whereas such functional connectivity in OA was significant only in RPE+. Taken together, the interactions between RPE-related regions and HC could be modulated by face-based social RPE, and the modulatory mechanisms are different between YA and OA.

Session: 1. Poster Board: 30

Neural mechanisms underlying memories for others whose impressions of trustworthiness were updated

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Keywords: Trustworthiness, memory, fMRI

The first impression of face-based trustworthiness is updated by social behavior. Functional neuroimaging studies have reported that interaction between the insula and hippocampus is important in the memory enhancement for faces with the first impression of untrustworthiness. However, little is known about the neural mechanisms underlying memory for others whose first impressions were updated by social behavior. In the present fMRI study, we scanned healthy young adults when they rated unfamiliar persons as target faces by the first impression of face-based trustworthiness (first phase) and then the impression of trustworthiness derived from their hypothetical actions (second phase). In the retrieval task after the rating task for encoding, participants were required to recognize target faces. Trials with decreasing impressions from the first to second phases were defined as Gap-, whereas trials with increasing impressions from the first to second phases were defined as Gap+. Trials showing no difference of impression ratings between both phases were defined as Gap±. In MVPA, three patterns of SVM binary classification, Gap- vs. Gap+, Gap- vs. Gap±, and Gap+ vs. Gap±, were significant in activity patterns of the dorsomedial prefrontal cortex (dmPFC), inferior parietal lobule (IPL), precuneus and insula. In functional connectivity analysis, hit rates in Gap+ were significantly correlated with functional connectivity between the dmPFC/insula and hippocampus. In Gap±, hit rates were significantly correlated with functional connectivity between the IPL and hippocampus. However, functional connectivity correlated with hit rates was not identified in Gap-. Taken together with behavioral data in which memory for faces was enhanced in Gap+, the memory enhancement could be involved by interaction of the dmPFC representing the updated impression of trustworthiness and the insula representing the face-based socioemotional information with the memory-related hippocampus.

Session: 1. Poster Board: 31

Roles of the social brain network and emotion network in memory for other persons with trustworthy impressions generated from social interaction

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Keywords: trustworthiness, memory, fMRI

Memory for other persons is modulated by an impression of trustworthiness. Functional neuroimaging studies have reported that the effect of face-based trustworthiness derived from the first impression on memory for faces is involved in the interaction between the insula as a part of the emotion network (EN) and hippocampus (HC). However, little is known about the neural mechanisms underlying the effect of trustworthiness generated from social relationship on memory for other persons. To investigate this issue, using fMRI, we scanned healthy young adults during the encoding of objects associated with trustworthy (Tru), intermediate (Int) or untrustworthy (Untr) persons, whose impressions of trustworthiness were formed in the Trust Game before fMRI scanning. After the encoding with fMRI, participants were randomly presented with target and distracter objects one by one, and were required to recognize whose person was associated with each object as a cue. In MVPA, all patterns of SVM binary classification, Tru vs. Int, Tru vs. Untr and Untr vs. Int, were significant in multivariate activity patterns of EN. MVPA for activity patterns in lateral parts of the social brain network (SBN) showed significant classification accuracies in Tru vs. Untr and Untr vs. Int, whereas in MVPA for multivariate activity patterns in medial parts of SBN, activity patterns significantly discriminated between Tru and Untr. Functional connectivity between EN and HC was significant in Tru and Int, whereas in Untr, significant functional connectivity with HC was identified in lateral parts of SBN. Taken together, memory for other persons with a trustworthy impression generated from social relationship could be involved in the interactions of HC with SBN which represents social knowledge or mentalizing, or with EN which represents emotional valence related to the trustworthy impression. In addition, the interacting mechanism could be modulated by impressions of trustworthiness for other persons.

Session: 1. Poster Board: 32

Social memory formation controlled by noradrenaline and microglia-mediated synaptic modulation in the medial prefrontal cortex

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Keywords: Social memory, mPFC, Noradrenaline, Synaptic plasticity, Microglia, Social defeat stress

Social memory relies on higher cognitive ability such as empathy, wherein the medial prefrontal cortex (mPFC) has been indicated to assume a pivotal role. However, the mechanism for forming the memory in the mPFC remains elusive. Recently, we discovered a new cellular mechanism where noradrenaline enhances synaptic plasticity through β2R-mediated disinhibition of microglia in pyramidal neurons of the rodent mPFC. The plasticity required classical signaling including CaMKII. In this study, we investigated the role of the microglia-mediated synaptic modulation in the mPFC by measurement of noradrenaline and manipulation of plasticity-related signals in observational threat conditioning (OTC) as a social memory paradigm. We found a tonic noradrenaline increase in the mPFC during the conditioning phase of OTC, and that β2R blockade prevented the conditioning. Furthermore, microglia ablation and the inhibition of CaMKII in the mPFC enhanced and reduced memory formation in OTC, respectively. Of note, AIP had no effect in conventional threat conditioning, suggesting that the mPFC plasticity had a selective role in social memory formation. These results suggested that learning involving complex factors relies on new cellular mechanisms that involve noradrenaline and microglia. In a pathological model, social defeat stress reduced memory formation in OTC, so we hypothesized manipulation targeting the microglia synaptic modulation pathway rescued the compromised memory formation, and conducted pharmacological experiments to examine the hypothesis. Overall, our findings provide new insights into the mechanisms of social memory formation in the mPFC, emphasizing the importance of noradrenaline and microglia-mediated synaptic modulation, along with its vulnerability to chronic stress.

Session: 1. Poster Board: 33

The social transmission of empathy relies on observational reinforcement learning

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Keywords: Social learning, empathy, fMRI

Theories of moral development propose that empathy is transmitted across individuals. However, the mechanisms through which empathy is socially transmitted remain unclear. Here, we combine computational learning models and functional magnetic resonance imaging to investigate whether, and if so, how empathic and non-empathic responses observed in others affect the empathy of female observers. The results of three independent studies showed that watching empathic or non-empathic responses generates a learning signal that respectively increases or decreases empathy ratings of the observer. A fourth study revealed that the learning-related transmission of empathy is stronger when observing human rather than computer demonstrators. Finally, we show that the social transmission of empathy alters empathy-related responses in the anterior insula, i.e., the same region that correlated with empathy baseline ratings, as well as its functional connectivity with the temporal-parietal junction. Together, our findings provide a computational and neural mechanism for the social transmission of empathy that accounts for changes in individual empathic responses in empathic and non-empathic social environments.

Social Neuroscience of the Behavioral Immune System: fMRI Insights into Collectivism and Infection Responses

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Keywords: Behavioral Immune System, Functional Magnetic Resonance Imaging (fMRI), Collectivism, Infection Threat Perception

This study aims to investigate the neural correlates of collectivism in response to perceived infection threats, contributing to the understanding of the behavioral immune system from a social neuroscience perspective.

In this study, 55 participants underwent functional Magnetic Resonance Imaging (fMRI) while being exposed to infection-related and neutral stimuli, aimed at eliciting emotional responses associated with health risks. The fMRI scans focused on regions involved in emotional and social cognition. Participants' collectivist orientations were assessed before and after the scans using the "Perceived Vulnerability to Disease" and "Horizontal-Vertical Collectivism and Individualism" scales. This allowed for an analysis of the correlation between collectivism levels and brain activity, particularly in areas related to social and emotional processing. The study thus combined fMRI data with behavioral assessments to explore the neural basis of collectivist responses to perceived infection threats.

We found a negative correlation between participants' pre-task collectivism scores and neural activity in the right inferior frontal gyrus and insula. This suggests a unique neural processing pattern in individuals with higher collectivist tendencies when confronted with health threats. Post-exposure, significant changes in brain activity were observed in regions associated with visual and emotional processing, aligning with shifts in collectivist orientations.

Our findings shed light on the neural underpinnings of collectivist responses to infection threats. They reveal how cultural orientations like collectivism are represented in the brain and how they adapt in response to health risks. This research enriches the field of social neuroscience by illustrating the neural basis of health-related social behaviors, paving the way for future explorations into the behavioral consequences of these neural adaptations in diverse cultural settings.

Differential effects of intraperitoneal injections of oxytocin receptor antagonist, L-368,899, on social rank and other social behavior in mice.

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Keywords: oxytocin antagonist, social rank, social hierarchy, social behavior, mice

Social rank within a group is essential for survival in many animals. Rank in the community helps to avoid unnecessary conflicts and establish stable relationships with others. Oxytocin has received increasing attention for its function in social behavior. However, the causal relationship between oxytocin levels and social rank has remained unclear. Here, we examined the effects of intraperitoneal injection of the oxytocin receptor antagonist L-368-899 on (1) social rank, (2) sex preference, (3) social preference, and (4) dyadic interaction in male mice. In the tube test, injection of the oxytocin receptor antagonist had no effect on first-rank mice, but caused fluctuation of the rank in second-rank mice, suggesting that the function of oxytocin in the maintenance of the social rank is rank-dependent. Second, injection of the oxytocin receptor antagonist dose-dependently impaired the sex preference of the male mice, confirming that oxytocin is essential in sexual behavior. Third, injection of the oxytocin receptor antagonist had no effect on social preference and dyadic interaction between the male mice, suggesting that oxytocin is not necessary in direct social interaction. Taken together, these results demonstrate that the role of the oxytocin in male mice is limited to a specific context of social behavior.

Session: 1. Poster Board: 36

Distal regulatory sequences contribute to diversity in brain oxytocin receptor expression patterns and social behavior

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Keywords: oxytocin system, behavioral evolution, topologically associating domain (TAD), bacterial artificial chromosome (BAC), brain, mammary gland, partner preference, maternal care, evolvability.

The oxytocin receptor (OXTR) modulates social behaviors in a species-specific manner. Remarkable inter- and intraspecies variation in brain OXTR distribution are associated with diversity in social behavior. To test the causal effect of developmental variation of OXTR expression on the diversity of social behaviors, and to investigate potential genetic mechanisms underlying the phylogenetic plasticity in brain Oxtr expression, we constructed BAC transgenic mice harboring the entire prairie vole Oxtr locus with the entire surrounding intergenic regulatory elements. Eight independent “volized” prairie vole-Oxtr (pvOxtr) mouse lines were obtained; remarkably, each line displayed a unique pattern of brain expression distinct from mice and prairie voles. Four pvOxtr lines were selected for further investigation. Despite robust differences in brain expression, Oxtr expression in mammary tissue was conserved across lines. These results and topologically associating domain (TAD) structure analysis suggest that Oxtr expression patterns in brain, but not other tissues, involve contributions of distal regulatory elements beyond our BAC construct. Moreover, “volized” mouse lines with different brain Oxtr expression patterns showed differences in partner preference and maternal behaviors. We speculate that transcriptional hypersensitivity to variable distal chromosomal sequences through long-distance interactions with proximal regulatory elements may contribute to “evolvability” of brain Oxtr expression. The “evolvability” of brain Oxtr expression constitutes a transcriptional mechanism to generate variability in brain OXTR which, through natural selection, can generate diversity in adaptive social behaviors while preserving critical peripheral expression. Transcriptional lability of brain OXTR expression may also contribute to variability in social phenotype in humans, including psychiatric outcomes.

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A cortical mechanism for integrating social information with estrous states to regulate sociosexual interest

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Keywords: female, estrous cycle, mPFC, sociosexual interest

Female estrus cycle can modulate sociosexual interactions to elicit sexual behaviors The medial prefrontal cortex (mPFC) is known to regulate social preference and behavioral flexibility, whether mPFC integrates social information with estrous states to dynamic modulate sociosexual interests in females remains unknown. Here we found Cacna1h-expressing neurons (mPFCCacna1h+) are the primary estrous-status tracker in mPFC. Functionally, inhibiting mPFCCacna1h+ neurons resulted in reduced sociosexual interests and sexual receptivity in estrus females, whereas activation heightened these behaviors in both estrus and diestrus stages. Notably, manipulating the activity of mPFCCacna1h+ neurons in males produced opposite effects compared to estrus females. Interestingly, in estrus females and males, the mPFCCacna1h+ neurons encode sex-biased male and female cues, respectively. The self-estrous status was represented in the mPFCCacna1h+ neurons of females. Furthermore, the periodic upregulation of Cacna1h, encoding T-type calcium channels, was critical in driving estrus-specific activity changes in females and mediating the sexually dimorphic function of mPFCCacna1h+ neurons in sociosexual interest. Overall, our study identified a crucial top-down modulation mechanism in the mPFC, where estrus-sensitive neurons adaptly integrate sociosexual cues with intrinsic estrous states, linking adaptive behavioral responses with physiological shifts in the dynamic regulation of female behaviors.

Session: 1. Poster Board: 38

Modulation of the behavioral and endocrine response to an aggression challenge by the neuropeptides isotocin and vasotocin in the Siamese fighting fish

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Keywords: aggression, vasopressin, isotocin, oxytocin, arginine vasotocin

Arginine vasotocin (AVT) and isotocin (IST), and their mammalian homologs arginine vasopressin (AVP) and oxytocin (OXT), respectively, have been implicated in the modulation of social behavior, including aggression, across different species. However, contradictory results for the role of these molecules in aggression have been published and the mechanisms underlying their action are still not well understood. Here, we investigated the possible modulation of the behavioral and endocrine response to an aggression challenge by AVT and IST in the Siamese fighting fish Betta splendens. For this, males were injected with different dosages of Manning compound and L-368,899, an AVT and IST antagonist, respectively. 1 h after administration fish were exposed to a mirror challenge for 30 min. Blood was collected at the end of trials for hormone analysis. Aggressive behavior was quantified from video. All fish displayed high levels of aggression towards their mirror image. The blockage of AVT receptors, but not of IST receptors, decreased the frequency of attack behaviours (charges) but had no effect on the duration of threat displays (opening of the opercula, distention of fins). Blocking AVT inhibited the increase in plasma levels of the androgen 11-ketotestosterone (KT) after fights. This suggested that AVT could play a role in the post-fight peripheral androgen response. To further investigate this hypothesis, testes tissue from males were incubated with and without AVT and the levels of KT measured at different time points. The results show a slow and direct effect of AVT in KT secretion. Taken together, the results support the hypothesis that AVT, but not IST, facilitates attack behaviour in Betta splendens and that this neuropeptide may directly promote KT release from testes during fights.

Session: 1. Poster Board: 39

Novel aromatase-flox mice show the behavioural relevance of locally produced estrogens in the hypothalamus

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Keywords: social behaviour, local steroid synthesis, social behaviour network

Social behaviour in many species is driven by hormones and neuropeptides acting via their cognate receptors in different areas of the brain. In vertebrates, this is thought to be due to hormones signalling in conserved nodes of the brain called the social behaviour network (SBN) that, in turn, is linked to both the cortex and the limbic system. In males, estrogen acting via the estrogen receptor alpha in the mPOA is critical for the display of sexual behaviour while estrogen produced in the forebrain is known to be important for learning and memory and regulation of anxiety. The behavioural contributions of neuroestrogens in the SBN are unknown. The mPOA is an integratory node of the SBN that expresses higher levels of aromatase in males than in females. In brain slices containing the mPOA incubated in artificial cerebrospinal fluid, we showed that more neuroestrogen is secreted from male slices than female slices. This study uses a novel aromatase-flox mouse to investigate the influence of neuroestrogens in social and non-social behaviours of the male mouse. AAV-cre-mediated knock down of the aromatase gene, which converts testosterone to estrogen, resulted in minimal disruption of sex or aggressive behaviour. However, mice showed significant alterations in non-social behaviours, such as reduced running wheel activity and increased anxiety. Our results suggest that local neuroestrogen production in the mPOA may play a subtle role in social behaviours and a larger role in motivated behaviours, via mechanisms that warrant further investigation.

Session: 1. Poster Board: 40

The neural mechanism regulating psychological stress-induced sweet taste modification.

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Keywords: Taste, psychological stress, hypothalamus

Psychological stress is known to induce overeating and sweet food consumption in modern hectic lifecycle. However, the neural mechanism behind this phenomenon is still less understood. Corticotropin-releasing hormone-expressing (CRH) neurons localized in the paraventricular nucleus of the hypothalamus (PVH) function as a trigger of biological responses to stress with diverse neural connections to various brain areas. We previously found that PVH CRH neurons induces selection of high carbohydrate diet over high fat diet during refeeding after fasting in mice. In this study, we investigated the role of PVH CRH neurons on taste perception under psychological stress to further understand how mental conditions affect eating behaviors.

As a mild mental stress model, a single social defeat stress was given to a C57BL/6J male mouse by a 5-min attack of an aggressor ICR male mouse and the subsequent overnight stay with the ICR mouse in the same cage divided by a metal wire mesh. We then performed brief access taste tests to evaluate taste preference in the presence or absence of the social defeat stress. We found that, sweet taste preference was significantly elevated after the social defeat stress.

To investigate the role of PVH CRH neurons on this psychological stress-induced sweet taste modification, we next expressed hM4Di, an inhibitory DREADD into PVH CRH neurons of CRH-Cre mice by injection of recombinant adeno-associated virus encoding Cre-dependent hM4Di. Chemogenetic inhibition of PVH CRH neurons partially blocked social defeat stress-induced enhancement in sweet preference. These results indicate that PVH CRH neurons may induce binge eating of sweet food under psychological stress conditions.

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Understanding the Neural Mechanisms for Repetitive behaviors: A role for Hypothalamic Endocannabinoids

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Keywords: Social Behaviors
Endocannabinoids
Stress

Introduction: Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition marked by a range of core symptoms, including repetitive behaviors, which pose significant challenges to affected individuals. Developing effective therapies for ASD necessitates a comprehensive understanding of the neurobiological underpinnings of these behaviors. In this context, repetitive grooming behaviors exhibited in rodents have emerged as a valuable preclinical model for investigating therapeutic interventions for ASD. Interestingly, repetitive grooming behaviors have been reliably observed in mice following blockade of the main central cannabinoid receptor (CB1R), suggesting a role for the endocannabinoid (eCB) system in regulating these behaviors. Moreover, a similar increase in these behaviors is seen following stimulation of the paraventricular nucleus of the hypothalamus (PVN), a region regulated by the eCB system. Based on this, we investigated the role of PVN eCB signaling in the regulation of repetitive grooming
Methods: we examined the impact of peripheral and intra-PVN pharmacological CB1R antagonism or peripheral pharmacological depletion of the CB1R ligand anandamide via inhibition of its metabolic enzyme (NAPE-PLD) on home cage behaviors (e.g. grooming). Activation of neurons in the PVN and corticosterone (CORT) release were measured using immunohistochemical and ELISA approaches.
Results: The CB1R inverse agonist AM251, antagonist NESS243, and NAPE-PLD inhibitor LEI401 all increased home-cage self-directed behaviors, c-fos activation in the PVN and circulating CORT. Moreover, intra-PVN AM251 administration recapitulated increases in repetitive behaviors seen following peripheral CB1R blockade.
Conclusions: Blocking eCB signaling, both through CB1R and NAPE-PLD disruption, precipitate repetitive self-directed behaviors and PVN activation. The link between eCBs and repetitive behaviors opens new avenues for investigating potential therapeutic targets for ASD.

Session: 1. Poster Board: 42

Intergenerational transmission of maternal behavioral traits in mice and the involvement of microbiota in this transmission.

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Keywords: maternal behavioral traits, licking/grooming, intergenerational transmission, microbiota, germ-free mice

The intergenerational transmission of maternal behavioral traits has been reported in several species. Studies, primarily on rats, have suggested the importance of postnatal experience and the involvement of epigenetic mechanisms in mediating these transmissions. This study aims to determine whether the intergenerational transmission of maternal behavioral traits occurs in mice and whether the microbiota is involved. We first observed that early weaned (EW) female mice showed lower levels of maternal behavior, particularly licking/grooming (LG) of their pups, than normally weaned (NW) female mice. This difference in maternal behavioral traits was also observed in the second generation, even though all mice were weaned normally. In the subsequent cross-fostering experiment, the levels of LG were influenced by the nurturing mother but not the biological mother. Finally, we transplanted the fecal microbiota from EW or NW mice into germ-free (GF) mice-raising pups. The maternal behaviors that the pups exhibited toward their offspring after growth were analyzed, and the levels of LG in GF mice colonized with microbiota from EW mice were lower than those in GF mice colonized with microbiota from NW mice. These results indicate that, among maternal behavioral traits, LG is intergenerationally transmitted in mice and suggest that the vertical transmission of microbiota is involved in this process. This study demonstrates the universality of the intergenerational transmission of maternal behavioral traits and provides new insights into the role of microbiota in the expression of maternal behavior.

Session: 1. Poster Board: 43

Investigating Neurotransmitter Systems, Neural Networks, and Social Behavior Using Non-Traditional Animal Models

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Keywords: Social behavior, neurodevelopment, neurotransmitters, nontraditional animal models

Animal models are essential for identifying biological mechanisms that underlie neurodevelopmental and neuropsychiatric disorders that impact humans. The goal of this study is to showcase the findings and importance of using nontraditional animal models for social behavior and its mechanisms. We characterized adult behavior in the laboratory opossum (Monodelphis domestica) in previous studies; using this same basis, we next aimed to characterize social behavior in younger animals in this species. In a preliminary study (n=7), we found that durations and frequencies of social behavior decreased from trial one to trials two ($p < 0.029$) and three ($p < 0.002$), suggesting habituation as observed in adults which could indicate learning. Young Monodelphis also only displayed social and nonsocial behaviors, whereas adults expressed aggression and social dominance behaviors. In a second study, we collected brain tissue and conducted Nissl and NeuN staining that have allowed us to characterize the developmental trajectory from early stages of development to younger ages and into adulthood in this species. We have tissue specimens that range from embryonic day 13.5, postnatal day 1, postnatal day 31, and postnatal 161. Currently, we have been working with another nontraditional animal model, the Syrian hamster (Mesocricetus auratus). We are conducting studies to determine the role of neurotransmitter systems and hormones (such as serotonin and vasopressin), acting within neural networks, in the regulation of social behavior. By working with nontraditional models, we have found that they provide useful social behavior patterns that are comparable, or in some cases, more advantageous, to traditional models. We aim to explore and expand on the in-depth benefits of using these animal models, which will allow for novel opportunities in social behavior research methods.

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An application of Parametric Empirical Bayes (PEB) on social neuroscience

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Keywords: DCM (Dynamic Causal Modeling), PEB (Parametric Empirical Bayes), functional connectivity, Neurolaw

Our fMRI study explores the functional connectivity related to legal decision making with the aim of providing scientific insights into criminal justice and lay judge system.
We hired legal experts and laypersons in an fMRI experiment in which they were asked to judge the sentences of remorseful and remorseless defendants in fictitious murder cases.
We found no differences in activation between the two groups (i.e., legal experts and laypersons). However, PEB method of the DCM analysis revealed differences in the pattern of connectivity between the two groups of activation.
In sentencing for remorseful defendants, laypersons showed increased strength in all bidirectional connections among activated regions of Brodmann area (BA) 32, BA23, the right posterior insula, and the precuneus.
In contrast, legal experts sentenced based on mitigation reasoning, showed increased strength only in the bidirectional connection between the insula and the precuneus.
When sentencing for remorseless ones without mitigation, both laypersons and experts increased the connection strength, but with reverse directionality, between regions; legal experts strengthened connectivity from BA10 to other regions, that is, the right anterior insula and BA23, but the directionality was reversed in laypersons. In addition, the strength of connection to BA32 and BA10 was correlated with changes in punishments by mitigating factors.
This is a crucial result that establishes the validity of the connectivity estimates, which were uninformed by the independent (behavioral) differences in the severity of punishment.
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Session: 1. Poster Board: 45

The physical and mental health benefits of touch interventions: A comparative systematic review and multivariate meta-analysis

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Keywords: Social touch; meta-analysis; mental health; physical health; robot touch; skin-to-skin contact

Receiving touch is of critical importance for human well-being. A number of studies have shown that touch promotes mental and physical health. However, effect sizes differ considerably across studies and potential moderators of touch interventions remain unclear to this day. We conducted a preregistered (PROSPERO: CRD42022304281) systematic review and a large-scale multivariate multilevel meta-analysis encompassing 137 studies in healthy participants and patients (166 cohorts, 9617 participants and 643 effect sizes) in the meta-analysis and 75 additional studies as part of the systematic review to identify critical factors moderating touch intervention efficacy. Included studies always featured a touch vs. no touch control intervention with health outcomes as dependent variables. We found comparable and medium-sized (Hedges' g ~ 0.5) effects of touch on both mental and physical health. Touch interventions were especially effective in regulating cortisol levels (0.78 [0.24;1.31]) and increasing weight (0.65 [0.37;0.94]) in newborns, as well as in reducing pain (0.69 [0.48;0.89]), feelings of depression (0.59 [0.40;0.78]) and state (0.64 [0.44;0.84]) or trait anxiety (0.59 [0.40;0.77]) for adults and children. Comparing touch interventions involving objects or robots with humans resulted in similar physical (0.56 [0.24;0.88] vs. 0.51 [0.38;0.64]) but lower mental health benefits (0.34 [0.19;0.49] vs. 0.58 [0.43;0.73]). Adult clinical cohorts profited stronger in mental health domains compared to healthy individuals (0.63 [0.46;0.80] vs. 0.37 [0.20;0.55]) but showed comparable physical health benefits (0.53 [0.38;0.69] vs. 0.47 [0.29;0.65]). We found no difference in children and adults comparing touch applied by a familiar person or a health professional (0.51 [0.29;0.73] vs. 0.50 [0.38;0.61]) but parental touch was more beneficial in newborns (0.69 [0.50;0.88] vs. 0.39 [0.18;0.61]). Intervention frequency positively correlated with increased health benefits in adults and children while session duration did not show significant effects. Leveraging those factors that influence touch intervention efficacy will help maximize the benefits of future touch interventions and improve neuroscientific paradigms to gain insight into the underlying brain processes of beneficial touch interventions.

Session: 1. Poster Board: 46

The neural bases of how dogs and humans navigate their social environment

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Keywords: social prediction, comparative neuroscience, dogs, humans, convergent evolution, task fMRI

One reason for humans' advanced social interaction skills is their capacity to continuously make predictions about the state of mind of others. Predictions (or expectations) about one's social environment can be formed based on the perception of others' actions, knowledge, and beliefs. A key region for this complex social ability in humans is the temporoparietal junction, and recent evidence suggests that the evolutionary origin of this area was already present in their close primate ancestors. Like humans, dogs are also sensitive to others' actions or intentions, but the neural mechanisms supporting this complex social ability remain unstudied. To close this research gap, we used a series of functional MRI tasks with awake and unrestrained pet dogs (N = 22-28, depending on the task) and humans (N = 40). Preliminary results indicate that observing social interactions recruits a complex occipital-temporal-parietal network in both species. The network includes face- and body-responsive brain areas and areas sensitive to dynamic aspects of social cues and action features in the dog suprasylvian and sylvian and human inferior and lateral temporal cortex. However, we found significantly stronger engagement of parietal cortices in humans than in dogs, while the temporal lobe was predominant in supporting social cognition for dogs. In addition, our findings show how the dog's temporal lobe responds to observing social interactions that take unexpected turns (e.g., interruption by another event) and if they elicit a social prediction error, analogous to observations in humans and non-human primates. Overall, these findings provide new insights into the neural mechanisms supporting dogs' complex social abilities and show whether social behaviours arise similarly in these species.

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Repetition suppression effects reveal distinct time courses of spontaneous categorization of elderly and young faces

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Keywords: EEG, face, age, spontaneous categorization

Social interactions with another people vary greatly depending on the age groups the other belongs to. In many cases, age information can be inferred from a quick glance at someone's face. In this electroencephalography study, we investigate young people's spontaneous categorization of young and elderly faces by quantifying the repetition suppression (RS) effect of neural responses. We find significant RS effects of elderly faces in the P2 time window (170-200 ms) and of young faces in the N2 time window (240-260 ms), indicating distinct time courses of categorizing young and elderly faces. Moreover, we do not find those RS effect when faces are presented upside down, suggesting that face inversion may interfere with age categorization. Our results show that young people's spontaneous categorization of elderly faces happens earlier than that of young faces, and that facial configuration is essential for spontaneous age categorization of faces. The current study provides new insight into the neural mechanisms underlying the way human brains automatically classify people into different age groups upon first glance.

Session: 1. Poster Board: 48

Neural representation of natural human conversation

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Keywords: Human social interaction, stereo EEG, Deep learning

Verbal conversations represent a primary mode of social interaction unique to humans. In a natural conversation, neural activities from distributed brain areas support the complex interplay of speech planning, production, and comprehension. However, little is known about the precise representation of linguistic information during natural conversations and the shared neural processes. Here, we performed stereo-EEG recordings obtained from 14 participants engaged in natural dialogue and performed a comparative analysis using pre-trained deep learning natural language processing models. We find a striking similarity not only in neural-to-artificial network activities but also in the encoding of linguistic information in the brain during both speech production and comprehension. These partially-overlapping patterns of neural activity that encode linguistic information exhibit a remarkable alignment with speaker-listener transitions, and are present in distinct brain areas and frequency bands, suggesting a hierarchically structured representation of information conveyed during dialogue. Together, our findings provide novel insights into the distributed neural dynamics underlying human social verbal communication, demonstrating how exchanged information is processed during speech production and perception.

Session: 1. Poster Board: 49

MDMA Modulates Sensorimotor and Affective Pathways in the Human Cortex During Affective Touch

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Keywords: MDMA, oxytocin, affective touch, fMRI

The stimulant ±3,4-Methylenedioxymethamphetamine (MDMA) heightens tactile perception and enhances pleasantness from affiliative touch. However, the underlying neural processes that contribute to such effects are not understood. Using a double-blind, randomized, within-subject design, this study examined the effects of MDMA (1.5 mg/kg) versus placebo, on neural activation during an affective touch procedure in healthy men and women (N = 22), using functional Magnetic Resonance Imaging (fMRI). While in a scanner, participants received forearm brush stroking at two distinct velocities: slower (3 cm/s) and faster (30 cm/s). Plasma oxytocin levels pre- and post- procedure were also obtained. We found that MDMA enhanced pleasantness of both types of touch, and increased oxytocin levels post-MDMA. fMRI data revealed that MDMA increased activation in primary sensorimotor areas and motion-sensitive temporal cortex during both touch conditions. MDMA did not selectively alter posterior insular activation in response to slow touch relative to faster touch. These results suggest MDMA alters early somatosensory processing during touch, which may affect the evaluation and drive for tactile engagement. These findings extend our knowledge of the neural processes underlying the effect of MDMA on affective touch.

Session: 1. Poster Board: 50

Exploring pupil response typicality during naturalistic viewing of social and non-social videos

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Keywords: pupil dilation; videos; eye tracking; naturalistic

While experiencing a naturalistic audiovisual stimulus, our pupil not only responds to the physical attributes of the stimulus, but also reflects internal processes such as attentional gain, vigilance, and emotion. These internal processes are essential components of social cognition. Accordingly, the pupil has been suggested as a measure of automatic processing of social cues. Since social cognition can differ between individuals, we hypothesized that pupil response patterns might also manifest respective and stable interindividual differences, especially in response to social stimuli. In the current study, we examined whether the pupil reacts similarly across individuals during naturalistic viewing of social and non-social videos at the group level, and whether individual participants have consistent patterns of deviation from this group average, that depend on video category. To that end, we presented participants with a series of 180 naturalistic videos (~15s each) displaying audiovisual scenes involving people, animals, and objects. Comparing two independent halves of the data revealed that each video induced typical pupil activity profiles. These reflected pupil responses to changes in luminosity, but also to changes in the emotional content of the scenes. We then quantified the extent to which the pupil response of each participant deviated from the average response (individual 'pupil typicality'). We found that individual pupil typicality was overall stable across videos, more so within than between categories, with the highest stability in the social category. Finally, we assessed whether pupil typicality was dependent on gaze direction typicality but found only a weak connection between the two measures. Our study demonstrates that pupil response to naturalistic audiovisual stimuli stably reflects interindividual differences in the processing of social and non-social cues.

Session: 1. Poster Board: 51

Impact of oxytocin receptor mutation on social distancing in male medaka fish mediated by visual familiarity recognition

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Keywords: oxytocin, familiarity, visual pathway

Familiarity recognition, one of the crucial social adaptive skills, is observed in various vertebrates. While recent studies have highlighted the role of oxytocin (OXT) in olfactory familiarity recognition in rodents, its involvement in visual familiarity recognition and subsequent behavioral choices is not well understood. In this study, we discovered that oxytocin receptor mutant (oxtr1-/-) males medaka are capable of distinguishing between "unfamiliar" and "familiar" based only on visual information. In small tank experiments, oxtr1-/- males displayed notable avoidance behavior towards novel (unfamiliar) individuals, in contrast to wild-type (WT) males. In three-chamber tests assessing visual discrimination, we compared the reactions of WT and oxtr1-/- males towards a "familiar male" from a long-term cohabitation and an "unfamiliar male" encountered for the first time. Our results showed that oxtr1-/- males tended to keep a longer distance from unfamiliar males and approached familiar males, while WT males did not. This indicated that oxtr1-/- males can visually distinguish novel individuals and exhibit avoidance behavior. Future research employing molecular genetic tools will further elucidate OXT-targeted neural circuits, which induce avoidance behavior based on visual familiar recognition.

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The role of prenatal exposure to climate-related disasters on auditory brainstem responses in newborns in high-risk neighborhoods

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Keywords: Natural disaster, psycho-socioeconomic determinants of health, SES, auditory brainstem responses, intrauterine, prenatal, high-risk neighborhood

The intrauterine period is a time of high susceptibility to perturbations that can elicit structural and functional changes in fetal organs, including the brain. The human auditory system develops prenatally and its early neural function can be assessed via Auditory Brainstem Responses (ABRs) at birth. Prior studies show the delays in newborn ABRs were associated with subsequent child suboptimal neurodevelopment. We examined the role of prenatal stress and its interaction with neighborhood socioeconomic status (SES) on infants' early brain functions, measured by ABRs at birth during 2010-2014 (n=462). Prenatal exposure to Superstorm Sandy (SS), a large-scale natural disaster, ascertained by both the dates of SS landfall and infants' birth, was used as a stress index. SES was based on a selection of neighborhood social characteristics derived from 2010 American Community Survey and mapped using geographical information system (GIS). ABRs waves I-V latencies, reflecting brainstem neural transmission and CNS integrity, were examined. The results from the multivariate GLM found delayed waves I ($p=.05$), II ($p=.03$), III ($p=.05$), IV ($p=.01$) and V ($p=.01$) in the SS-exposed in utero relative to those unexposed. There were also interactions between SS-exposure and SES on waves II ($p=.04$), III ($p=.01$), and IV ($p=.02$), where greater ABRs' delays in the SS-exposed were found in those living in a low SES neighborhood. The formal test of synergy showed accelerated delays in responses in waves II ($p=.02$), III ($p=.03$), IV ($p=.009$), and V ($p=.05$). Our results show that prenatal stress was associated with slower neural transmission and that the poor social environment further amplified this suboptimal functioning. As the brain modulates stress adaptation and regulation, the use of newborn ABRs, as an indicator of global brain functions in response to prenatal stress, can be an innovative way of identifying neurodevelopmentally at-risk children, living in a high-risk SES neighborhood.

Session: 1. Poster Board: 53

Effects of intraperitoneal injection of a non-competitive NMDA receptor antagonist, MK-801, on social and non-social behavior in male mice.

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Keywords: ultrasonic vocalizations, communication, language, schizophrenia, mice

For many animals including humans, vocal communications are essential for survival. Mice produce ultrasonic vocalizations in a variety of contexts. N-methyl-D-aspartate (NMDA) receptors are widely distributed in the central nervous system and are known to play essential roles in synaptic plasticity, learning, and memory. However, the role of NMDA receptors in ultrasonic vocalizations is unclear. Here, we examined the effects of systemic administration of an uncompetitive NMDA antagonist, MK-801, on ultrasonic vocalizations and other social and non-social behavior in male mice. In experiment 1, we investigated the ultrasonic vocalizations emitted by male mice toward female mice. After the successful classification of ultrasonic vocalizations into 11 categories with an open-source computational vision and machine learning techniques, we analyzed the relationship between the properties of ultrasonic vocalizations and approaching behavior. Male mice produced ultrasonic vocalizations when they were close to the location of the female mice, confirming that ultrasonic vocalizations are associated with social signals. In experiment 2, we examined the effects of the intraperitoneal injection of the NMDA antagonist, MK-801, on the ultrasonic vocalizations and approaching behavior by male mice toward female mice. Intraperitoneal injection of MK-801 dose-dependently decreased the number of ultrasonic vocalizations, and increased locomotor activities, but did not affect the time spent with female mice. In experiment 3 and 4, we confirmed that injection of MK-801 dose-dependently increased locomotor activities in the open-field task but did not affect preference for novel same sex individuals in the social preference task. These results will pave a way forward to understand the neurobiological mechanism of vocal communications and its relationship with other social and non-social behavior.

Session: 1. Poster Board: 54

Disentangling the impact of substance use in offenders with antisocial personality disorder - a resting state fMRI study

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Keywords: antisocial personality disorder, substance use disorder, default mode network, resting state fMRI, violent offences

Antisocial personality disorder (ASPD), as described in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), is defined as a pervasive pattern of disregard for the rights of others. Previous neuroimaging studies have shown alterations within individuals in ASPD, especially within the Default Mode Network (DMN). However, the interpretation of studies regarding neural alterations in individuals with ASPD is often limited by the presence of comorbid mental disorders such as substance use disorder. In this study we investigated the role of substance abuse on resting state functional connectivity in the DMN in clinically assessed (1) male violent offenders with a diagnosis of antisocial personality disorder (ASPD) (n = 22), (2) men without ASPD or history of violent offences but a comparable history of substance use disorder (SUD) (n= 15) and (3) non-violent healthy controls (HC) (n=18). A group comparison (ANOVA design) revealed a differentiated pattern of functional connectivity (FC) within the DMN in individuals with ASPD compared to HC. The ASPD group showed an increased FC between the posterior cingulate cortex (PCC) and precuneus (MNI: 0, -54,30) as well as between PCC and bilateral areas of the occipital cortex (MNI: -51, -60, 21; MNI: 51, -72, 36). The SUD group did not differ significantly from the other two groups. Our results indicate ASPD associated alterations in FC between brain areas which are involved in specific aspects of social cognition, such as episodic memory retrieval or self-awareness. These abilities have been shown to be limited in individuals with ASPD. However, some results of previous studies could not be validated (e.g., decreased connectivity between amygdala and medial prefrontal areas). Therefore, our results emphasize the importance of an adequate definition for control groups within clinical samples and the need for controlling comorbid disorders (e.g. substance use disorder) within forensic samples to generate interpretable results.

Session: 1. Poster Board: 55

Nucleus accumbers oxytocin mediates social isolation-induced anxiety-like behaviors in female prairie voles

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Keywords: oxytocin, isolation, anxiety, nucleus accumbens

Brain oxytocin (OT) has been implicated in a variety of behaviors including adult social attachment, mother-infant bonding, and social buffering of anxiety-like behaviors and stress responses. We conducted a series of experiments to reveal the role of OT in the nucleus accumbens (NAcc) in mediating social isolation-induced anxiety-like behaviors in adult female prairie voles (Microtus ochrogaster). In Experiment 1, compared to the controls cohoused with cage mates (Co-housed), females that experienced 6-weeks of social isolation (Isolated) displayed increased anxiety-like behaviors indicated by spending significantly less time in the open arms during an elevated plus maze (EPM) test. Isolated females also showed a decrease in OT receptor (OTR) expression in the NAcc as well as a decrease in the number of OT projection neurons from the paraventricular nucleus of the hypothalamus (PVN) to the NAcc, compared to their Co-housed counterparts. In Experiment 2, intra-NAcc administration of OTR antagonist at 10ng or 100ng in 200nl CSF/side increased anxiety-like behaviors in Co-housed females, whereas intra-NAcc administration of OT decreased anxiety-like behaviors in Isolated females. In Experiment 3, chemogenetic manipulation was applied to the OT projection pathway from the PVN to the NAcc. Co-housed females were injected with rAAV-Oxytocin-CRE-WPREs in the PVN and retrograde cre-dependent hM4 AAV in the NAcc. Fourteen days later, intra-NAcc injections of 1.0mM colozapone-N-oxide (CNO) increased their anxiety-like behaviors in an EPM test. Conversely, Isolated females were injected with the same rAAV-Oxytocin-CRE-WPREs in the PVN and retrograde cre-dependent hM3 AAV in the NAcc after 4-weeks of social isolation. Fourteen days later, intra-NAcc injections of CNO decreased their anxiety-like behaviors in an EPM test. Taken together, our data demonstrate that the NAcc is a brain region in which OT from the PVN is involved in mediating anxiety-like behaviors induced by chronic social isolation.
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Social attention in the wild - Interactive effects of oxytocin and naltrexone on social attention in ASD during a naturalistic interaction

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Keywords: Social Attention, Autism Spectrum Disorder, Oxytocin, Opioids, Eye Tracking

Attention to social stimuli is a key component of social behavior and facilitates the development of fundamental social skills. This basic affiliative behavior seems to be reduced in individuals with a diagnosis of autism spectrum disorder (ASD). The μ-opioid system and its interaction with oxytocin have been suggested as a potential neural substrate of social attention in animal studies. Here, we present findings from an unrestrained eye-tracking paradigm using a face detection algorithm to measure fixation rates on facial areas during a naturalistic interaction. In a first study, data from 62 healthy adults was collected for gaze behavior and scores on the autism spectrum quotient (AQ). We observed a significant negative correlation of fixation rates to the eye region and AQ ($r = -0.15$), indicating participants with high autistic traits were fixating less on the eye region. Second, in a crossover study, we investigated the interactive effects of naltrexone and oxytocin in 27 participants with ASD and 32 controls. In a preliminary analysis, we observed no effects for oxytocin, naltrexone or their combination on fixations to the eye region, however the difference between ASD and control groups replicated. Thus, although more research is needed to uncover the neural basis of social attention, our findings demonstrate how characteristics of gaze behavior in ASD can successfully be investigated in naturalistic experiments.

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Neuroticism associated with the activities in left ventrolateral prefrontal cortex and motor cortical area during emotional imagery task

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Keywords: Neuroticisim, fNIRS, prefrontal cortex

Neuroticism is one of the personality traits according to Big Five model associated with emotional regulation and social anxieties. Recently, it has also been associated with prefrontal-amygdala connectivity. Thus, the functions in the prefrontal cortex (PFC) are considered one of the key roles for neuroticism and anxiety disorders. However, it was still uncertain what are the functional roles of these neuroticism-associated neural systems dynamically. In this study, we hypothesized that the PFC including the neural system associated with neuroticism; and evaluated the brain activities during emotional imagery tasks using functional near-infrared spectroscopy (fNIRS).

In the experiments, we asked participants to imagine three types of emotions (happy, angry, and neutral) without any facial or verbal expressions. The imagination time was set to 41 s and it was repeated six times with 30s resting per an emotion type. The optodes (4×4×2) for fNIRS signals were placed as the bottom of optodes were positioned just above the eyebrows. The positions of each optode and anatomical landmarks were recorded by a 3D digitizer. Additionally, we calculated Spearman's correlation coefficients of neuroticism scores of Big Five inventory with both beta values of fNIRS signals evaluated by generalized linear model (GLM) and spatial activation patterns decomposed using principal component analysis (PCA).

As a result, we observed significant correlations in the left ventrolateral prefrontal cortex (VLPFC: BA 44, 45) and motor cortical area (BA 6) during the imagination of happy and angry emotions. Additionally, we found that two principal components related to brain activations around the left VLPFC and motor cortical area strongly correlated with neuroticism scores (rho = 0.5-0.8).

As a conclusion, we considered that the emotions were regulated by left PFC in a neuroticism-associated manner, which might be mediated through prefrontal-amygdala connectivity and/or mirror neuron system.

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The Regulation of Social Facilitation by Monoaminergic System

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Keywords: Social recognition, Social environment, Social behavior, Social facilitation, Monoaminergic system, ASD

It is well known that social environment affects to cognitive and behavioral properties. For example, the presence of conspecific facilitates an individual's performance (social facilitation: SF). SF is closely related to social recognition (SR). Impairment of SR is thought to cause for behavioral abnormalities observed in neuropsychological symptom such as autism spectrum disorders (ASD).

In order to study the regulation of SR, we examined SF using model mice. In this study, SF was analyzed from the elevation of locomotor activity in their home cage. The subject male mice were maintained in one side of the separate cage, which was separated by metal plate with slit. The locomotor activity was scored for 5 days using wheel running device in the home cage. At day 3-5, the other male mouse was represented into the other side of the separate cage as observer mouse. We found that the locomotor activity of WT's subject mice were elevated in the presence of observer mice (Pair) compared with the absence of observer mice (Solo). Pair / Solo ratio by the locomotor activity was 140% (SF index). We also observed that SF index was suppressed in STX1A KO, which was known as ASD model mice. It was reported that monoaminergic systems are disturbed in STX1A KO. We studied if monoaminergic systems relate to regulation of SF.

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Neural signature of disrupted sociality: Understanding the inter-brain neural relationship across the brains of socially interacting Shank2 mutant mice

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Keywords: Autism, Social interaction, Shank2, Inter brain synchrony, In-vivo electrophysiology, Social cognition

What happens in the brains of socially interacting individuals? This key question in social neuroscience has generated decades of research, especially from neuroscientists studying autism spectrum disorder(ASD). Patients diagnosed with ASD are often incapable of engaging in a typical social interaction and show a lack of social interest or motivation. Yet, the unique characteristics of the neural activities in ASD patients that may lead to this pronounced social deficit remain elusive. In this study, we explore the inter brain relationship between the brains of socially interacting mice, with a particular focus on inter brain synchrony or inter brain similarity. We conducted simultaneous in vivo electrophysiology recordings in the medial prefrontal cortex (mPFC) of freely socially interacting mice, a brain region that has been found to play an essential role in social behaviors. We employ two types of mice, Shank2 gene knockout mice (Shank2 KO), a well-established animal model of ASD and Shank2 wild type mice (Shank2 WT). We present behavioral findings, and results from single neuron neuronal correlates analysis, and local field potential analysis. Preliminary results suggest genotype-specific neural activities in the mPFC of socially interacting mice and decreased inter brain synchrony between two interacting ASD model mice.

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The power of music: Enhancing predictive ability in children with autism through music therapy

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Keywords: Autism, predictive processing, music

Music has been connected to autism spectrum disorder (ASD) since it was first described. Considering that music is regarded as a "social art" and many deficits in ASD are found in the social domain, beneficial effects of music therapy (MT) have long been assumed. However, its efficacy remains variable among individuals, and mechanisms of actions unexplored. To address these gaps, our study investigates whether children's understanding of musical components, such as predictability, and their preference for it (consonant versus dissonant musical endings), serves as a predictor of MT effectiveness. Here 21 children with ASD, aged 6-12, completed 12 sessions each of MT and play-based therapy (PT) in a randomized sequence. In pre- and post-therapy assessments, preference for expected musical endings alongside clinical outcomes including social communication, participation, family quality of life (FQoL), and symptom severity were evaluated. Initial analyses revealed no significant association between clinical outcomes and preference for consonant music at baseline. Interestingly, a non-significant increase in preference for consonant vs. dissonant music was observed after MT ($M = 0.85$) compared to baseline ($M = 7.85$), $t(38.08) = -1.15$, $p = .26$. Moreover, a trend was observed, indicating an association between children's baseline preference for consonant music and the improvement in FQoL after MT, $r = .46$, $p = .06$. These results are discussed in the context of the predictive processing theory of autism, as the effectiveness of MT may stem from inherent features of music, which evoke pleasure through systematically fulfilling or challenging predictions.

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Link Between Broad and Detailed Aspects of Social Perception in Children, Adolescents and Adults with Typical Development and with Autism Spectrum Disorders: An Eye-Tracking Study

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Keywords: Social perception, Broad and Detailed Aspects, Eye-tracking, Autism

Over the last 20 years, eye-tracking studies have allowed to quantified social perception abnormalities in autism spectrum disorders (ASD). Most studies used complex social stimuli, i.e, movies depicting characters in social interaction, which measure detailed aspects of social perception. Atypical gaze pattern in ASD has also been investigated using less complex stimuli, based on a preferential looking paradigm, consisting on silent videos presenting simultaneously social (children dancing) and geometric (fractals moving) motion, which measures broader aspects of social perception. Both types of paradigms have proof able to detect social perception abnormalities in ASD. However, the relationship between these two levels of social perception has not yet been explored. Therefore, the goal of this study was to investigate intra-individual correlation between different levels of social perception: broad social perception and detailed aspects of social perception. Therefore, we collected eye-tracking data from 124 individuals: 52 with ASD (44 males; age = 12.5 ± 6.6 y) and 72 typically developing (TD) individuals (49 males; age = 14.4 ± 6.6 y). All participants watched a preferential looking video, where number of fixations to social or geometric motion were obtained, and a video presenting scenes displaying social interactions, where number of fixations to the eyes of characters were obtained. Results showed a significant positive correlation between number of fixations to the eyes and number of fixations to social motion in both ASD (b=0.3, t(48)=2.2; p=0.03) and TD (b=0.3, t (68)=2.3; p=0.02) groups: participants who looked more to the eyes of characters while watching social scenes were those who looked more to the social motion when watching the preferential looking paradigm. Our results further validate the use of shorter and simpler eye-tracking paradigms, which may have substantial repercussion to investigating social perception processes in younger children, as well as in individuals with more severe autistic symptoms. Finally, validating the use of such stimuli can also allow multicentric and cross-cultural studies in ASD, that remained highly needed.

Session: 1. Poster Board: 62

Embodiment in Virtual Reality (VR) influences the neural processes of face gender categorization and improves empathy

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Keywords: Gender categorization, Virtual Reality, Empathy

Embodiment in Virtual Reality (VR) has been widely used to train empathy and reduce implicit gender bias. A critical underpinning of gender stereotypes and bias is categorical thinking towards women (or men), referred to as 'gender categorization'. This study utilizes ERP measures to explores the influence of embodiment in Virtual Reality (VR) on neural processes of face gender categorization and empathy. Using a mixed design, 68 male participants engaged in a 25-minute VR role-play game, randomly embodying either a male or female avatar. Pretest and posttest of Gender Implicit Association Tests (IAT) a significant shift in gender identity when embodying a female avatar, while male avatar embodiment had no significant effect. Female avatar embodiment increased empathy, as measured by the Interpersonal Reactivity Index (IRI) questionnaire, in the domains of Fantasy, Empathic Concern, and Perspective Taking, whereas male avatar embodiment only enhanced empathy in the Fantasy domain. The timing of the repetition suppression effect in the Frontal-Central lobe differed between avatars, occurring earlier with male avatar embodiment (N1 component, 120-140ms) and occurring later with female avatar embodiment (P3 component, 280-350ms). These findings suggest that opposite-sex embodiment promotes empathy and delays gender categorization, while same-sex embodiment has limited effects. VR embodiment holds potential for reduce gender stereotypes and bias by influencing gender identity, gender categorization, and empathy.

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Increased dyadic social interaction by lipopolysaccharide-induced inflammatory reactions in male but not female mice.

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Keywords: social behavior, sex difference, inflammation, depression, animal model

Depression is a major mental disorder. Accumulating evidence suggests that inflammatory processes are closely correlated to the pathophysiology of depression. Inflammatory responses are indexed by elevated systemic cytokines, such as IL-1β, IL-6, and TNF-α. Intraperitoneal injection of lipopolysaccharide (LPS) is known to cause inflammatory responses and is widely used in animal models of inflammatory depression. Despite the close relationship between social behavior and depression, how LPS-induced inflammatory responses affect social behavior remains unclear. Here, we examined the effects of inflammatory responses on social and non-social behavior in C57BL/6J mice after the intraperitoneal injection of LPS. By the immunological examinations with ELISA and flow cytometry, we found prominent increases of IL-1β, IL-6, and TNF-α and decreases of T cells, B cells, neutrophils, and monocytes. There was a sex difference in the baseline number of B cells, neutrophils, and monocytes. Through the behavioral assessments, we found that LPS-induced inflammatory responses increased contact time and decreased dyadic distance in familiar and unfamiliar males. Meanwhile, these differences were not found in female dyads. LPS injection caused decreased body weight, locomotor activities, and fecal outputs in an open-field test and decreased not only sucrose preference but also the overall number of licking in a sucrose preference task in both male and female mice. Our results suggest that social behavior is modulated by LPS-induced inflammatory responses in a sex-dependent manner. The increased contact time of dyadic interaction in male dyads could not be explained by weight loss or decreased locomotion, orofacial movements, and reward sensitivities because these results were also observed in female dyads. Our findings pave the way to understanding the relationship between immune responses and social behavior.

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Sex-Dependent Modulation of Neuronal Circuits in Object Recognition through pair bonding

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Keywords: Microtus ochrogaster, partner preference test, novel object recognition

In humans, it has been reported that opposite-sex bonding has been associated with positive effects on disease risk, cognitive function, attention, and memory. Translating this phenomenon to monogamous prairie voles, our study explores the impact of pair bonding on object cognition and delves into the intricate neural mechanisms underlying these effects. We have shown that pair bonding improves object cognition in monogamous prairie voles. However, the neural mechanism is still obscure. Using immunohistochemistry, we identified cfos-positive neurons during object recognition, comparing pair-bonded voles with opposite-sex and same-sex housed voles. Two-way ANOVA revealed no significant effects of housing partner or sex. However, heat maps generated using Spearman's rank correlation coefficients suggested a sex difference of effects of pair bonding on the number of activated neurons. In males, the pair bond group indicated a notably larger number of significant correlations compared to the cage mate group. Notably, the dentate gyrus (DG) demonstrated significantly correlations with prefrontal cortices including the infralimbic, prelimbic, and anterior cingulate (ACC) cortices in the pair bond group. Conversely, in females, pair bonding resulted in a reduction of significant correlations, with correlations observed only between the DG and the lateral septum, as well as the ACC and the paraventricular thalamic nucleus. These results suggest that pair bonding sex-dependently modulates the neural circuit for object recognition in prairie voles, shedding light on the intricate interplay between social behaviors and neural function.

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Pair bonding has sex-dependently an impact on neuronal circuits that respond to fear conditioning in monogamous prairie voles

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Keywords: c-fos, fear memory, sex difference, social buffering

The influence of social relationships on health is well-documented, with the presence of others playing a crucial role in mitigating the physiological stress response. Recent investigations have disclosed that oxytocin-mediated pair bonding effectively diminishes fear memory in monogamous prairie voles (Microtus ochrogaster). The administration of an oxytocin receptor antagonist, particularly prior to the occurrence of electrical foot shocks, abolishes the pair bonding-induced effect, implicating the involvement of an oxytocin signal in modulating fear memory. The aim of this study was to elucidate the underlying neuronal mechanisms of these phenomena by conducting a comparative analysis of the c-Fos-expressing neuron population following electric shock in prairie voles cohabiting with either opposite-sex partners (pair bond group) or same-sex conspecifics (cage mate group). Additionally, we explored potential sex differences in activated neural circuits.

In females, pair bonding exhibited a significant augmentation in the number of cFos-positive cells within the amygdalostriatal transition area (ASt), concomitant with a notable decrease in the dentate gyrus (DG). Conversely, males did not manifest significant alterations in these measures. Spearman's interregional correlation coefficients were subsequently computed within each group. Comparative analysis of mean correlation coefficients unveiled a significant augmentation in the bed nucleus of the stria terminalis (BNST) in females undergoing pair bonding, coupled with a diminution in the ASt and DG. Notably, males engaged in pair bonding demonstrated a substantial increase in mean correlation coefficient values within the anterior cingulate cortex and paraventricular hypothalamic nucleus. Our results suggest that pair bonding has an impact on neuronal activity in response to fear conditioning in a sex-specific manner.

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Sex differences in neural representations of social and nonsocial reward in the medial prefrontal cortex

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Keywords: social reward, medial prefrontal cortex, sex differences

The perception of social interactions as rewarding is necessary for appropriate social behavior. While progress has been made towards understanding the neural circuits underlying social behavior, those involved in social reward processing and whether they are shared with nonsocial rewards remains unknown. We developed a novel two choice (social-sucrose) operant assay to directly compare social and nonsocial reward-seeking. We also performed cellular resolution calcium imaging of medial prefrontal cortex (mPFC) neurons in both male (459 neurons, 9 mice) and female (570 neurons, 6 mice) mice while they completed the two choice assay across various internal states (water restriction and social isolation). We identified non-overlapping, sex- and state-dependent populations of social and nonsocial reward neurons. With water restriction, all mice showed increased sucrose reward-seeking and an increased proportion of sucrose reward responsive neurons. We tracked individual neurons and found that this increase was driven by the recruitment of previously latent mPFC neurons. Following social isolation, the proportion of social reward responsive neurons remained the same, but the amplitude of their responses varied in a sex-dependent manner. In particular, the amplitude increased in female mice and decreased in male mice after social isolation. This sex-dependent change was also evident in reward-seeking behavior, with female mice seeking fewer social rewards and male mice seeking more social rewards relative to sucrose rewards after social isolation. We optogenetically manipulated (excited and inhibited) mPFC neurons during the reward period of the two choice assay and found that it disrupted reward-seeking behavior across sexes. Thus, using a novel operant assay, we identified distinct and flexible neural representations of social and nonsocial reward in the mPFC that vary in a sex- and state-dependent manner and are essential for appropriate reward-seeking behavior.

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Simultaneous tracking of autonomic nervous activity and home cage behavior in mouse mothers during pregnancy to lactation

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Keywords: Electrocardiogram, Pregnancy, Parturition, Lactation, Long-term observation, Mouse, Maternal behavior, telemetry

The changes in female mammals are thought to involve dynamic changes in the autonomic nervous system. In human studies, it has shown that mothers and infants influence each other's autonomic nervous activity through their behaviors, suggesting an interaction between autonomic activity, mother's condition and mother-offspring relationship. Although temporal measurements of autonomic activity have been studied in humans, no studies have analyzed long-term changes. Mouse mothers can form social bonds with their pups, and they have a short period of pregnancy and lactation. Therefore, our laboratory established a method to implant telemetry into pregnant mice to record electrocardiogram (ECG) and simultaneously record home cage behavior. Our results showed that ECG could be stably recorded regardless of the mother's movement or parturition. The heart rate variability (HRV) based on ECG showed a gradual decrease in heart rate from pregnancy to lactation, followed by a sharp increase in sympathetic activity as the pups developed. Furthermore, the simultaneous recording of maternal behavior (e.g., crouching, licking/grooming) and general behavior (e.g., food intake, drinking) with ECG in the home cage enabled us to specify the ECG data while the mouse expressed a certain behavior, thereby revealing the characteristics of autonomic nervous activity during each behavior. Thus, our method allows us to investigate the interaction among three factors: autonomic activity, mother's behavior, and pup development, and to understand the characteristics and mechanisms of changes in autonomic nervous activity occurring in mothers from pregnancy to weaning.

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On the relationship between self-regulation problems in parents and their children: An ERP study

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Keywords: parenting, self-regulation, awareness of emotions, event-related potentias (ERPs), Go/No-Go

Previous research indicated that parenting styles may influence cognitive deficits and the occurrence of ADHD in children. The present event-related potential (ERP) study examined the relationship between parenting styles and executive functions as well as emotional awareness in their children. Participants were first-grade students of elementary schools (N = 119) and their parents (mothers = 103, fathers = 77). The study was conducted at two time points that were separated by several weeks. During the study, two behavioral tasks (Go/NoGo and BART), EEG recordings and several questionnaires were used. Children were assessed for their locus of control, emotional awareness, motivation to express negative emotions and anxiety symptoms. Parents were assessed for impulsivity, family emotional expression, and parenting styles. The results show that children with low executive attention abilities (indexed by high Reaction Time Variability) were characterized by lower P300 amplitude as well as by difficulties in inhibiting and responding adequately when compared to children with high executive attention. Children with low executive attention abilities were also characterized by lower emotional awareness and their mothers were more impulsive and implemented an authoritarian or uninvolved parenting style. Conclusions: Executive function difficulties are significantly related to deficits in emotion awareness. Parents' low awareness of their own emotions and difficulties in regulating emotions, manifested in the choice of an authoritarian or uninvolved parenting style, are related to deficits in executive functions and emotion regulation in their children. The discussion about the direction of these relationships requires further research.

Session: 1. Poster Board: 69

Investigating the role of oligodendrocytes in regulating pair bonding and the responses to loss in prairie voles

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Keywords: prairie vole, pair bonding, loss, grief, oligodendrocyte

Bonding and loss are fundamental human experiences that shape brain function and behavior. For most people, the severity of grief and its maladaptive effects subside over time via an understudied adaptive process. Socially monogamous prairie voles (Microtus ochrogaster) are a laboratory-amenable rodent species that forms pair bonds akin to human romantic relationships, making them ideal for studying the neurobiology of bonding and loss. Previously, we performed RNA sequencing of the vole nucleus accumbens and identified a putative role for myelination and oligodendrogenesis in pair bonding and loss adaptation. To determine if pair bonding induces cell genesis, for the first week of pairing, we supplied 5-Ethynyl-2 -deoxyuridine (EdU) in the drinking water of males in both opposite- and same-sex pairs. Then, to characterize how oligodendrocyte populations are affected by bond loss, we compared males that had cohabitated for a total of six weeks to those that had only cohabitated for two weeks followed by four weeks of separation. To delineate bond-specific changes, we compared pair-bonded opposite-sex paired males to their same-sex peer housed counterparts. We combined the EdU label with either Olig2, a cell-type specific oligodendrocyte marker, or ASPA, a marker found exclusively in mature oligodendrocytes. Using whole brain mapping, we found that pair bonding led to a brain-wide enhancement of newborn cells as indicated by increased EdU positive cells. This was particularly prominent in the infralimbic area, the anterior olfactory nucleus, striatum, pallidum, and the periventricular region. Animals separated from a pair bonded partner exhibited an intermediate phenotype in the nucleus accumbens possibly providing an additional indicator of loss adaptation. Ongoing work is quantifying the co-expression of EdU+/Olig2+ and EdU+/ASPA+ to delineate putative oligodendrocyte-mediated changes that underlie bonding and loss adaptation.

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Developmental onset of pair bonding behavior in prairie voles

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Keywords: development, pair bonding, behavioral plasticity

Socially monogamous prairie voles are widely known for their ability to form pair bonds between mating partners. Decades of research in prairie voles has helped to characterize the neurobiological mechanisms that enable adult mammalian pair bonding. Because of this adult-centric focus, we know comparatively less about the age during which prairie voles become capable of forming pair bonds, much less the neuroscience underlying this developmental behavioral plasticity. This study aimed to identify the age at which subadult voles become capable of pair bonding. We took three groups of females (juveniles [P20-23], periadolescents [P45-50], and adults [P60-63]) and co-housed them in pairs with age-matched males. After 48 hours of cohabitation, we tested subjects in a 3-hour partner preference test. We found that compared to adults, juveniles spent significantly less time huddling with their partner, but significantly more time huddling in general. Further, a preference for a partner was not apparent in juveniles but did emerge in periadolescents. Together these data suggest that female prairie voles become capable of pair bonding by periadolescence, highlighting that the transition between juvenile and periadolescent life stages may capture when pair bonding neural processes come online to support mature social behavior. These findings broaden our understanding of pair bonding behavior to include developmental onset and lay the groundwork for future studies on the protracted development of the monogamous brain.

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Social connectedness in the context of stress: role of endogenous opioids

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Keywords: social connectedness, social stress, opioids

Social motivation and bonding in non-human animals rely on and are modulated by opioid signalling. However, modulatory effects depend on motivational state with opioid blockade increasing social motivation in distressed animals and decreasing it in non-distressed animals (Løseth et al. 2014, Front. Behav. Neurosci.). Enhanced social motivation in context of stress is typically targeted towards familiar and trusted individuals and might reflect reliance on social support for allostatic regulation. Social support is theorized to be opioid dependent (Panksepp et al., 1978, Biol Psychiatry). In a recent meta-analysis of studies implicating opioids in human social connectedness, we found that naltrexone caused a slight overall decrease in connectedness in no-stress contexts (Løseth et al. 2023, PsyArXiv). Here, we investigated the effects of opioid blockade on connectedness in the context of stress in a pre-registered (osf.io/5k2wj) between-subject double-blind randomized placebo-controlled study. 129 pairs of real-life friends (65 female dyads, 258 participants total) received 50mg per-oral naltrexone (NAL, opioid antagonist) or placebo (PLA) and spent 1 hour in social isolation before a dyadic social stress task. During recovery, participants either interacted freely with their friend (social support) or were kept apart (non-support) during a 5-min recovery period. After a new separation of ~20 mins, participants were assigned to view an hour-long horror movie either together or alone. Results are preliminary. Social connectedness ratings (VAS 0-100, N = 192) were reduced by 1-hour isolation (mean reduction = -12, SE=1.1) in both drug groups (post-isolation mean PLA: 58.3, SE = 2.4, NAL: 52.9, SE = 2.4). The dyadic stress task increased connectedness in both drug groups (mean overall increase from post-isolation = 10.7, SE = 1.2, post-stress mean PLA: 68.9, SE = 2.4, NAL:64.1, SE = 2.5). Social support during recovery further enhanced connectedness (mean increase from post-stress = 11.2, SE = 1.7) in both drug groups (post-recovery mean PLA: 83.9, SE = 3.4, NAL: 77.4, SE = 3.5). As for the horror movie, a significant three-way interaction between drug, viewing condition and stage emerged ($F(2, 1124) = 6.1$, $p = .002$): Within the naltrexone group, connectedness decreased in participants watching alone (mean change: -14, SE=2.8), and increased in those watching together (mean change: 13, SE=1.3). In the placebo group, connectedness remained relatively stable in those watching alone (mean change: 3, SE = 1.7), and increased in those watching together (mean change: 9.5, SE = 2.6). Overall, naltrexone did not prevent feelings of social connectedness.

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Roles of the default mode network modulated by levels of the sense of agency during future thinking and autobiographical memory retrieval

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Keywords: future thinking, sense of agency, fMRI

Future thinking (FT) refers to an ability to project the self forward in time to pre-experience an event. Functional neuroimaging studies have demonstrated that the default mode network (DMN) contributes to both FT and autobiographical memory retrieval (AMR), and the memory-based simulation of future events is mediated by DMN shared between FT and AMR. However, little is known about how the neural representation in the DMN subsystems are modulated by levels of sense of agency (SoA) in memories referenced for simulating future events and for remembering past events. In the present fMRI study, we scanned healthy young adults during imagining future events simulated by and remembering past events from memories experienced in the virtual reality environment (Higher SoA: HS) or memories observed on the PC monitor (Lower SoA: LS). In univariate analysis for FT, the parahippocampal cortex (PHC) and ventral posterior inferior parietal lobule (vpIPL) in the medial temporal lobe (MTL) subsystem of DMN showed significantly greater activation during imagining future events simulated by the HS-related memories than the LS-related memories, whereas PHC activation in AMR significantly increased during remembering past events experienced in the HS-related memories compared to those in the LS-related memories. In MVPA for FT, successful and failed imagination of future events simulated by the HS-related memories were significantly classified by multivariate activity patterns in the Core system and MTL subsystem of DMN. MVPA for AMR revealed that multivariate activity patterns in the MTL and dorsomedial prefrontal cortex (dmPFC) subsystems of DMN significantly discriminated between the successful and failed remembering of past events from the HS-related memories. These findings suggest that the neural representation of the DMN subsystems in FT and AMR are modulated by levels of SoA in memories referenced for simulating future events and for remembering past events.

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Neurocomputational mechanisms of affected beliefs

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Keywords: belief formation, affect, motivation, social learning, fMRI, computational modeling

Self-beliefs, such as beliefs about our abilities, attractiveness, or personality, are under constant (re)evaluation depending on the feedback and information we receive from our surrounding world. However, feedback processing is not a passive process during which information is picked up in an objective manner, rather the idea prevails that belief formation is essentially biased and shaped by affective and motivational processes. In several studies, using the Learning-of-own-performance task (Müller-Pinzler et al., 2019, 2022), we approach the question of how humans arrive at these self-beliefs in the first place (study 1) and, once established, how these self-beliefs are revised in the face of conflicting evidence (study 2). Using computational modeling, functional neuroimaging and psychophysiological data, we show that the formation of self-beliefs is biased towards negative information and this bias is associated with the experience of affective states during belief formation. The results further suggest that individuals who update their beliefs more negatively, and experience stronger negative affect, process negative information more intensely than positive information as indicated by increased pupil dilation and neural activation within the insula and amygdala (study 3). Finally, in a clinical sample of persons diagnosed with major depression and healthy controls, we replicate the negativity bias by showing that both groups have similar patterns of negatively biased belief formation. Further, in the insula negatively biased updating was accompanied by stronger tracking of negative, but not positive, prediction errors with increasing symptom severity (study 4). Our findings provide support from healthy and clinical samples for the overall rationale of the formation of affected beliefs, that is, the notion that beliefs are fundamentally shaped by motivational biases as well as affective experiences during feedback processing.

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Transcendent thinking counteracts longitudinal effects of mid-adolescent exposure to community violence in the anterior cingulate cortex

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Keywords: longitudinal, brain development, adolescents, stress, social cognition

Exposure to community violence and crime (CVE) presents a significant social stress for low-SES urban youth, even for youth who do not participate. Adolescence is a period of extensive brain maturation, characterized by social sensitivity and emotional lability, that co-occurs with increased independence outside the home. Mid-adolescence is also a hallmark developmental stage when youths become inclined toward, and often motivated, to enrich their concrete, empathic, and context-specific interpretations of situations with abstract, systems-level considerations that transcend the current situation to address broader personal, ethical, and systems-level issues—an achievement here termed transcendent thinking.

Here, 55 healthy youth from low-SES urban communities in Los Angeles, with no history of delinquency (32 female; 27 Latinx, 28 East Asian), reported their CVE and underwent structural MRI first at age 14-18, and again two years later. At the start of the study, participants also discussed their feelings about 40 short documentaries about other teens' compelling situations in a 2-hour private interview.

Controlling for CVE and brain structure at the study's start, new CVE across the 2-year inter-scan interval was negatively associated with gray matter volume change in the anterior cingulate cortex (ACC), a region implicated in PTSD, anxiety and OCD, and across multiple other cortical and subcortical social-affective and physiological regulatory regions, even controlling for family SES (income/needs; education). Participants' transcendent thinking in the interview independently predicted positive change in the ACC, even with all relevant controls. Results are robust after bootstrapping.

Findings highlight the continued vulnerability of youth to community violence in the late-teen years, as well as the benefits of supporting teens' development of dispositions to reflect on the complex personal and systems-level implications and affordances of their civic landscape.

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Effects of a mixed mind-body and psychosocial intervention model on mental health indicators, prosociality and hearth rate variability. A study with a Venezuelan migrant population in Colombia.

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Keywords: Migration, mind-body strategies, psychosocial interventions, mental health, social skills

According to the International Organization for Migration (IOM) (2018), migration brings about several physical and psychological risks and consequences. Such impacts frequently result in conditions like post-traumatic stress disorder and depression, as migrants often face war, trauma, violence, and other perilous situations throughout their migration journey, including stressful encounters during resettlement in a new country (Um et al., 2020). This study investigates the effectiveness of a three-month intervention utilizing a mixed model based on mind-body (yoga and meditation) and psychosocial strategies, on psychological, physiological, and behavioral measures among 88 Venezuelan migrants in three Colombian cities (control = 39 and intervention = 48). Participants in the treatment group demonstrated significant improvements across various psychological measures, including reductions in depression and anxiety symptoms (p-val <0.001), enhancements in emotional and psychological well-being perception (p-val <0.001), and increased scores in compassion and social commitment, as well as positive body perception (p-val <0.001). Additionally, various Heart Rate Variability measures showed significant improvements compared to the control group (Respiratory Sinus Arrhythmia while sitting, Heart Period while standing, and Vagal Efficiency, p-val < 0.05) while significant reductions were observed in the control group (Respiratory Sinus Arrhythmia while standing, Heart period while standing and Vagal Efficiency, p-val < 0.05). These findings contribute to our understanding of effective strategies for supporting the mental health and social skills of migrant populations and emphasize the importance of targeted interventions in host countries. Future research should explore the long-term effects of the intervention and investigate potential moderators or mediators of treatment outcomes.

Propensity to revenge: a fNIRS study on forgiveness and dark factors of personality

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Keywords: fNIRS, ultimatum game, dictator game, forgiveness, revenge, dark factors

Revenge is an act of social behavior that is influenced by a complex set of factors. We are focusing our research on dark factors of personality (D) that refers to the general tendency to maximize one's individual utility — disregarding, accepting, or malevolently provoking disutility for others — accompanied by beliefs that serve as justifications. These factors may exert negative effects on forgiveness. To investigate the neurobiological basis of this proposition, 80 subjects with high vs. low D scores complete an ultimatum game (UG) and a dictator game (DG) with 40 trials for each game for every participant. Data collection is organized in the following way. In the UG, the participants accept or reject offers from the fair or unfair virtual opponents. After that, in the DG setting, they have the opportunity to forgive or take revenge on the unfair opponents by allocating fair or unfair amounts of money. During this task, the activity of the dorsolateral prefrontal cortex (DLPFC) is assessed via functional near-infrared spectroscopy (fNIRS). We hypothesize that the participants with high D scores exhibit significantly more revenge-seeking behavior than the individuals with low D scores, and this behavioral difference is reflected in the activation pattern of the left DLPFC, since its activity is associated with retaliation. Data collecting is ongoing, results will be presented during the conference.

An Integrative Model of Information Sharing Decisions: Semantic features, neural correlates, and affective experience

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Keywords: social sharing; information transmission; affect; social neuroscience

Decisions to share information can lead to widespread content dissemination, influencing critical societal outcomes. However, it is not clear how text features, brain responses, and affective experiences together predict these decisions. To bridge this gap, we developed an integrative framework based on appraisal theories of emotion. This approach examines how content attributes, brain reactions, and emotional experiences collectively influence sharing behavior. Focusing on health-related messaging, we analyzed content features using text analysis, brain activity collected via neuroimaging (fMRI) with 41 participants, and affective experience via subjective reports from 247 individuals. Using dimension reduction techniques, we identified key underlying components and assessed their distinct and combined contributions. Our findings revealed that present-tense and emotion-related text features, appraisal of information relevance and emotional impact, and reward-related brain responses each predicted population-level article sharing. When these predictors were combined, each added unique predictive validity, suggesting they each contribute distinct information (overall Rsq = 0.44, $p < .001$). Additional analyses indicated that social- and self-related brain responses show relationships with sharing that are mediated by differences in a specific pattern of text features including elevated use of personal pronouns and present tense language. In summary, our study highlights that brain responses, psychological experiences, and textual features each provide unique predictive insights into information sharing. This research illuminates the psychological and neural mechanisms behind information sharing and identifies specific patterns of content features that may trigger these mechanisms.

Session: 2. Poster Board: 3

Neural coordination underlying altruistic behavior in the social brain

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Keywords: Altruism, Prosociality, EEG, Connectivity, Social Brain

Prosocial behavior has been thought as a fundamental feature for the success of primate evolution. Humans frequently prefer sharing resources with another conspecific rather than keeping them for themselves, even when no benefit could explicitly arise from such decision. In certain contexts, nonhuman primates also display such prosocial preference. Among different kinds of prosocial behaviors, altruism is considered to be especially unique given that it describes behaviors benefitting another individual at one's own cost. Human neuroimaging studies have suggested that choices benefitting others are represented in the anterior cingulate cortex (ACC) and the orbitofrontal cortex (OFC). However, it remains unclear how ACC and OFC activations are coordinated or influenced by other key social brain areas in the human brain such as the temporo-parietal junction (TPJ) during altruistic behaviors. Here, we asked participants (n = 75) to make social decisions in which they choose to accept or reject a reward for themselves (Self) or for another individual (Other) while their neural activity was recorded using EEG. These rewards could be allocated for free (Costless condition) or after exerting a cognitive effort by completing an N-back memory test (Costly condition). Participants were slower and less prone to accept Other-benefitting compared to Self-benefitting offers in the Costly, but not in the Costless, condition, indicating that altruistic choices require balancing subjective costs and benefits. Crucially, we observed distinct coherence patterns across ACC, OFC and TPJ in Other-benefitting compared to Self-benefitting costly choices. These coordination patterns were also frequency-specific and showed different temporal characteristics depending on the coordinated pairs. Altogether, our findings suggest that altruistic decisions are likely shaped by coordinated computations between prefrontal cortical areas and the TPJ involved in decision-making and social cognition.

Insula and anterior prefrontal cortex mediates emotional and reasoning processes respectively in moral decision-making

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Keywords: decisiona-making, moral, emotion, reasoning

In moral decisions, emotional and reasoning systems compete and integrate to reach a final answer. Although preceding studies have identified some brain regions related to moral decision-making, few study managed to study emotional and reasoning processes independently as they are usually mixed in decisions. In the current study, we managed to construct single-factor-motivated moral decision-making tasks that are solely dependent on either emotional or reasoning system and investigated neural substrates with functional magnetic resonance imaging. Moral dilemmas were constructed with fictional characters deliberately designed to be aligned in either emotional or reasoning value, while differing in the other. Their values were quantified with Likert scale and the aligning design was verified in web survey. In the experiment, participants were asked to choose to save 1 person from each pair, so that each decision was based on only one value difference (emotional or reasoning condition). ‘Controls’ were pairs where one character is greatly higher in both emotional and utilitarian values, making them relatively easy. Results showed that insula demonstrated significantly higher activations in emotional conditions compared with reasoning and control conditions. On the other hand, anterior prefrontal cortex (AntPFC) showed higher activation only in reasoning but not control conditions. Furthermore, we noticed that that posterior cingulate cortex (PCC) and dorsolateral prefrontal cortex (DLPFC) were activated in both emotional and reasoning conditions but not in control condition. These results proved that insula and AntPFC mediates emotional and reasoning processes respectively in moral decision-making. They also implied potential higher functions of PCC and DLPFC in processing conflicts of emotional and reasoning system.

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Adaptation of the Carbon Emission Task to fMRI settings

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Keywords: decision-making, climate change, pro-environmental behaviour, carbon-emission task, fMRI

Reducing greenhouse gas emissions is a pressing societal concern. The Carbon Emission Task (CET) is a behavioral paradigm aimed at measuring climate action with real-life consequences (Berger & Wyss, 2021). In the CET task, participants make a series of choices between monetary rewards and reducing CO2 emissions.

We adapted the CET task for fMRI settings. First, we adjusted the design of the experiment by reducing the visual complexity of the trial. Furthermore, besides expanding the total number of decision trials we added baseline trials to control for the motor activity related to responding. Stimuli presentation time and inter-trial intervals were also adapted to maximize signal-to-noise ratio. To validate the CET, data from 160 healthy participants was collected.

On the behavioral level, we replicated the findings of the original study, showing that the proportion of climate-friendly choices depends on the size of monetary reward (negative relationship) and the level of CO2 emission (positive relationship).

At the neuronal level, we identified brain regions related to climate change decision-making: the left posterior cingulate gyrus (associated with self-related processing), the left anterior cingulate gyrus (associated with error detection and conflict processing), and the medial prefrontal cortex (related to value integration and cost-benefit assessment).

The study validates the utility of CET in neuroimaging settings and sheds light on the neural mechanisms behind climate-related decision-making. The task programmed in the Presentation software is publicly available (https://github.com/nencki-lobi/neurogrieg) for scientific use to stimulate further research on the brain basis of pro-environmental behavior.

Session: 2. Poster Board: 6

Change in the foraging strategies in freely moving rhesus monkey dyads

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Keywords: social, non-human primates, foraging behaviour

For animals that live in complex social groups, optimally adjusting foraging strategy based on the state of nearby conspecifics is a vital social cognitive skill. Previous studies suggested that the frontal areas play a role in foraging as well as social cognitive behaviour. However, due to technical limitations, most of such findings have been based on chair-seated monkeys performing highly structured tasks, and how well they generalize to more naturalistic behaviour remained unknown. To address this, we analysed data from the Playground Experiment, which utilised the wireless neural recordings techniques in freely moving animals while they engaged in naturalistic foraging behaviour in a controlled environment. Two rhesus macaques foraged for solid and liquid reward in a large enclosure (Exploration Room), which was equipped with 3 three types of foraging stations designed to inducerequiring different full-body actions for collecting food. On one wall, 2 touchscreen-based kiosk systems (XBIs) were mounted, providing liquid rewards upon touch. From the ceiling, 4 elastic strings (“branches”) hung, providing access to grapes when pulled down against resistance. On the floor, 6 litter piles (“patches”) were positioned across the room, which contained treats that monkeys had to search. Behavioural data were recorded using 4-6 cameras and analysed by combining FairMOT-based 2D action classification and keypoint tracking (DeepLabCut). Preliminary analysis showed that 1) in early sessions, monkeys explored all foraging stations, and 2) in later sessions, one monkey dominated monopolized the XBIs while the other foraged on patches. This supports our hypothesis that monkeys change their foraging strategy as the social context evolves, and provides a proof of concept that our setup can induce rich naturalistic foraging behaviours. Future analysis will include neural data from frontparietal areas to elucidate how decision processes integrate the information of where the reward sources and a foraging partner are.

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Effects of Interoceptive Brain Processing on Moral Decision-Making

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Keywords: Moral decision-making, interoception, EEG

Not harming others is considered widely as the most fundamental element of human morality. Harm aversions based on outcomes of an action and the reactions to the action itself are considered as utilitarianism and deontology, respectively. Here in this study, we used hypothetical moral dilemmas which capture the debate between individual rights and common good to investigate how interoceptive processing affect utilitarian and deontological moral decision-makings. Specifically, a neurophysiological measure called heartbeat-evoked potential (HEP), an averaged electrophysiological component from electroencephalogram (EEG), was used to index cardiac interoceptive processing. A total of 27 participants was asked to make utilitarian and deontological choices for personal and impersonal moral dilemmas (18 for each) while their EEG and electrocardiogram were being recorded. We found that the proportion of utilitarian choices were greater within impersonal moral dilemmas than personal ones (impersonal 73%, personal 59%). The differential HEPs between utilitarian and deontological moral judgments was observed in the right frontal electrodes between 314 and 446 milliseconds after the R-peaks especially right before making choices. However, no difference in HEPs was found between personal and impersonal moral dilemmas. The difference in HEP amplitude between deontological and utilitarian choices was not result from cardiac artifacts. Our findings reveal that the brain utilizes interoceptive information to make subsequent moral decisions.

Socially influenced preference revaluation: Insights from rat studies

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Keywords: social decision-making, preferences, translational neuroscience, rats

Social learning is crucial and adaptive in various social species as it enables individuals to acquire valuable information from others, facilitating transmission of knowledge within a community. Through a simple adaption in the widely used Social Transmission of Food Preference (STFP)-task, we obtained quantitative measurement about the degree of social influence on innate choices. First, test rats (TR) reveal a preference for one of two flavored food types in a non-social context. Subsequently, they are paired with a demonstrator which had recently been fed with TR's lesser preferred flavor. Following short social interaction, TRs preferences are scored again. It was shown, that TR are enhancing the intake of the demonstrated food, hinting to its re-evaluation by coupling with a social stimulus. This naturalistic set-up requires the cognitive ability to flexibly integrate socially cued information. To disentangle the neuronal basis of this behavior, we utilized rats transgenic for the Disrupted-in-schizophrenia1 (DISC1) protein, which is highly associated with disturbed dopamine signaling. Dopamine is a prominent candidate to fundamentally regulate the observed behavior through its intervention in reward processing, learning and subjective value. Through a battery of behavioral control tasks, we uncovered a distinctive disability in DISC1-rats to appropriately implement social information. We show that, while wildtype rats exhibited increased consumption of demonstrated flavor following social interaction, DISC1-rats failed to up-value socially cued food. Notably, this deficit was not attributed to impaired social exploration, hedonic coding, odor discrimination, or disruption in reward and reversal learning. Thus, the DISC1-induced phenotype in the adapted STFP may provide valuable insight into so far overlooked behavioral symptoms specific to DISC1's impact on social learning and preference revaluation, while leaving other behavioral key domains related to dopamine unaffected. In addition, these results yield the first steps toward unraveling neurobiological mechanisms underlying the valuation of other opinions in social learning.

Session: 2. Poster Board: 9

Neural Mechanisms Underlying the Enhanced Cooperation Induced by Multicultural Experience

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Keywords: fNIRS, hyperscanning, identities, multicultural experience, cooperation, public goods game, TPJ

Understanding the complexities of identity and international collaboration is crucial for unifying people with varied viewpoints, especially in an era when global issues require collaborative solutions. Despite the recognised significance of multicultural experiences in promoting cooperative behaviour, there is a research gap in understanding the exact neural underpinnings that support this effect. In this study, participants from both Hong Kong and Mainland China will be recruited and receive different identity manipulations. Afterward, they will form groups to play a public goods game while the temporoparietal junction (TPJ) activity is simultaneously measured. Our hypotheses include: (1) Multicultural subjects are expected to demonstrate a significantly higher cooperation rate compared to monocultural subjects. (2) Subjects with a shared identity are anticipated to exhibit a higher cooperation rate than those who activate different identities. (3) Multicultural experience is predicted to amplify the performance gap between subjects in the shared identity and different identity conditions due to identity-related deficits. (4) Neural activities in the TPJ of multicultural subjects are expected to be significantly higher compared to monocultural subjects. (5) The multicultural condition is expected to display higher interpersonal neural synchronization (INS) than the monocultural conditions. (6) Greater group INS is hypothesized to correlate with a higher cooperation rate. (7) Multicultural subjects are expected to demonstrate higher Global and Local Network Efficiency compared to the monocultural conditions. (8) The different identity condition is expected to show higher Local Network Efficiency than the shared identity condition.

Session: 2. Poster Board: 10

Neural signatures underlying dilemma moral judgment and non-dilemma moral evaluation

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Keywords: Moral decision-making; Dilemma moral judgment task; Non-dilemma moral evaluation task; Meta-analysis; Neuroimaging

People's moral decisions vary depending on different moral scenarios and questions. Differences in research approach to moral decision-making have led to several discrepancies in the taxonomies as well as in the neurobiological underpinnings. For example, dilemma moral judgment and non-dilemma moral evaluation tasks constitute two main types of moral decision-making tasks that may produce different neuropsychological consequences. However, little is known about whether dilemma moral judgment and non-dilemma moral evaluation tasks involve overlapping or distinct neural substrates. To address this issue, we quantitatively synthesized brain areas involved in moral decision-making based on neuroimaging studies investigating neural signatures associated with dilemma moral judgment tasks (21 studies; 28 contrasts; 240 foci; 678 subjects) and non-dilemma moral evaluation tasks (30 studies; 35 contrasts; 298 foci; 799 subjects). Activation likelihood estimate (ALE) analysis identified consistent involvement of the left dmPFC, right vmPFC, bilateral TPJ, left precuneus, right TP, and left OFC in both task processes. Contrast analyses showed that the left OFC, right vmPFC, and right TP were employed in the non-dilemma moral evaluation tasks, suggesting that value, emotion, and personal memory were implicated in non-dilemma moral evaluation tasks; the left dmPFC, bilateral TPJ, and right precuneus were recruited in the dilemma moral judgment tasks, suggesting cognitive conflicts, mentalizing, and self-reference were linked to dilemma moral judgment tasks. Together, these findings reveal that non-dilemma moral evaluation and dilemma moral judgment tasks involve common and distinct neural circuits and may provide a deeper understanding of the role of social cognition and emotion in moral judgment. Given the critical role of moral judgment in ethical behaviors and business decisions, our research may inform discussion about how individuals evaluate actions against moral values and norms.

Session: 2. Poster Board: 11

The formation of free-riders from mouse groups in a reward-threat conflict situation is related to their mPFC-BLA-NAc activity

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Keywords: Worker - Freerider problem, Social behavior, Neural oscillation, mPFC-BLA-NAc activity

This study examines the social behavioral dynamics of mice, focusing on the establishment and evolution of the division of labor in cohabiting groups and the corresponding neural mechanisms. The naturalistic foraging paradigm was used as follows: mice were faced with food limitations and had to approach a spider robot for their food supply. Neural activities in the medial prefrontal cortex (mPFC), nucleus accumbens (NAc), and basolateral amygdala (BLA) were monitored using the CBRAIN (Collective Brain Research through Activity Interaction Neuroplatform) telemetry system (Kim et al., Sci Adv, 2020). Despite all mice being capable of foraging, a behavioral division emerged under group conditions. Some mice, the 'actors', actively engaged in foraging, while the 'freeriders' relied on food obtained by others. Over time, the number of freeriders increased, and some actors began foraging more frequently. Neural oscillation analysis showed significant differences between these groups. Actors had higher beta frequency bursts (24 – 32 Hz) in the mPFC, NAc, and BLA during foraging than freeriders. Freeriders' beta bursts decreased over time, whereas actors' either remained constant or increased. Additionally, the beta-to-gamma (72 – 92 Hz) burst ratio was higher in actors than in freeriders during foraging. These findings indicate that distinct neural oscillatory patterns can differentiate behavioral roles in group dynamics. The study provides new insights into how mPFC, NAc, and BLA regulation are associated with social labor division in mice, suggesting that specific brain regions play key roles in the manifestation of these social behaviors.

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Possible Involvement of Familiarity in Collective Decision-making in Response to Visual Threat Signal in Medaka Fish

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Keywords: Collective decision-making, group decision-making, looming stimuli, familiarity, synchronous behavior, teleost fish

Social animals engage in collective decision-making to efficiently migrate, forage, or escape from predators. This study reveals that 6-fish groups of medaka fish, socially familiarized for a 1-month, collectively respond to visual looming stimuli (LS); LS mimics predator attack. We identified two group-level response patterns to LS: synchronized freezing or not. These patterns suggest a binary choice in a group response to the LS. Also, consistent behavioral response to the LS over multiple behavioral trials for a 3-day was observed, indicating stable group decision-making. Furthermore, we showed that synchronous freezing could be predicted by the maximum swimming speed among individuals during the LS presentation. If a group included at least one fast-moving individual (>7.5 cm/s), the group tended to freeze synchronously in response to the LS. Next, to investigate the role of individual behavior in group decisions, we swapped three members between the freezing and non-freezing (6-fish) groups. Right after replacement, the clear binary response patterns diminished, suggesting that social familiarization might be necessary for the synchronous response. To confirm the effect of social familiarization (reared in the same tank), we prepared groups with unfamiliar individuals and conducted continuous behavioral tests over varying familiarization periods (0, 2, and 4 weeks). We found that the number of freezing individuals tended to increase in a few groups over time, implying that social familiarity might increase information sharing and group conformity in response to visual threat signals. Expanding on the well-established studies of neural mechanisms in animal responses to LS, our research points to the impact of a fast-moving member's emergence and familiarity on individual response behaviors.

Session: 2. Poster Board: 13

Functional role of prediction in empathy for pain

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Keywords: empathy, prediction, facial expression, pain, EEG

There has been increasing evidence that prediction modulates emotion recognition. However, little is known about possible effects of prediction on empathy for others' pain. We addressed this issue by collecting self-report and electroencephalogram (EEG) measures of empathy induced by perceived painful versus neutral facial expressions. In a learning task participants made a prediction about the expression of the upcoming faces (painful/neutral) before perception of ing a painful or neutral face. We found that participants reported greater own unpleasantness and stronger intensity of others' pain following a painful (vs. non-painful) prediction. Our analyses of EEG signals during pain judgement on each face revealed that painful prediction significantly enhance the neural responses to painful (vs. neutral) faces at 200-470 ms over the fontal/central/parietal electrodes but suppressed the neural responses to painful (vs. neutral) faces at 150-200 ms and 470-670 ms. These results provide evidence for modulations of multiple processes involved in by prediction of others' pain.

Do we empathize humanoid robots and humans in the same way?

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Keywords: Empathy, Human-humanoid robot, Ventral lateral prefrontal cortex, fMRI, EEG

Humanoid robots have been designed to look more and more like humans to meet social demands. How does the brain empathize humanoid robots who look the same as but are essentially different from humans? To address this issue, we examined subjective feelings, electrophysiological activities, and functional MRI signals during perception of painful and neutral expressions of faces that were recognized as patients or humanoid robots. We found that healthy adults reported deceased feelings of understanding and sharing of humanoid robots' compared to patients' pain. Moreover, humanoid robot (vs. patient) identities reduced long-latency electrophysiological responses and blood oxygenation level–dependent signals in the left temporoparietal junction and anterior insula to painful (vs. neutral) expressions. Furthermore, we showed evidence that humanoid robot identities inhibited a causal input from the right ventral lateral prefrontal cortex to the left temporoparietal junction, contrasting the opposite effect produced by patient identities. These results suggest that humanoid robot (vs. patient) identities decrease both affective and cognitive responses to perceived pain in others. Our findings provide a neurocognitive basis for understanding human interactions with humanoid robots.

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Individual Differences in Neurophysiological Correlates of Moral Transgression

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Keywords: Moral, Guilt, ERPs, fMRI

Humans perceive and judge an action as morally right or wrong based on their subjective experiences. How this individual variability is displayed through neural representations remained intriguing. Therefore, we designed a moral-action mental stimulation task, where participants are required to view a series of actions and mentally stimulate themselves as the agents of moral and immoral behaviors under EEG and MRI scanner, respectively (N=31). Although no differences in early ERP component (error-related negativity, ERN) were spotted among scenarios, individual differences in guilt-proneness successfully predicted subjects' ERN amplitude. Furthermore, later components displayed larger negativity in immoral scenarios. Subject's activity in the anterior cingulate cortex correlates with both their late negativity (LN) amplitude and self-reported guilt rating in immoral trials. Activities in the amygdala, ventromedial prefrontal cortex, and temporal parietal junction are also correlated with one's LN amplitude. Supporting the moral dynamic framework, our results displayed individual variability in moral judgments, suggesting that our subjective feelings of wrongness can impact our brain activity in moral processing.

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Disentangling the physiological and cognitive pathways of fear and anxiety

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Keywords: fMRI, fear, anxiety, VR, Cognitive reappraisal

Despite sustained investment in the development of new treatments for anxiety and stress-related disorders, there has been a lack of any significant progress in the past few decades. This stagnation may be due to a flawed framework for understanding anxiety. Specifically, the view of a single “fear circuit” may be misleading, in that physiological responses to threat and the subjective experience of fear could be two distinct and dissociable processes. Our aim is to disentangle the pathways involved in the automatic, physiological response to fearful experiences, and the conscious, cognitively-guided mechanism of fear processing in humans. We recorded physiological and behavioral measures and subjective fear reports, while participants explored fear-inducing virtual reality (VR) environments we designed. Each environment was explored twice – first naïvely, then a second time following an additional piece of verbal information, aimed at manipulating the subjective experience and enabling cognitive reappraisal. We then scanned participants in a 7T fMRI scanner, exposing them to videos from their VR experience, as well as other short fearful video clips – presented twice, in a similar manner to the VR, enabling cognitive reappraisal. Our preliminary results show a decrease in reported fear level as well as physiological changes between the two VR sessions. Our goal is to build an individualized fear-response profile that will include physiological and behavioral responses, along with brain imaging. This will highlight individual differences in physiological vs. cognitive fear responses, advancing diagnosis and targeted treatments for anxiety disorders.

Session: 2. Poster Board: 17

Brain Responses to Emotional Climate Change Stories

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Keywords: fMRI, climate change, emotions

There is a growing interest in climate emotions, as they are crucial in shaping how we respond to climate change. However, climate emotions are mostly examined through self-report measures, which are prone to social desirability bias. In this study, we used functional magnetic resonance imaging (fMRI) to investigate the underlying brain correlates of the emotional experience of climate change.

Specifically, we examined brain responses elicited by a set of standardized, validated emotional stimuli related to climate change. We used Emotional Climate Change Stories to induce anger, hope, or a neutral state in 160 healthy adults. While reading these stories, participants rated their emotional experience on valence and arousal scales.

We observed that emotionally charged stories were equally arousing, however angry stories were considered as most negative and hopeful stories - as most positive.

Brain regions involved specifically in the processing of emotional climate change narratives were identified. We found that in comparison to reading neutral stories, emotional stories were related to stronger activations in the left precuneus, left angular gyrus, posterior cingulate gyrus, caudate and superior frontal gyrus as well as bilateral temporal gyrus. Moreover, we found that climate anger and climate hope were associated with different brain activity patterns: medial prefrontal cortex and the caudate were more active when reading angry stories, and the occipital pole - when reading hopeful stories.

To the best of our knowledge, the current study is the first attempt to use advanced neuroimaging techniques to investigate the specific emotions related to climate change.

Ventromedial prefrontal neurons represent self-states shaped by vicarious fear in mice

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Keywords: empathy, observational fear, prefrontal cortex

Perception of fear induced by others in danger elicits complex vicarious fear responses. In rodents, observing a conspecific receive aversive stimuli leads to escape and freezing behaviors. It remains unclear how these behavioral self-states in response to others in fear are neurophysiologically represented. In this study, we explored the function and neural representation of neurons in ventromedial prefrontal cortex (vmPFC), an essential site for empathy, in an observational fear (OF) paradigm using male mice. To objectively classify the complex behaviors during OF, we employed DeepLabCut with dimension reduction clustering and identified eight types of stereotypic behaviors. Optogenetic inhibition of the vmPFC specifically disrupted OF-induced escape behavior, but not freezing behavior. In vivo Ca2+ imaging revealed that both stereotypic behaviors and freezing could be decoded from vmPFC neuronal activities. We identified two distinct neural subpopulations that are activated and suppressed when observing a demonstrator receiving foot shocks (other-shock). Neural activities of other-shock activated and suppressed neurons were negatively and positively correlated with self-freezing, respectively, revealing a mixed neural representation of other- and self-states in vmPFC neurons. By inhibiting the input from the anterior cingulate cortex (ACC) or basolateral amygdala (BLA) to the vmPFC during Ca2+ imaging, we found that the representation of the self-state in the other-shock activated and suppressed neurons required neural inputs from the ACC-vmPFC and BLA-vmPFC, respectively. Optogenetic inhibition of ACC/BLA -vmPFC accelerated escape behavior. Our study suggests that mixed population coding in vmPFC neurons represents self-states that are shaped by the other-state to elicit OF-induced escape behavior.

Selective inhibition of oxytocin receptor expressing neurons in anterior cingulate cortex disrupts consoling in male and female prairie voles.

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Keywords: empathy, prairie vole, oxytocin, consoling

Consolation, or comforting physical contact directed toward a distressed party, is an empathy-like response observed across species. Monogamous prairie voles reliably express consolation, in the form of allogrooming, towards their partner in distress. Consolation induces activity in anterior cingulate cortex (ACC) and oxytocin receptor (OXTR) antagonist in ACC ablated consoling. The ACC is also implicated in empathy in humans, suggesting conserved mechanisms from rodents to humans. Here, we first used DREADDs to inhibit general activity in the ACC. Voles of both sexes received control (AAV8-hSyn-mCherry; N=11) or inhibitory DREADD (AAV8-hSyn-hm4di-mCherry; N=11) virus bilaterally to ACC and later paired with an opposite-sex partner. Subjects underwent a multi-day consolation test where on subsequent days their partner was either separated for 30 min or separated and given mild footshocks (30 min: 5x, 0.8mA, 0.5s) before reunion. Subjects received 3mg/kg injections of CNO 30 min prior to reunion and allogrooming during the reunion was scored. Control animals displayed increased allogrooming towards their partner after the mild footshock compared to separated only ($p < 0.01$). Voles expressing inhibitory DREADDs failed to increase allogrooming in response to partner distress ($p > 0.05$) and ex-vivo slice electrophysiology revealed that CNO application induced membrane hyperpolarization in cells expressing hm4di. Next, in situ hybridization showed that OXTRs localize to glutamatergic, not GABAergic cells in layers 5 and 6 of vole ACC. Finally, Oxtr-P2A-Cre voles were generated using CRISPR/ Cas9 to allow selective manipulation of OXTR-containing cells. Male and female voles received a Cre-dependent control (AAV8-hSyn-DIO-mCherry; N=11 per sex) or inhibitory DREADD (AAV8-hSyn-DIO-hm4di-mCherry; N=11 per sex) virus bilaterally in ACC. Subjects were paired with an opposite-sex partner and underwent the consoling test with CNO administration. Control animals increased allogrooming in response to partner distress ($p < .05$). Chemogenomic inhibition of ACC ^Oxtr cells disrupted distress-induced allogrooming in both sexes ($p > 0.05$). Future experiments will utilize Oxtr-Cre voles for visualization and manipulation of ACC ^Oxtr circuits involved in rodent empathy-like behavior.

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Imminence of predator threat detected through the accessory olfactory system in mice

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Keywords: Predator defensive behavior, emotion, olfaction, mice

Animals have the innate ability to select optimal defensive behaviors with an appropriate intensity in response to predator threat in specific contexts. Such innate behavioral decisions are thought to be computed in the medial hypothalamic nuclei that contain neural populations directly controlling defensive behaviors. The sensory organ of the accessory olfactory system, the vomeronasal organ (VNO), is one of the major sensory channels through which predator cues are detected. The ascending inputs from the VNO reach to the medial hypothalamic nuclei, especially to the ventromedial hypothalamus (VMH), via the medial amygdala and bed nucleus of the stria terminalis. In this study, we show that cat saliva contains predator cues that signal imminence of predator threat and regulate the robustness of freezing behavior through the VNO in mice. Cat saliva activates neurons expressing the V2R-A4 subfamily of sensory receptors, suggesting the existence of specific receptor groups responsible for freezing behavior induced by the predator cues. The number of VNO neurons activated by cat saliva correlates with the freshness of saliva and the intensity of freezing behavior, while the downstream neurons in the accessory olfactory bulb (AOB) and defensive behavioral circuit are quantitatively equally activated by fresh and old saliva. Strikingly, however, the number of VMH neurons activated by fresh saliva positively correlates with the intensity of freezing behavior, whereas no such correlation was observed with neurons activated by old saliva. Detailed spatial analysis of the fresh and old saliva-responding neurons revealed a neuronal population within the VMH that is more sensitive to fresh saliva than old saliva. Taken together, this study demonstrates that predator cues differentially activate the sensory-to-hypothalamus defensive behavioral pathway over time to properly modulate behavioral outputs in accordance with the imminence of predator threat.

Session: 2. Poster Board: 21

Functional connectivity in emotional ambiguity processing: a multimodality perspective and clinical implication.

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Keywords: Amygdala, Medial prefrontal cortex, Emotion, Ambiguity, fMRI, EEG, Neuropsychiatry

Understanding and interpreting subtle emotions conveyed through facial expressions is crucial for effective social communication. This process involves the interplay of bottom-up and top-down processes, primarily engaging the amygdala and prefrontal cortex (Sun et al., Translational Psychiatry, 2023). Here, we applied multimodal connectivity analysis to achieve a circuit-level understanding of neural information transmission pathways underlying ambiguous emotion recognition and the consequences of malfunction in neuropsychiatric disorders. An emotional discrimination task using morphed fearful-happy emotions was conducted among 90 college students, 202 neuropsychiatry patients, and 71 age-matched controls. Through fMRI, we examined the functional and effective connectivity of the amygdala-PFC network in emotional ambiguity processing and its correlation with behavior in normal individuals (n=19). We utilized two methods, PPI and DCM, to assess the strength and direction of connectivity between the amygdala, dmPFC, and vmPFC. Our findings revealed that the dmPFC modulates the amygdala during ambiguity resolution, and the strength of dmPFC-amygdala connectivity positively correlated with sensitivity to ambiguity. Using EEG, we investigated cortical connectivity through cross-channel coherence, cross-frequency coupling, and source connectivity. We found that parietal-frontal coherence and parietal delta-alpha oscillatory coupling encode emotional ambiguity (n=23). EEG source connectivity also showed top-down regulation by the dmPFC, consistent with the DCM results. Additionally, we examined deficits in emotion and ambiguity processing among five groups of neuropsychiatry patients, including Schizophrenia (SCZ, n=43), ASD (n=52), ADHD (n=36), Anxiety (n=38), and Depression (n=33). Our behavioral results indicated reduced sensitivity to emotional intensity in SCZ, ASD, and ADHD, as well as reduced sensitivity to ambiguity in SCZ, ASD, Anxiety, and Depression compared to Neurotypicals. Furthermore, we estimated the connectivity strength of the amygdala-PFC network among patients using a predictive model derived from fMRI participants based on the positive correlation between dmPFC-amygdala and ambiguity. Our results showed enhanced dmPFC-amygdala connectivity in SCZ but decreased connectivity in Depression. These findings have provided clinical guidance to improve social abilities among psychiatry patients based on the nuanced understanding of the delicate dmPFC-amygdala circuit.

Session: 2. Poster Board: 22

Inhibitory parvalbumin neurons in the insular cortex process the information of social behavior

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Keywords: Empathy, Calcium imaging, DREADD

Social behavior is critical for social animals, including humans. Although there are significant individual differences in social behaviors, reduced sociability is one of the features of autism spectrum disorders (ASDs). It has been reported that inhibitory neuron marker proteins were slightly decreased in autistic brains, suggesting that the inhibitory neurons are important for social behavior. However, the neural mechanisms of inhibitory modulation in social behavior remain unclear. Recently, our laboratory reported that the information on social interaction was encoded in the neural ensembles named “Social Cells” in Insular Cortex (IC) pyramidal neurons of mice [Miura et al., 2020], suggesting that IC is one of the critical brain regions for social behavior. From this point of view, we investigated the activities of inhibitory parvalbumin (PV)-expressing interneurons in the IC during social behavior of mice. For neural activity analysis, we injected the AAV-syn-flex-GCaMP6f viral vector into the IC of PV-cre mice and recorded cellular activities of the PV+ neurons by microendoscopic calcium imaging. As a result, 11.7% of PV interneurons were activated during social interaction in the home cage test, suggesting that social behavior information is encoded in the neural ensembles of PV interneurons in the IC. Furthermore, we analyzed the activities of PV+ neurons during social or object interaction in a linear chamber. As a result, 7.0% of PV neurons were activated by the social interaction and 2.6% were activated by the object interaction. Next, we examined the activities of PV+ interneurons in interaction with forced swim stressed conspecifics and found that mice show higher interaction duration with stressed conspecifics than non-stressed conspecifics and more PV+ neurons were activated by interaction with stressed mice, suggesting that some PV+ neurons encode emotional information of other conspecifics. Finally, we suppressed the PV+ neural activities by inhibitory DREADD receptor hM4Di and found that the ratio of social interaction with familiar mice was slightly increased, and social interaction duration against stressed mice were decreased by suppression of PV+ neurons. Taken together, our study indicates that IC inhibitory interneurons encode social information and modulate social behavior.

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A genome-wide association study for subjective well-being in Japanese populations

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Keywords: Subjective well-being, GWAS, Culture

Subjective well-being (SWB) encompasses an individual's cognitive evaluations of life, the experience of positive emotions, and the absence of negative emotions. In recent years, significant interest has emerged in exploring genetic influences on SWB. Okbay et al. (2016) conducted a large-scale genome-wide association study (GWAS) using European population datasets and identified three polymorphisms associated with SWB. However, due to geographical variations in allele distribution and gene-environment interactions, further investigations are necessary to generalize these findings. Indeed, Kim et al. (2022) discovered three novel polymorphisms linked to SWB using samples from Korean populations. To deepen our understanding of genetic influences on SWB across different populations, we conducted a GWAS involving over 3000 Japanese participants. These participants completed questionnaires that included two SWB measures: life satisfaction and subjective happiness. We identified a novel polymorphism (rs35179066) associated with SWB. Additionally, among the three polymorphisms identified by Kim et al. (2022), two (rs61461200 and rs2293171) exhibited significant effects on SWB in our study, indicating a shared genetic basis for SWB in East Asian populations.

Session: 2. Poster Board: 24

Avatar versus human in pain: effects of state empathy on socially induced hypoalgesia using immersive virtual reality

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Keywords: Observation, Social, Learning, Empathy, Virtual reality, Pain, Placebo, electroencephalography (EEG), Neuroscience

Observing another person experiencing pain reduction from a treatment influences one's placebo responses to the same treatment. We determined the effects of state empathy on socially induced hypoalgesia using virtual reality (VR) with a human versus avatar demonstrator to intentionally manipulate empathic responses in observers. We used baseline peak alpha frequency (PAF) to predict socially induced placebo effects.

Participants observed a human or an avatar demonstrator experiencing pain changes with placebo versus control conditions in VR and non-VR settings. We measured their state empathy ratings for the demonstrator's pain intensity and pain unpleasantness sensations. Subsequently, participants underwent the same treatments seen during observation but with identical thermal intensities to test for placebo effects. Baseline PAF was measured as a predictor of placebo effects.

Independent of VR and non-VR settings, observation increased state empathy for pain intensity and unpleasantness. However, observation of the human demonstrator induced greater empathy compared to the avatar. Observation subsequently induced significant placebo effects for pain intensity and pain unpleasantness in VR and non-VR, with larger placebo effects in non-VR. Demonstrator-type elicited different effects on placebo hypoalgesia depending on the VR setting. Within VR, placebo hypoalgesia was greater with the avatar compared to the human demonstrator, while the opposite trend was seen within non-VR. Cognitive state empathy mediated the relationship between demonstrator-type and placebo effects. Finally, faster PAF in somatosensory and frontal regions predicted greater placebo effects.

These findings may hold clinical relevance with the perspective of customizing VR and social learning interventions tailored to patients' needs.

Session: 2. Poster Board: 25

Involvement of Anterior Cingulate Cortex in emotional contagion in mice, measured using functional Ultrasound Imaging

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Keywords: emotional contagion, functional ultrasound imaging, mice, anterior cingulate cortex

We often feel distress when witnessing another individual in pain. The emotional state of others eliciting a similar state in the observer is defined as ‘emotional contagion’. This is observed in humans and other species, including rodents (Carrillo et al., 2019). Human fMRI studies identified the anterior cingulate cortex (ACC) as a key region activated both by our own emotional states and by observing similar emotions in others (Lamm et al., 2011). Rodent experiments show individual neurons in the ACC to be both activated by the self-experience of pain and while witnessing a conspecific in pain (Carrillo et al., 2019). General inhibition of the ACC has been found to reduce emotional contagion, suggesting a causal role of the ACC in this processes. To gain further insight into the evolution of the mechanism underlying transfer of distress and to understand how conserved this is across rodents and humans, comparison of rodent and human data using the same measure of brain activity is needed. Functional Ultrasound Imaging (fUSI) is a breakthrough modality that provides a measure comparable to human fMRI, by recording local changes in cerebral blood volume induced by neural activity. Here, by imaging a mouse witnessing another receiving a shock, we show that fUSI can measure ACC activity during distress transfer in mice. ACC was activated by foot shock observation, but not during fear memory recall. Beyond the ACC, we additionally observed a similar activation pattern in the retrosplenial cortex. These findings demonstrate the usability of fUSI in reproducing responses more directly comparable to human fMRI (Lamm et al., 2011). Future steps include using the potentially wide field of view of fUSI to record from more brain regions and compare the whole circuit, and the implementation of functional connectivity analyses similar to those used in human fMRI. Finally, combining fUSI with neurostimulation could help test the necessity of these functional connectivity maps.

Session: 2. Poster Board: 26

Secondary teachers' neural and heart-rate dynamics while evaluating their own students' versus other students' academic work

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Keywords: education, emotion, social cognition, fMRI, psychophysiology

Classroom teaching, when done well, is inherently deeply socially and emotionally skilled work, especially in low-SES urban secondary school settings. Effective teachers in these settings build strong relationships with their students and leverage their understanding of students' cognitive and psychosocial assets and histories to support their academic learning and personal development. Secondary teaching is therefore a unique authentic context in which to study expertise in positive social-affective interpersonal processes.

Here, 35 urban public secondary teachers in the Los Angeles area, identified as highly effective by their administrators, underwent fMRI and simultaneous pulse oximetry recording as they graded their own and other students' assignments, matched for complexity, accuracy, and length. Despite awarding similar grades across conditions, when grading their own students, participants showed 1) increased activation of right executive control network regions, involved in effortful top-down regulation; 2) increased activation of salience network regions, involved in emotion processing; and 3) decreased heart rate deceleration (HRD), an automatic cognitive orienting response that indexes outward attention and decreases during internally focused reflection, such as when considering social context.

These findings together suggest that expert teachers leverage social-affective processing—possibly their deep familiarity with their students—as they work, even when their students are not present. In support of this interpretation, teachers with more years of experience showed a greater neural effect. These findings hold important implications for teachers' professional development and training, and contribute to knowledge of social processing in an authentic, specialized context.

Session: 2. Poster Board: 27

Development of a system enabling a detailed behavioral tracking during the naturalistic communication among animals

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Keywords: direct communication, attention, songbird, motion tracking, behavioral neuroscience

Understanding animal behavior is indispensable in the realm of behavioral neuroscience. A key challenge in this field is the analysis of behavior during the naturalistic communication. Despite many studies uncovered the fundamental roles of behavioral responses during communications, the detailed aspects of these behaviors within such process remain poorly understood. This deficiency primary arises from the absence of sophisticated tools for analyzing intricate behaviors and the attention of subjects in naturalistic, free-moving conditions. In this study, we introduce a high-precision system for behavior analysis using a marker-based motion capture technique. Employing the color markers and a novel algorithm including the color feature extraction and motion tracking techniques, this system accurately tracks the marker and body location of freely moving subjects across environments and individuals and is applicable to multiple subjects during social interaction. With this system, we tracked the body location and head direction of zebra finches and quantitatively analyzed behaviors of zebra finches in response to various stimuli, including male versus female, live versus virtual signal, and assessed their changes in individual discrimination or in the process of learning. Our analysis revealed variations in the use of right and left eyes, as well as the duration of sight, among the signals presented. Additionally, the behavioral analysis of directly interacting birds revealed more naturalistic aspects of social interactions. This system provides an efficient and easy-to-use tool for advanced behavioral analysis in small animals, enabling an objective method to deduce their focus of attention. Moreover, our system provides an objective mean to evaluate their cognition of communicative signals and to analyze the involved neural mechanisms.

Session: 2. Poster Board: 28

Effects of group-based operant task experience on dominance hierarchy in male mice.

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Keywords: operant learning, social interaction, group behavior

Dominance hierarchy in a same-sex group of mice influences social interaction within a group. To assess the effect of task excution on the establishment of social rank within a group, we have developed “tag-of-war task", which enabled a group of mice to perform an operant task together. A group of 3 mice were placed into the start area of a rectangle open field, which was separated into two areas by a transparent Plexiglas guillotine door. Three ropes were sticked in the holes on the door and mice were trained to pull them out. After all ropes were pulled out, the door was opened and mice could explore the area behind the door (reward area) freely. Thirty-six (12 groups) adult male ICR/Jcl mice were used. Six groups were assigned to perform the task once a day for 11 days (task group) and the remaining not to perform (no-task group). In addition to the tag-of-war task, they underwent tube test to determine social rank in a group.

As a result, task experiences promoted rank difference in task engagement; subordinate individuals performed more tasks. Moreover, task experiences promoted more frequent entrance to the reward area in subordinates, suggesting that dominants chased the subordinates out from the area. These results indicate that experience of operant task in a group promotes establishment of social rank within a group. Supported by KAKENHI 22H01099 to MN.

Session: 2. Poster Board: 29

Socially Induced Placebo Effects Are Blocked by Naloxone - A Mixed Experimental Approach

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Keywords: Social Learning, Placebo analgesia, endogenous opioids

Recent studies indicate that endogenous opioids (MOPRs) regulate social threat learning, placebo analgesia, and empathy. The goal of this study was to determine the role of MOPRs in socially induced placebo analgesia using intra-nasal administration of naloxone. We conducted a study in 68 healthy participants with equal number of males and females aged 32 +/- 10.8 years using a previously published socially induced placebo manipulation paradigm. Each participant observed and then received a placebo and control cream sequentially while being tested for pain. We anticipated that, through observation of the demonstrator, study participants would form behavioral analgesia. This was a 2 (group: naloxone vs. saline) X 2 (condition: placebo vs. control) double-blind mixed experimental design with group as the between-subjects factor and condition as the within-subjects factor. Each participant was randomly assigned to either naloxone or saline. Participants who were randomized to naloxone received 8 mg naloxone (Narcan nasal spray). We found a main effect of treatment whereby those in the saline group had greater socially induced placebo effects (6.4 +/- 4.8; $F(1,804.04)=6.3$, $p=0.012$) as compared to those who received naloxone who showed no placebo effects (-0.1 +/- 5.3). These effects were independent of sex (no main or interaction effects). These findings extended upon prior results from our lab showing that mentalizing processes mediate social induced analgesia with changes that were paralleled in the temporoparietal junctions. Herein, we showed for the first time that MOPRs are involved in socially induced placebo effects opening new research avenues in social neuroscience.

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Implicit racial bias moderates the impact of self-reported race/ethnicity on socially induced placebo analgesic effects.

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Keywords: social learning, race, ethnicity, implicit bias, placebo effects, pain

Social learning influences placebo analgesia. Self-reported race/ethnicity and participant-experimenter race/ethnicity concordance have a significant impact on the placebo hypoalgesia, but no studies examined racial bias mechanisms underlying socially induced placebo effects.
We examined the impact of self-reported race/ethnicity, participant-experimenter race concordance, and racial implicit bias on the placebo analgesia induced by social learning and explored the potential markers. From three different studies, 116 healthy participants went through a social learning paradigm where they observed a demonstrator experiencing pain under control and “analgesic treatment” conditions followed by a self-experience phase. The implicit racial bias was measured with the Implicit Association Test (IAT). For this multi-study project, we used a general linear model to examine the effects of race/ethnicity measurements on the placebo effects induced by social learning, and the mediation/moderation approach to test the IAT effect.
We found no main effect of race measurements. However, we observed an interaction effect of race and race concordance on placebo effects in White (W) and Asian (A) participants. When the race was not concordant, the A participants had greater placebo effects than W participants. Additionally, the higher placebo effects in A were moderated by an implicit positive bias towards W people. When there was race concordance, W and A had similar magnitude of placebo effects with no racial bias moderation.
We had demonstrated an impact of race/ethnicity on conditioned placebo effects. Herein, we showed that the racial influence is modulated by implicit racial bias, at least in W and A participants indicating that examining the mere direct effect of race is not enough to grasp its complexity in the context of placebo effects.

Session: 2. Poster Board: 31

Pre-registration: Endogenous opioid modulation of threat and safety learning in healthy humans

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Keywords: mu-opioids, naltrexone, threat and safety learning, anxiety, human research

Endogenous opioids have a role in a range of different social processes such as social reward, bonding and attachment. To ensure that social interactions are safe and rewarding, an individual must be able to learn about and interpret danger and safety signals in their environment. Preclinical studies have shown opioid modulation of responses to safety and danger, with endogenous opioid blockade resulting in sustained fear responses (freezing) throughout fear extinction training (safety learning). So far however, little is known about how opioids affect human fear and safety learning. Here, we use the opioid antagonist naltrexone (50mg) to uncover the role of opioids for fear extinction learning in 80 healthy participants. The study is a mixed design with drug as a between subject factor and a task specific repeated measures design. The effect of naltrexone on the participants ability to learn about threat and safety cues will be assessed using a set of highly robust and translational measures, here focusing on fear potentiated startle as the primary outcome measure. In line with preclinical findings, we expect that blocking the mu-opioid system will impair safety learning indicated by sustained startle responses during two safe contexts: extinction learning and fear retention. We will use linear mixed models with stimulus type and time (within), drug (between) and their interactions as fixed factors, and a subject specific intercept as random effect. This study will provide mechanistic insight into threat and safety learning, a key process in social interactions often impaired in affective disorders such as anxiety.

Session: 2. Poster Board: 32

Memory misattribution between self and other

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Keywords: Memory misattribution, Self schema, Closeness

Memory Misattribution (MM) refers to accurately recalling information but attributing it to the wrong source. In social contexts, MM is more likely in closer relationships. Previous theories suggested that MM results from the overlap of self-other schema, interpreting this overlap as an increase in subjective similarity due to heightened subjective closeness. However, recent studies questioned the correlation between closeness and MM, and the neural basis of MM remains unknown. Considering the diverse definitions and measurement methods for closeness in previous research, we suggest that the interpretations of overlap may not be accurate, and closeness is multidimensional. By identifying which dimension of closeness correlates with MM, we can reveal MM's true
mechanisms, and hint its neural mechanism. In this study, participants assessed the likelihood of self or others encountering an item, and the brain data were collected during this period. Subsequently, participants underwent source memory tests. The behavioral
results showed that only diversity, a sub-scale of objective closeness, significantly correlates with MM. It suggests that MM is associated with complex memory structure formed by objectively existing pre-information, rather than subjective perceptions. Based
on this result, we hypothesize that the diverse shared experiences may lead to more complex other schema, causing increased overlap of self-other schema, manifested as an overall increase in whole-brain self-other neural representational similarity. Therefore,
we will examine the correlation between representational similarity and MM to validate the neural mechanisms of MM. The analysis of fMRI data is still ongoing.

Conditional knockout of Shank3 by in vivo genome-editing in the ventral CA1 impairs social memory

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Keywords: Social memory, Hippocampus, ASD, In vivo genome editing

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition characterized by persistent deficits in social communication along with highly restricted, repetitive behaviors. One of the comorbidities frequently observed in Individuals with ASD is social memory impairment. A series of previous studies have shown that hippocampal ventral CA1 (vCA1) neurons and its microcircuits in the hippocampus are essential for social memory. We recently reported that the neurophysiological representation of social memory in the vCA1 neurons is disrupted in ASD-associated SH3 And Multiple Ankyrin Repeat Domains 3 (Shank3) knockout mice. However, it is still unclear whether the dysfunction of Shank3 in vCA1 causes the social memory impairment observed in ASD. In this study, we found that vCA1-specific Shank3 conditional knockout (cKO) by the adeno-associated virus (AAV)- or specialized extracellular vesicle (EV)- mediated in vivo gene editing was sufficient to recapitulate the social memory impairment observed in individuals with ASD. Furthermore, the utilization of EV-mediated Shank3-cKO allowed for quantitative examination of the role of Shank3 in social memory. The results suggest that there is a certain threshold for the proportion of Shank3-cKO neurons required for social memory disruption. Our study provides insight into the population coding mechanism of social memory in vCA1, as well as the pathological mechanisms underlying social memory impairment in ASD.

Session: 2. Poster Board: 34

The representation of conspecific sex in ventral hippocampal social memory

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Keywords: social memory, ventral hippocampus, electrophysiology

Social memory, the ability to recognize familiar individuals, is vital for adaptive social interactions. Extensive studies, particularly in rodent models, have highlighted the crucial role of the hippocampus in processing social memory. Within the hippocampus, the ventral CA1 region (vCA1) is known for storing memories of familiar conspecifics. However, the multi-dimensional nature of social memory and its behavioral impact remain less explored. Here we show that mouse vCA1 neurons encode both the identity and properties of familiar conspecifics. A subset of neurons exhibited non-linear mixed selective responses to combinations of sex and strain of the individuals, while another group of neurons specifically responded to either sex or strain, forming a low-dimensional, generalized representation of social properties. Neurons linked to social identity predominantly were activated around the trough of the hippocampal theta rhythm, whereas neurons associated with social properties fired during the ascending phase or near the peak of the theta rhythm during social interactions. We found that optogenetic reactivation of female social memories in mice induced place preference. This response was also observed when reactivating male social memories following ablation of either the medial amygdala (MeA) or the dorsal CA2 region (dCA2) of the hippocampus. Furthermore, selectively reactivating neural populations related to distinct female social memories, specifically representing the female sex, replicated this preference. These findings reveal that vCA1 neurons use dual coding schemes to represent the identity and properties of familiar conspecifics as a cohesive social memory.

Session: 2. Poster Board: 35

Social and Non-social Reward Representations in the Basolateral Amygdala

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Keywords: basolateral amygdala, social reward, operant conditioning

The amygdala is a complex brain structure that is involved in a wide range of emotional and social processes. In recent years, researchers have become increasingly interested in the role of the amygdala in the processing of social reward. Social reward can be defined as the pleasurable experience that individuals gain from social interactions, such as receiving praise, feeling socially accepted, or experiencing a sense of belonging. While the amygdala is known to be involved in social reward processing, how different regions within the amygdala, like the basolateral amygdala (BLA), contribute to this process needs clarification.

Using a novel two-choice operant task developed by the Murugan Lab (Isaac et al 2023), I aim to disambiguate how the BLA is involved in reward processing. Using in vivo cellular resolution calcium imaging, I compare the responses of individual BLA neurons to choice and consumption of social and nonsocial (sucrose) reward during a novel self-paced two-choice operant paradigm. In this exciting study, I find that individual BLA neurons are modulated by both social and sucrose choice and reward in a state-dependent way. I also uncover a potentially antagonistic representation between social reward and sucrose reward, highlighting novel insight into the encoding of reward in the BLA. Within the context of what the Murugan Lab has found in the mPFC, this work leads to exciting questions about the effect of projections between mPFC and BLA and how they may be reciprocally encoding social and nonsocial reward.

Session: 2. Poster Board: 36

Estrogen receptor beta positive neurons in the medial amygdala regulates male preference towards receptive female odors.

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Keywords: Social behavior, Social preference, Estrogen receptors, Fiber photometry, DREADDs.

Information processing about the sex and reproductive state of conspecific individuals is critical for successful reproduction and survival in males. Male mice primarily use olfactory cues to discriminate and find the right individual for efficient expression of sexual behavior. In general, males show a preference for receptive females (RF) over non-receptive females (XF) or intact males (IM). Our previous studies with RNAi-mediated brain site-specific knockdown revealed that the presence of estrogen receptor beta (ERβ) in the medial amygdala (MeA) is necessary for “receptivity-based” (RF vs. XF) but not for “sex-based” (RF vs. IM) preference. However, the neural circuit that controls two types of preference has not been determined. Thus, we performed a series of studies in ERβ-iCre mice: fiber photometry recording of the neuronal activity of ERβ positive neurons in the postero-dorsal MeA (MeApd-ERβ+ neurons) during two types of social preference tests; examination of the effects of chemogenetic suppression of MeApd-ERβ+ neuronal activity on preference behavior; and neuronal activity recording of the bed nucleus of stria terminalis (BNST), a primary projection site of MeApd-ERβ+ neurons, during preference tests under chemogenetic suppression of MeApd-ERβ+ neurons. We found that excitatory input of MeApd-ERβ+ neuronal activity to the BNST is required for receptivity-based preference, whereas the BNST neurons control sex-based preference independent of the influence of MeApd-ERβ+ neuronal excitation.
(Supported by 15H05724 and 22H02941 to SO.)

Session: 2. Poster Board: 37

Excitation of estrogen receptor β-expressing neurons in the lateral septum inhibits social anxiety in male mice.

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Keywords: social behavioral network, lateral septum, anterior hypothalamus, ERβ, social anxiety, DREADD

Testosterone, after being converted to estradiol, regulates a variety of social behaviors, including social anxiety, by acting on estrogen receptors (ER) α and ERβ in male mice. We have previously reported that the distribution patterns of ERα and ERβ are different in the lateral septum (LS), one of the key brain regions responsible for male social behaviors (Hasunuma et al., Neuroscience, 2023). Site-specific deletion of ERβ, but not ERα, in the LS enhanced levels of social anxiety in male mice. Moreover, we found that ERβ-expressing LS neurons densely innervated the anterior hypothalamus (AHA), which has been known to regulate anxiety-like behaviors in general. These findings indicate that ERβ-expressing LS neurons modulate social anxiety through neural pathways to the AHA. Thus, in the present study, we examined the effects of chemogenetic manipulation of the neuronal activity of ERβ-expressing LS neurons on social anxiety in ERβ-iCre male mice. We found that excitation of ERβ-positive LS neurons suppressed the levels of social anxiety, as indicated by increased levels of social investigation, without affecting the levels of anxiety in a non-social context. In parallel with behavioral effects, it was found that the number of c-Fos-positive cells was significantly increased in the AHA. These findings collectively suggest that the neuronal connection of ERβ-expressing LS neurons with the AHA plays a role in the regulation of anxiety levels, specifically in social contexts, in male mice.

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Session: 2. Poster Board: 38

Estrogen receptor β in the medial amygdala is necessary for mate preference but not for lordosis in female mice

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Keywords: sexual behavior, gonadal steroid hormone, RNA interference

Estrus female mice prefer sexually active males over non-active males (female-type mate preference), but the role of the gonadal hormone estradiol and its mechanism of action remain unclear. Given the essential role of estrogen receptor (ER) β in the medial amygdala (MeA) in males' preference for sexually receptive females (Nakata et al., 2016; Takenawa et al., 2023), we examined the role of ERβ in the MeA in the regulation of mate preference in females using the adeno associated-virus (AAV) -mediated RNA interference technique. Ovariectomized adult female C57BL/6N mice were given hormonal priming (estradiol benzoate, 5 μg/0.1 ml oil, at 48 and 24 h, and progesterone 250 μg/0.1 ml at 3~4 h, before the test) and underwent a screening test for a preference toward gonadally intact males over gonadectomized males. They were then injected with either ERβ knockdown or control viruses into the MeA. After a two-week recovery period, mice underwent weekly mate preference tests three times (week 1: vehicle, week 2 and 3: hormonal priming). We found that the control group restored preference toward gonadally intact male mice under the hormonal priming condition, but the ERβ knockdown group failed to show female-type mate preference in all three tests. On the other hand, ERβ knockdown did not affect lordosis behavior assessed after the preference test on week 3. These results suggest that estradiol action through ERβ in the MeA is critical for female-type mate preference but not for lordosis expression. Supported by 23KJ0281 to LK, 15H05724, and 22H02941 to SO.

Session: 2. Poster Board: 39

Estrogen receptor β expressing neurons in the dorsal raphe nucleus serve as an inhibitory regulator on the brain network for female receptivity.

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Keywords: Female sexual receptivity, Sexual behavior, Lordosis, Estrogen receptor beta, Dorsal raphe nucleus, Estrous cycle

The expression of sexually receptive lordosis behavior in female mice is regulated by the central action of fluctuating levels of estradiol during the estrous cycle. Behavioral estrus, characterized by a peak in sexual receptivity, transits rapidly into a post-estrus phase with diminished female receptivity. The action of estradiol is mediated by two distinct estrogen receptors, ERα and ERβ, each of which has unique expression profiles. In particular, ERβ in the dorsal raphe nucleus (DRN) has been previously proposed to play a different role from ERa in the hypothalamic areas for the expression of lordosis behavior during the estrous cycle. In the current study, we aimed to determine the regulatory role of ERβ-expressing DRN neurons (DRN-ERb+ cells) in the downshift in receptivity from the day of the estrus to the day after the estrus. We discovered that chemogenetic inhibition of DRN-ERb+ cells prevented the expected decline of lordosis in the day after the behavioral estrus, while activation of these cells suppressed lordosis expression during estrus. Fiber-photometry recordings demonstrated that DRN-ERb+ cells were responsive during an array of female-male behavioral interactions, with heightened activity in response to male intromission, particularly on the day after the behavioral estrus. Anatomical mapping revealed that DRN-ERb+ cells projected to brain regions associated with suppression of female sexual receptivity. These findings collectively suggest that the decline of receptivity in the post-estrus day is due to potentiated DRN-ERb+ neuronal activity, which serves as an inhibitory regulator on the brain circuitry that controls female receptivity. (Supported by JSPS 21J10590 to TM to TM, and 22H02941 to SO.)

Session: 2. Poster Board: 40

Vasopressin neurons control mating behavior in zebrafish.

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Keywords: Mating behavior, Vasopressin neurons, Zebrafish, sexual dimorphism

Mating behavior plays a pivotal role in the survival and perpetuation of animal species. Vasopressin modulates social communication, social investigation, territorial behavior, and aggression, predominantly in males. Recently, knockdown or pharmacological manipulations of the vasopressin system impaired both courtship behaviors and success rates in fish. However, in contrast to its structurally and functionally similar peptide oxytocin, our knowledge of the roles of vasopressin neurons on mating behaviors remains very few and remains further elucidated. Nevertheless, the methodological approach employed in previous studies significantly impacts the ability to discern comparative details. Therefore, it is essential to meticulously examine the population of vasopressin neurons which are predominantly responsible for male and female reproduction in mating behavior. In the present study, we used zebrafish as animal model to study the specific population of vasopressin neurons in both male and female zebrafish after mating behavior. To quantify the neural activation of vasopressin neurons, we performed double fluorescence in situ hybridization (dFISH) targeting vasopressin neurons and the immediate early gene product cFos in adult zebrafish of both sexes after mating behavior. We quantitatively compared the counts of activated vasopressin neurons. Our data revealed that the quantity of activated vasopressin neurons in the mated females was lower compared to unmated females. Our next step is to characterize the vasopressin neuron subpopulation after mating, aiming to provide a thorough understanding of their features. Our study offers valuable insights into conserved vasopressin neurons in teleost fish, highlighting their role even in the absence of mate choice.

Session: 2. Poster Board: 41

Immunohistochemical Localization of Oxytocin in the Monodelphis domestica Brainand Relevance to Field of Social Neuroscience.

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Keywords: Oxytocin, social behavior, immunohistochemical localization, non-traditional animal model.

Oxytocin (OT) is a neuropeptide that regulates social behavior and stress responses in both animals and humans. It acts in the nervous system to influence social preference, memory, and aggression, which can vary across animal species. In mammalian species, OT is produced by neurons in the paraventricular nucleus (PVN) and supraoptic nucleus (SON). However, in some species, OT has been found in other areas. The present study's goal was to describe the location of OT in the short-tailed opossum (Monodelphis domestica) brain. Most neuroscience studies of OT research utilize traditional rodent models. The present research aims to contribute to the literature by focusing on non-traditional animal models. Immunohistochemistry was conducted to characterize OT neurons in the PVN and SON of the Monodelphis brain. Four males and 4 females were included in this study. Although there were no significant biological sex differences ($t(6)=1.688$, $p=0.142$), females seemed to have more oxytocinergic neurons in the PVN. The study included the dorsomedial hypothalamic nucleus (DHN), but there were no significant sex differences in the number of neurons in this area ($t(6)=0.051$, $p=0.961$). Interestingly, qualitative observations suggest that there were more oxytocinergic neurons in the DHN than in the PVN, especially in males. These findings are different compared to traditional rodent models, where it has been found that there are greater oxytocinergic neurons in the PVN. Further exploration of the neuroanatomy of the Monodelphis will be conducted to assess OT immunoreactivity in other areas of the brain in comparison to rodent and other non-traditional species.

Functional Reorganization in the mPFC-BLA-A1 Circuit of Mice following Acute Oxytocin Administration

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Keywords: oxytocin, prefrontal cortex, auditory cortex, basolateral amygdala, functional connectivity, local field potentials (LFPs)

Oxytocin plays an important role in social bonding, and behavioral studies have shown that social context can modulate emotion and sensory processing. Recent studies have also shown that oxytocin enhances connectivity between subcortical regions and higher cortical areas during social-related tasks. However, it remains unclear whether the oxytocin-induced changes in the social brain circuitry are task-dependent or if they occur during resting-state. Here, we investigated the acute effects of oxytocin during resting state on local field potentials (LFPs) in the in the prefrontal cortex (mPFC), primary auditory cortex (A1), and basolateral amygdala (BLA) of mice, brain areas implicated in emotion and sensory processing. We found that oxytocin administration led to an immediate and persistent decrease in high theta (7-12 Hz) power across all three regions. Additionally, the mPFC showed reductions in beta (22-34 Hz) and gamma (40-70 Hz) power. Despite the overall decrease in power, we observed an increase in functional connectivity, particularly in the theta frequency band, between the mPFC and BLA. These results suggest that oxytocin may decrease local neuronal firing rates while reconfiguring neural circuits mediating theta-band communication, potentially enhancing information transfer efficiency. Our findings provide novel insights into the circuit-level mechanisms by which oxytocin increases salience for social stimuli.

Session: 2. Poster Board: 43

Amygdala Neurons Differentiating Unfamiliar and Familiar Mice to Establish Social Novelty Preferences

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Keywords: central amygdala, Npbwr1, social novelty preference

Despite its critical importance to social animals, the mechanisms underlying the establishment of new social interactions remain largely unknown. We identified a role for neurons expressing neuropeptide B/W receptor-1 (NPBWR1) in the central amygdala (CeANpbwr1 neurons) in this process. CeANpbwr1 neurons were activated only during physical interactions with unfamiliar mice, but not with familiar mice. Manipulations of the neuronal circuit comprising CeANpbwr1 neurons suggested that this excitation was essential for sustaining physical interactions with novel conspecifics. Remarkably, stimulating CeANpbwr1 neurons effectively reversed sociability deficits induced by chronic social defeat stress. Conversely, overexpressing human NPBWR1 in CeANpbwr1 neurons, which reduced CeANpbwr1 neuronal activity, led to decreased social interaction with unfamiliar conspecifics. In contrast, the human NPBWR1 gene with a single nucleotide polymorphism (404A>T) did not show this effect. These findings demonstrate that CeANpbwr1 neurons maintain social novelty preference, while NPBWR1 counters this function. Moreover, polymorphisms found in NPBWR1 may play a role in shaping an individual's characteristics when interacting with unfamiliar individuals.

Session: 2. Poster Board: 44

Neural correlates of resilience under different operational definitions: A resting-state fMRI study

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Keywords: Resting-state fMRI, Stress resilience, Regional homogeneity, Functional connectivity

Psychological resilience is a multi-dimensional construct that counteracts psychopathology. Different operationalizations of resilience were adopted in the literature, which represented a specific dimension of resilience. To understand the neurosciences of resilience more comprehensively, this study aims to explore the underlying neural correlates of different operational definitions of resilience in the same participant using a resting-state fMRI approach. Fifty-eight healthy university students in Hong Kong underwent resting-state fMRI brain scanning. Their self-perceived overall resilience levels, state and trait resilience levels, and resilience as an outcome were measured by the Connor-Davidson Resilience Scale (CD-RISC), State-Trait Resilience Scale (SRC/TRC), and the ratio of general mental health and perceived stress, respectively. Correlation and regression analyses were performed between the different measures of resilience and the whole-brain local activities (measured by regional homogeneity), as well as between resilience measures and long-range functional connectivity from both a whole-brain and a seed-based approach. Fourteen brain regions were preselected based on previous review and the result of the local activities. For the local activity, SRC was found to be negatively correlated with the hippocampus and parahippocampal gyrus. The outcome-based measure of resilience was negatively correlated with the angular gyrus and insula. For long-range functional connectivity, TRC was found to be negatively associated with the connectivity between the amygdala and inferior frontal gyrus from both a whole-brain and a seed-based approach. Functionally, no overlapping regions or pathways were found, indicating that different operationalizations of resilience represent distinct areas of resilience. This finding provided a better understanding of the neurological aspect of different resilience measures, which will be beneficial for future resilience research.

Session: 2. Poster Board: 45

Searching for Dedicated Social Cognition Network

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Keywords: Social cognition, fMRI, Task battery, Eyetracking, Naturalistic,

Social cognition is a complex process that comprises diverse social skills, mostly studied separately in neuroscience. Different brain regions are known to be involved in various social skills, Yet, it remains unclear whether social cognition is, in fact, one process that has many aspects, or whether it is truly distinct mechanisms, each working when required in its own specialized domain. Furthermore, the level of dissociation of social cognition from general cognition is also unknown.

To this end, we designed a battery of tasks, each comprised of a social and a non-social version, conducted in and outside of the fMRI. Tasks included movie watching, emotion/sound categorization, motion prediction, working memory, and attention. in the new tasks we designed, we saw an overall convergence across participants to a common “ground truth”, though there was a substantial variance between individual participants. This variance is a robust individual trait, remaining stable within participants. Moreover, while these personal profiles were remarkably stable, they diverged considerably within individuals between the social and non-social versions of the same task, implying different underlying neural mechanisms. This divergence was captured in our preliminary fMRI data as well, showing known social cognition networks activated only on the social version of the tasks.

Surprisingly, our preliminary behavioral results show only a partial correlation between the different tasks, leaving open questions about the nature of the relatedness of the social processing aspects of the tasks and their specificity.

This is the first step in creating a holistic understanding of social cognition and in untangling the complex relations between social and non-social cognition. This knowledge can elucidate some of the mechanisms underlying social impairments and offer much-needed objective measures for social cognition, combined with fMRI.

Session: 2. Poster Board: 46

The influence of contextual factors and rater reliability on the quantification of social behavior of Monodelphis domestica, a non-traditional animal model for neuroscience research

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Keywords: Intrarater-reliability, Ethogram, Social Behavior, Monodelphis domestica, Measurement Error

Characterization of social behaviors in non-traditional animal models using rigorous quantitative methods is important for the generation of new knowledge in the field of social neuroscience. Our aims were to replicate previous findings that suggest that the laboratory opossum (Monodelphis domestica) displays social behaviors comparable to traditional models and consider the importance of inter-rater (IRR) and intra-rater reliability in study design. Using an established ethogram of species-typical behavior, our team confirmed that Monodelphis display social behaviors that are comparable to rodent models, although Monodelphis displayed higher aggression in certain contexts. Two raters scored social behaviors of two-paired Monodelphis subjects through the open-source Behavioral Observation Research Interactive Software (BORIS). Initial scoring sessions for the first-paired subjects yielded low IRR scores (k=0.743, k=0.730). Subsequent scoring sessions for the second-paired subjects demonstrated an increase in IRR (k=0.906, k=0.879). Additionally, intrarater-reliability was assessed by a single rater to independently score a subset of the recorded behaviors over two rounds. Results showed a reduction in the total amount of behavior occurrences scored by a single rater for each subject, with the most substantial difference in one subject's overall scored behaviors amounting to a twenty-nine percent decrease in round two. The discrepancies in both measurements of reliability highlight the importance of rater reliability consistency. Through our innovative approach in characterizing the social behavior of a non-traditional animal model, we plan to further standardize the methodology used to train researchers in scoring the social behavior of laboratory animals undergoing experimental manipulations, contributing to the advancement of neuroscience.

Session: 2. Poster Board: 47

Interpersonal Neural Synchronization during Mutual Prediction in Ball Catching Task

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Keywords: Social interaction, Mutual Prediction, EEG, Hyperscanning

Individuals often predict the movements of others during joint activities. For instance, in baseball, infielders must coordinate their actions to catch a fly ball, ensuring they neither collide nor let the ball fall to the ground. However, the neural underpinnings that govern whether mutual predictions lead to successful or unsuccessful outcomes are unclear. Our study delved into the neural coordination between individuals during successful (catching the ball) or failed (dropping the ball) joint actions using a simulated ball catching task. Eleven pairs of participants performed the task while we simultaneously recorded their inter-brain Electroencephalography (EEG). Each participant controlled a cursor on a computer screen to coordinate with the other participant to catch a falling ball without colliding. The body sizes (normal or large) of the cursors were varied in a blocked design, such that the chance of collision changed accordingly, while the size of the hand and reliability of the catch remained constant. We tracked the frequency of ball drops and collisions between participants, and estimated the inter-brain EEG synchronization within each pair, using the Phase Locking Value (PLV) for each trial. To determine if the inter-brain connectivity values during trials were higher than chance level, we used surrogate data analysis to account for any spurious connections. Our findings reveal that pairs with fewer instances of the ball dropping had a greater number of significant inter-brain connections. This suggests that inter-brain synchronization might be a key neural factor in supporting successful joint activities.

Session: 2. Poster Board: 48

Perceptual crossing paradigm as a method to study second-person neuroscience: an EEG hyperscanning study.

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Keywords: Perceptual Crossing, Second-Person Neuroscience, EEG, EEG Hyperscanning

The growing interest in the social neuroscience field has allowed us to dive deeper into the concept of second-person neuroscience, which highlights the neural response during an active, real-time, and reciprocal social interaction. The Perceptual Crossing (PC) paradigm is considered ideal for studying real-time reciprocal social interaction in a pair of individuals. In the PC experiment, a pair of participants interact through a minimalistic interface based on a continuous sensorimotor haptic feedback loop. This paradigm has proven to be a suitable approach for studying the fundamental role of sensorimotor interaction in the social abilities of different groups of people, including adults, adolescents, and adults with autism. However, to date, there has never been any in-depth study that explores the neuroscience aspect of the PC paradigm and only a few past studies have looked into the subjective experience evaluation of PC. The current study collected EEG hyperscanning data from PC experiment performed by two individuals, and the participants' subjective experience during PC was also measured. The goals of this study are to identify distinct brain signatures that occur during PC, from the perspective of single-brain and inter-brain, as well as to eventually correlate those signatures with behavioural measures. This study is expected to broaden the knowledge around the field of social neuroscience, especially in regard to second-person neuroscience.

Session: 2. Poster Board: 49

The effects of cleft lip/palate and subsequent repair on the neural processing of infant faces

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Keywords: face perception, parental responses, EEG

Research using a variety of neuroimaging techniques (fMRI, MEG, EEG) has demonstrated that Infant faces elicit enhanced neural processing relative to adult faces, likely due to their importance evolutionarily in facilitating bonds with caregivers. Facial malformations have been shown to impact early infant-caregiver interactions negatively. However, it remains unclear how such facial malformations may impact the early neural processing of these faces. Across two studies, we used electroencephalography (EEG) to investigate adults' early neural processing of infant faces with cleft lip/palate as compared to unaffected infant faces (study 1) and the impact of cleft repair surgery on these neural responses (study 2). The N170 response was significantly larger for infant faces with cleft lip/palate as compared to unaffected infants and infants after repair surgery. The P200 response was significantly reduced for infant faces with cleft lip/palate as compared to unaffected infants and infants after repair surgery. These results suggest that infants' faces with cleft lip/palate are processed differently very early in the perceptual process, particularly with respect to configural processing (N170) and face typicality (P200). These processing differences may contribute to several important aspects of development (e.g., joint attention) and may play a vital role in the previously observed difficulties in mother-infant interactions.

Pain sensitivity is decreased during heavy metal music festival

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Keywords: Music, pain perception, social rituals, ECG

Music festivals are social rituals that can attract vast numbers of participants over a duration of several days. Here we investigated pain threshold before and during a music festival as an indirect indicator of endorphin levels to gain more insight in why going to festivals may be motivating on a physiological level. 60 Participants performed an ECG, cold pressor pain test and filled out questionnaires on the day before the Wacken Open Air heavy metal music festival, and 62 on the 3rd and 4th day of the festival. Results show that compared to the baseline day where people were already present at the festival putting up their accommodation (tents, campers) but no bands were playing, during the festival participants with low and medium alcohol consumption showed a greater pain tolerance ($p = .021$; 95% CI: -.576; -.049). If participants with high alcohol consumption were included in the analysis no such effect was observed. During the festival we found a positive correlation of anticipatory excitement and pain tolerance ($r = -.416$; $p = .003$). Heart rate variability before the festival correlated positively with pain sensitivity ($r = -.371$; $p = .016$). No such correlation was observed during the festival ($r = -.156$; $p = .289$). We discuss that participants with high alcohol consumption needed to be excluded from the analysis in accordance with previous literature showing that high alcohol consumption can have a major influence on how pain is perceived. We conclude that pain tolerance during the festival probably was increased due to increased endorphin levels. Such an increase in endorphin levels would probably play an important role in the physiology of why many people experience it as especially enjoyable attending music festivals in person. The data seem to suggest that before the music festival the heart rate variability physiological measures show a correspondence to pain perception that disappears during the festival.

Session: 2. Poster Board: 51

Tactile discrimination is associated with social touch preference in two cross-cultural cohorts

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Keywords: Social touch, sensory, perception, discrimination, tactile

Social touch plays a vital role in social bonding and cognition. However, the mechanisms underlying how social touch elicits pleasant or aversive responses remain unclear. Furthermore, the role of sensory perception (i.e. detecting and discriminating stimuli) in shaping these responses, and the impact of contextual factors such as gender and cultural differences, are not fully understood.

In this study, we investigated the subjective pleasantness of social touch in 48 adults: 26 from the UK (18-38 years; 15 Female, 11 Male) and 22 from Singapore (21-37 years; 13 Female, 9 Male). Social touch preference was assessed using a novel, quantitative Social Touch Task, which presented images of dyadic social touch interactions from different touch partners. Tactile perception was assessed using a well-validated battery of psychophysical vibrotactile tasks. The Touch Experiences and Attitudes Questionnaire (TEAQ) and Social Touch Questionnaire (STQ) were also used to assess social touch preference.

Across both cohorts, female participants rated touch from a friend or stranger of different gender as less pleasant than male participants. Singaporean adults rated touch from a friend as less pleasant than those in the UK cohort. Interestingly, participants with higher amplitude discrimination thresholds in both cohorts had a lower preference for social over non-social touch in the Social Touch Task and had lower preference scores in the social touch questionnaires.

These findings suggest that poorer tactile discrimination could predict lower subjective pleasantness of social touch in adults. As discrimination of stimuli requires GABA-mediated inhibitory processes, our results suggest a role for altered GABA signalling in driving context-dependent preference of touch. Future work will aim to further elucidate these mechanisms using MRS and fMRI. Our findings have implications for neurodevelopmental conditions characterised by atypical social and sensory processing.

Effects of interaction with virtual dogs on negative mood and oxytocin secretion

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Keywords: Oxytocin, virtual dog, video game, mood

Companion animals (CA) have been shown to have a variety of positive effects on humans, including improved mental health and the release of oxytocin. However, it is often difficult to keep CAs in urban apartment complexes, and the financial burden is significant. To address this problem, interaction with virtual pets has received much attention in recent years. The present study examined the effects of interacting with a virtual dog in a video game on mood and oxytocin secretion. Ninety undergraduate students participated in the experiment and were randomly assigned to three conditions. Virtual dog/interaction condition: Participants interacted with the dog in the video game (Nintendo Switch: LITTLE FRIENDS-DOGS & CATS-) for 20 minutes by walking, throwing a ball, and brushing. Virtual dog/observation condition: Participants watched the screen for 20 minutes while other participants assigned to the virtual dog/interaction condition interacted with the video game dog. Control condition: Participants played a puzzle game (Tetris) alone for 20 minutes. Before and after the game, participants completed questionnaires and their saliva was collected. Oxytocin levels were measured by ELISA from the collected saliva. Negative mood was significantly reduced in the interaction and observation conditions compared to the control condition, but there was no difference between the interaction and observation conditions. In addition, no condition differences were found for changes in oxytocin levels. These results suggest that virtual dogs, even when there is no interaction and only observation, are effective in reducing negative mood but are not associated with oxytocin secretion.

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Rapid and Remarkably Plastic Body Coloration Changes in Oryzias celebensis as a Social Signal Influenced by Environmental Background

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Keywords: Oryzias celebensis, visual signal, rapid colouration change, social signal, aggressive behaviour, intraspecific competition, environmental background

Rapid body coloration changes in some animals, such as chameleons and octopuses, serve dual functions: camouflage and intraspecific communication. It has hypothesized that these color changes originally evolved to provide camouflage and subsequently was co-opted as social signals. However, the interplay between these two functions at the molecular and neural levels has been scarcely studied. In this study, we investigated remarkably plastic coloration changes that occur in an Indonesian medaka fish (Oryzias celebensis) to understand the relationship between aggressive behavior and body coloration changes. In an algae-covered tank consisting of 2 males and a female, males with blackened markings exhibited more frequent attacks compared to those without blackened markings and females. Additionally, we observed that the males with blackened markings were seldom attacked by males without blackened markings and females. These tendencies persisted even in groups consisting of 3 males. In contrast, neither attack behaviour nor black coloration changes were observed in the transparent condition. These observations suggested that blackened markings in males are indicators of aggression and serve as social signals to deter attacks from others. Secondly, we found that, in transparent tank without algae, black coloration as well as aggressive behaviors were completely repressed, indicating that environmental background plays a crucial role in influencing both coloration and aggressive behaviors. Considering its potential to apply genome editing technologies similar to Japanese medaka (O. latipes), this species offers a unique opportunity to explore the molecular and neural bases of visual communication and their evolutionary origins.

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The modulation of pupil size and facial mimicry in response to social stimuli requires conscious awareness

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Keywords: awareness, emotion recognition, physiological indexes

Continuous flash suppression (CFS) has been widely used to investigate the effects of semantic or emotional processing on visual perception. We used a variant of the CFS paradigm (break-through CFS), not only to confirm a top-down modulation of visual awareness driven by social contents, but also to examine if implicit processing of emotional content precedes or follows its conscious appraisal. To this aim, we have chosen pupil dilation and facial mimicry as implicit responses to emotional social stimuli and collected these measures during the bCFS task. Stimuli consisted of emotional facial expressions (happy, fearful, neutral) and their phase-scrambled versions. All stimuli were matched in terms of luminance. To the right eye, we presented a stream of Mondrian patterns, which temporarily suppressed the visual stimuli presented to the left eye. We recorded reaction times for the stimulus to break through suppression.
Behavioural findings showed that participants became aware of the face images faster than their scrambled versions. Furthermore, happy faces were detected faster and more accurately than fearful or neutral faces. On the physiological side, results from pupillometry and electromyography revealed that top-down modulation of the pupil and facial reactions occurs only after the conscious perception of the stimuli. These findings suggest that non-threatening emotional social stimuli (faces) elicit specific physiological responses only after their conscious appraisal. This paradigm can potentially contribute to our understanding of the multiple pathways that a social stimulus follows from its early visual recognition to its cognitive interpretation, through its resonance in the autonomic nervous system.

Session: 2. Poster Board: 55

The relationship among subjective hyperacusis responses, sensory issues, sensitivity to reward and punishment, and anxiety in adults

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Keywords: Auditory reactivity, neurodevelopmental disorder, Behavioral Inhibition System, Behavioral Activation System

Background: Hyperacusis is loudness intolerance, which consists of a lower auditory threshold, annoyance, fear, and pain, negatively impacting daily activities and social interactions. The nature of hyperacusis remains unclear. Objective: This study aimed to (1) identify multiple types of subjective discomforts, those were an unpleasant feeling, fear, anger, and pain, induced by loud noises separately using visual analog scales and (2) investigate the relationship among hyperacusis discomforts, sensory issues, sensitivity to reward and punishment, anxiety in the general population. Methods: 441 adults aged 18 to 90, including 309 females and 152 adults with a self-reported diagnosis of any psychiatric disorders, answered an online survey. Results: An unpleasant feeling and fear showed significantly moderate positive correlations with auditory hypersensitivity measured by the Glasgow Sensory Questionnaire, while anger and pain showed significantly weak correlations with it. 303 participants (68.71%) answered that noises induced pain. People who responded to noise with pain showed higher responses to noises with an unpleasant feeling, fear, and anger and higher levels of general anxiety. Moreover, subjective pain response is distributed differently from the other three types of discomfort, suggesting that pain may be a distinctive aspect of hyperacusis among the discomforts. Hyperacusis was not associated with sensitivity to reward and punishment, indicating that hyperacusis was independent of those temperamental traits, which are tightly linked to psychiatric disorders. Conclusion: The results suggested that exploring subjective responses in each sensory modality, independent of specific disorders, would offer a new perspective for addressing core features of sensory issues, including hyperacusis.

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The relationship between attention deficit hyperactivity disorder (ADHD) traits and fatigue induced by daily life activities in adults

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Keywords: neurodevelopmental disorder, tiredness, task-induced fatigue, everyday life

Fatigue is one of the well-described symptoms in people with attention deficit hyperactivity disorder (ADHD). Although it has been suggested that people with ADHD are easily fatigued when performing tasks in laboratory settings, the relationship between fatigue induced by daily life activities and ADHD traits is still unclear. In this study, we conducted an online survey to investigate these relationships in a general population.

250 adults completed the questionnaire including the Japanese version of the Chalder's Fatigue Scale (CFS; general fatigue), the Clutter Image Rating (CIR), questions for the daily life activity-induced fatigue and accidents, and the Adult ADHD Self-Report Scale (ASRS-J; ADHD traits). Participants were asked to imagine 8 daily life activities in the morning: getting up, washing face, makeup/shaving, selecting clothes, changing clothes, preparing breakfast, eating breakfast, and cleaning up. A visual analog scale was employed to measure the fatigue induced by each activity.

There was a moderate positive correlation between ADHD traits and general fatigue. Surprisingly, increasing ADHD traits related to smaller probabilities to execute each activity in usual life. This effect was significant in eating breakfast and washing face.

We also conducted a factor analysis on the questions about daily life activity-induced accidents to extract general characteristics (e.g. sensory issues, motor control deficits, etc.) possibly affect daily life. We assessed the influence of these characteristics on fatigue induced by each activity using a multiple regression model. These results revealed a significant influence of ADHD traits on execution of daily life activities.

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Alexithymia, not autism, modulates atypical cognitive modulation of pain experience.

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Keywords: Pain, autism, alexithymia, placebo

Pain is often a motivationally salient signal, whether in relation to actual or potential tissue damage, social rejection, emotional distress, etc. Pain experience can be altered by expectations, producing nocebo and placebo effects, which can be explained by Bayesian theories of perception. It has been suggested that Bayesian inference is atypical in autism, a condition marked by difficulties in social and emotional communication. In addition, recent research indicates that interoceptive difficulties in autism (a reduced ability to identify and perceive bodily sensations) are better explained by co-occurring alexithymia. The present study used a placebo hypoalgesia paradigm to modulate behavioural and neural responses to pain stimuli (Eippert et al., 2009). We investigated whether the differences observed in the initial placebo effect calculated by pain intensity ratings and anticipatory galvanic skin response (aGSR), and the extinction function could be explained by individual differences in autistic and alexithymic traits. Results showed it is alexithymic traits, not autistic traits, that predict the magnitude of the initial placebo effect measured by pain intensity ratings and the extinction function. This study provides further evidence for the alexithymia hypothesis, that socio-emotional difficulties observed in autism are better explained by alexithymia, not autism. The results have implications for pain and empathy research (e.g., in-group and out-group behaviour on empathy for pain), as well as conditions affecting the complex interplay between the central and peripheral nervous system, such as those affecting interoception. Furthermore, the current results have implications for how the neural pain signature (Wager et al., 2013) can be applied in clinical and sub-clinical populations, such as those with alexithymia, as well as in clinical settings when providing pain management and relief care for the autistic population.

Oxytocin-induced increases in cytokines and clinical effect on the core social symptoms of autism

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Keywords: Oxytocin, Cytokine, Clinical trial, Neuroinflammation, Proteomics

Although oxytocin may provide a novel therapeutics for the core features of autism spectrum disorder (ASD), previous results regarding the efficacy of repeated or higher dose oxytocin are controversial, and the underlying mechanisms remain unclear. The current study is aimed to clarify whether repeated oxytocin alter plasma cytokine levels in relation to clinical changes of autism social core feature. Here we analyzed cytokine concentrations using comprehensive proteomics of plasmas of 207 adult males with high-functioning ASD collected from two independent multi-center large-scale randomized controlled trials (RCTs): Testing effects of 4-week intranasal administrations of TTA-121 (A novel oxytocin spray with enhanced bioavailability: 3U, 6U, 10U, or 20U/day) and placebo in the crossover discovery RCT; 48U/day Syntocinon or placebo in the parallel-group verification RCT. Among the successfully quantified 17 cytokines, 4 weeks TTA-121 6U (the peak dose for clinical effects) significantly elevated IL-7 (PFDR < 0.001), IL-9 (PFDR < 0.001) and MIP-1b (PFDR < 0.001) compared with placebo. Inverted U-shape dose-response relationships peaking at TTA-121 6U were consistently observed for all these cytokines (IL-7: P < 0.001; IL-9: P < 0.001; MIP-1b: P = 0.002). Increased IL-7 and IL-9 in participants with ASD after 4 weeks TTA-121 6U administration compared with placebo was verified in the confirmatory analyses in the dataset before crossover (PFDR < 0.001). Furthermore, the changes in all these cytokines during 4 weeks of TTA-121 10U administration revealed associations with changes in reciprocity score, the original primary outcome, observed during the same period (IL-7: P = 0.067; IL-9: P = 0.005; MIP-1b: P = 0.005). These findings provide the first evidence for a role of interaction between oxytocin and neuroinflammation in the change of ASD core social features, and support the potential role of this interaction as a novel therapeutic seed.

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Cultural contexts in neurodegenerative disorders: Exploring associations between living conditions, social factors, and biomarkers among Hispanic subgroups

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Keywords: Hispanic subgroups, adverse health outcomes, living conditions

Background: As of 2022, the Hispanic population represents the biggest minority group in the United States of America, accounting for 19% of the population (USA Census Bureau, 2023). Hispanics face many challenges, among them higher-than-average adverse health outcomes such as increased obesity, hypertension, neurodegenerative diseases, and poor healthcare access. Those who reside in institutions have an increased risk of developing adverse health outcomes. Social researchers have advocated that the Hispanic community would be better understood if they were studied as a subgroup instead of categorizing this community into one group (Weinick et al., 2004). The current study aims to describe the relationship between institutional living, tau biomarkers, and different adverse health outcomes among Hispanic subgroups. Method: The present study will utilize data from +47,000 individuals in the NACC dataset to conduct a Kendal tau correlation analysis heatmap to describe the relationship between tau biomarkers, Hispanic subgroups, and the following adverse health outcomes: dementia, hypertension, diabetes, B12 deficiency, insomnia, alcohol, depression, anxiety, memory, orientation, depression severity, anxiety severity, and dementia. Result: The results revealed that Mexicans had a higher correlation in comparison with other Hispanic subgroups for dementia ($\tau b = .334$, $p < .05$), orientation ($\tau b = .273$, $p < .05$), and alcohol consumption ($\tau b = .234$, $p < .05$). Conclusion: The NACC dataset provides valuable information of health outcomes of older adults in the United States of America. To our knowledge, this is the first study to describe the differences and similarities of Hispanic subgroups in the United States of America.

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Psychiatric symptoms are associated with poor performance and enhanced metacognition in computationally complex decisions

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Keywords: Complex decision-making, knapsack problem, computational psychiatry, metacognition, confidence, psychopathology

Complex decision-making is computationally intractable, which makes it fundamentally different from simple perceptual and knowledge-based decision-making. Till now, no study has explored how performance and metacognition, the ability to monitor, reflect on, and control one's cognitive processes, are associated with psychopathology. Here, we recruited a large, general population sample (N=800) in an online experiment. Participants completed a complex decision-making task (the 0-1 knapsack problem) and a set of questionnaires. We used factor analysis of the self-report questionnaire responses to identify transdiagnostic symptom dimensions of psychopathology, and then related them to participants' performance and metacognition in the complex decision-making task. Analysis revealed that participants who scored higher on the symptom dimension of compulsive-behavior-and-intrusive-thought had poorer performance but increased confidence level and enhanced metacognitive ability in the complex decision-making task. Moreover, symptom dimensions of anxious-depression and inattention-impulsivity-overactivity were correlated with reduced confidence level, but unrelated to either decision performance or metacognitive ability. Our findings provide evidence for the link between certain psychiatric symptom dimensions and performance and metacognition in complex decision-making. Our study therefore bridges the gap between research on complex decision-making and an understanding of distortions of metacognition in psychopathology.

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Measuring stress in fish: the light/dark test in marine medaka Oryzias melastigma

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Keywords: Stress, anxiety, marine medaka, light/dark test

The light-dark preference test (LDPT) is widely used in rodents to assess anxiety/stress behavior, where innate preference for the dark compartment is exacerbated under stressful conditions. However, its use with other vertebrates, namely fish, has produced variable results and one possible explanation is the lack of standardization between studies. Here, we investigated the response to this test in the marine Medaka Oryzias melastigma, a model species to investigate the impact of stressors in marine fish. The body of Medaka is usually light colored and accordingly, under normal raising conditions, preference for the light (less contrasting) compartment was observed from 6 day-post hatching (dph) onwards (N=36; $p < .05$), with animals spending more than 75% (N= 36; S.E.< 4.1%) of their time in the bright area from 42 dph onwards. However, this innate preference was dependent on rearing environment and test conditions. Juveniles (56 dph) reared in a white (W) or black (B) background environment differed in coloration, being darker in B. The preference for the light/dark area was clearly impacted by rearing conditions, with B fish preferring the dark compartment and the opposite for W fish. These differences were more obvious when animals were tested with light from below than with light from above. There was a clear interaction between rearing environment and test lightning conditions, with B fish traveling a greater distance ($p= .021$) than W fish with illumination from above, while the opposite was observed with light from below ($p= .002$). Our results suggest that background coloration opposite to that of the raising environment is stressful for the animals, as inferred from reduced total time spent and distance traveled in those compartments. Long-term background adaptation and light position during testing can produce significant differences in the behavior of the animals and should be considered when designing experiments. Overall, our experiments support LDPT as a useful tool to measure stress/anxiety behavior in O. melastigma and emphasize the need for standardization of raising and test conditions.

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Behavioral assessment and biomarker development for characterization of a marmoset model of autism spectrum disorder

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Keywords: Autism, marmosets, biomarker, behavioral assessment

Autism spectrum disorder (ASD) encompasses a diverse range of complex neurodevelopmental conditions characterized by deficits in social interaction, communication, stereotyped behavior and restricted interests. Although an estimated one percent prevalence in the world's population, there is currently no established medical treatment for core deficits in ASD. To enhance diagnostic accuracy and develop improved treatments, there is a substantial need for dissecting ASD heterogeneity, including variations in developmental stage, immunological effects and metabolic status. Identifying biological abnormalities in ASD, facilitated by an animal model demonstrating human ASD-like social behavior, is essential for comprehending pathogenesis and developing pharmacological treatments. This study aimed to establish ASD symptom assessment and biomarkers using an ASD model marmoset induced by prenatal valproic acid (VPA) exposure. Similar to other animal models of ASD, the VPA marmosets displayed significantly higher home cage activity, particularly during the first hour after waking. Daily home cage activity positively correlated with increased salivary cortisol levels collected 30 minutes after waking. Findings from the reversal learning task indicated that ASD model marmosets exhibit accelerated skill acquisition but tend to adhere to previous learning. To assess autistic-like behaviors in marmoset childhood, we analyzed the time spent gazing at other individuals, revealing a significantly longer duration of social gazing in the control group compared to ASD model marmosets at the age of three months. In a longitudinal study involving the same animals, deficits in social attention in childhood correlated with ASD-like social disturbance and inflexible behavior in adulthood. These results, derived from experiments in both adult and infant marmosets, pave the way for targeted therapeutic interventions, ushering in a new era of personalized medicine for ASD tailored to individual neurobiological profiles.

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Preregistration: Impact of childhood social stress on drug effects in young people entering residential treatment for substance use problems

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Keywords: Social stress; childhood; early-life; reward; substance use

Early-life interpersonal stress is significant and socially-oriented environmental exposure with enduring impacts on neurodevelopment, and a major risk factor for addiction. One mechanism supported by preclinical and human experimental research is a heightened sensitivity to the rewarding effects of drugs after early interpersonal stress. Using novel data, we examine the impacts of early interpersonal stress on positive and negative drug experiences – including socially-oriented experiences – among young people in residential treatment for substance use problems. We take a latent-class, data-driven approach to understand how different positive and negative drug experiences co-occur, leading to different 'experience profiles'. This will be followed by understanding whether early interpersonal stress is associated with a specific response profile/class, and whether these are associated with later substance use. The findings of these analyses will uncover the impacts of early interpersonal stress on social, cognitive, physical, and mental drug experiences that could lead to susceptibility to addiction.

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Social stimulus generalization in animal models for schizophrenia

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Keywords: rat, schizophrenia, social novelty recognition

Schizophrenia is a psychiatric disorder with symptoms such as hallucinations, delusions, social withdrawal, and cognitive dysfunction. Many studies have been conducted using rat models to elucidate the mechanisms of schizophrenia.
However, it has been considered difficult to imitate delusions, which are one of the important symptoms of schizophrenia, in rat models due to the less complex cognition and brain information processing of rats compared to humans. Excessive social generalization is the simplest form of delusions. It means that value information assigned to one individual is also assigned to other individuals. In rats, excessive social generalization may lead to difficulty in recognizing social novelties. The purpose of this study was to investigate whether rats modeling schizophrenia develop deficits in social novel recognition, which can lead to delusions in humans with schizophrenia. Changes in social preference, social novelty preference, and social novelty recognition in schizophrenia model rats and healthy control rats were measured weekly from 8 to 11 weeks old using a 3-chamber test. The EGF-treated group showed social preference and social novelty preference at 8 and 9 weeks old, but these decreased at 10 and 11 weeks old. Notably, social preference was significantly lower than that in the saline-treated group.
On the other hand, social novelty recognition in the EGF-treated group decreased after 9 weeks old, and was smaller than that in the saline-treated group at 9 and 10 weeks old. These results confirm that the EGF-treated rats showed a decrease in social novel recognition ability, i.e., excessive social generalization, which occurred earlier than the changes in other social characteristics. This study demonstrates that animals can exhibit primitive delusions, contributing to research on delusions using animals.

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The brain structural difference related to grandparenting in healthy seniors : The interaction with biological sex

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Keywords: Grandparenting, Parenting, Caregiving, Cortical Thickness, Parenting Brain

Changes in social structures have led to the increase of the male parenting, and the grandparents are also taking on a more active role in parenting. Parenting is known to change both the structure and function of the brain. However, little is known about the effects of grand-parenting on the brains of seniors. This study investigates the effect of grandparenting on brain via adopting healthy community cohort (KoGES) of seniors. The cortical thickness of seniors who are living with their grandchildren is compared to those are not. The result revealed an interaction between grandparenting and biological sex in the bilateral primary somatosensory cortex. Especially, Males living with grandchildren have grater graymatter thickness in the left somatosensory cortex (3b, HCP-MMP1 nomenclature). The primary somatosensory cortex is known to involves the astute attention toward caretake and social vocalizing while parenting. Although the cross-sectional nature of study and indirect measurement of caregiving limit the generalizability of the findings, the results are particularly significant in light of previous studies that have reported alterations in cortical thickness in parents, suggesting a continued impact of caregiving roles on brain structure even in later life.

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Sex-specific differences in behaviour after exposure to microplastics in the marine medaka Oryzias melastigma

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Keywords: Microplastic pollution; polystyrene microparticles; open-field test; behavior; sex-differences; Oryzias melastigma

Organisms face increasing risks as a consequence of exposure to various forms of pollution, with adverse health repercussions. Among the emerging pollutants, microplastics (MPs, particles smaller than 5 mm) have garnered significant attention due to their widespread presence in diverse environments and exposure routes. However, the precise consequences of MP exposure on organisms remain uncertain, with studies showing the possibility of these particles being translocated across biological membranes and reaching the central nervous system by crossing the blood-brain barrier. In the present study, we aimed to investigate the effects of microplastic exposure on behavior using the marine medaka Oryzias melastigma as a model species. Adult males and females were exposed to 1 mg/L of polystyrene MPs (PS-MPs) either with 0.5 µm or 1 µm for 21 days, and their behaviour assessed on the last day using the open-field test. Overall, females had a smaller body length and body weight when compared with males, but no differences arose within sex due to MP exposure. Fish exposed to MPs did not differ statistically within sex when analysing their behaviour for PS-MP-0.5 and PS-MP-1 and, hence, were grouped for subsequent analyses with the control treatment. Females exposed to MPs were more active (measured as the total distance travelled) than exposed males, while exposed males spent less time in the open area of the tank when compared to control males but similar to both female treatments. These results point to sex-specific changes in behaviour in response to MP exposure in the marine medaka that should be considered in future studies. Further work will focus on determining which organs and tissues these particles are translocated to from the gut and possible changes in gene expression at the neurogenomic level.

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Calcium signaling in the nucleus accumbens during social interactions in male and female Syrian hamsters

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Keywords: Syrian hamsters, sex differences, nucleus accumbens, fiber photometry calcium signaling

The rewarding properties of social interactions are critical for the expression of adaptive social behaviors, and the development and maintenance of beneficial social relationships. The nucleus accumbens (NAc) encodes reinforcement for social behaviors and calcium is a biomarker of neuronal activity. This study investigated changes in calcium signaling in the NAc in male and female Syrian hamsters from their first social experience compared to subsequent social interactions, i.e. the effects of repeated brief social experiences on calcium activity. This experiment tests the hypothesis that repeated social experience potentiates calcium signaling in the NAc. Ault male and female Syrian hamsters were single housed and injected with a virus containing a calcium indicator (AAV5-hSyn-Soma-jGCaMP8f) and a fiber optic cannula into the NAc. Four weeks later, males and females underwent four days of testing in which they experienced a 10-min interaction with a smaller male stimulus hamster. Both male and female Syrian hamsters naturally establish dominant-subordinate relationships. With repeat social experience, there is a decrease in the latency to initiate an aggressive interaction ($p < 0.050$), a social behavior shown to be rewarding. There is also an increase in the area under the curve (AUC) and peak height in calcium during the first 5 sec of the initiation of a social interaction, compared to the 5 sec just before the initiation of the interaction, in male and female Syrian hamsters ($p < 0.050$). As hypothesized, with repeat social experience there is a further potentiation of calcium signaling for the initiation of a social interaction compared to signaling during prior tests ($p < 0.050$). These studies suggest that social experience results in a potentiation in synaptic communication between neurons in the NAc in males and females. Future studies will increase sample sizes to allow analysis of sex as a factor, investigate the role of glutamate from the prefrontal cortex on this calcium signaling and social reward, and dissociate the role of the direct versus indirect circuits in the NAc in males and females. Advancing understanding of sex differences in social reward will advance understanding of sex differences in the susceptibility of psychiatric disorders such as autism and social anxiety disorder.

Transcriptional bases of different social bonds

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Keywords: relationships, bonding, single nucleus RNA-seq

Different types of relationships require different sets of behaviors to support them. For instance, friendships and romantic relationships encompass some shared behaviors and some unique behaviors. To identify the cell type-specific gene expression changes that support relationship-appropriate behaviors, we used socially monogamous prairie voles, which form same-sex (peer) bonds and mixed-sex (mate) bonds akin to human friendships and romantic relationships, respectively. We used single nucleus RNA-sequencing (snRNA-seq) to examine transcription in the nucleus accumbens (NAc), a brain region critical for reward behavior and social bonds, in peer- and mate-paired female and male prairie voles. We found that, compared to peer-paired females, mate-paired females have a higher proportion of dopamine receptor D1 neurons expressing prodynorphin (Pdyn) and dopamine receptor D2 neurons expressing proenkephalin (Penk). Using a gene module analysis, we also found that genes related to microglial activation and neuronal development were higher in peer-paired females compared to mate-paired females. The more pronounced effect we see in females may be due to the profound physiological changes required to support reproduction in females relative to males. Together, our data support the hypothesis that unique transcriptional states support different types of social bonds, and may facilitate relationship-appropriate behavior.

Session: 2. Poster Board: 69

Loneliness Syndrome of Youth : Concept Mapping

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Keywords: loneliness syndrome, Conceptual mapping, Youth,

The purpose of this study is to explore the experiences and perceptions of loneliness syndrome, symptoms of loneliness syndrome, and coping-related factors in young people in their 20s and 30s after the end of COVID-19 to inductively conceptualize and develop a theoretical model. To this end, we intend to apply and interpret the theory of evolutionary theory (ETL) of loneliness. In Professor Cacioppo's ETL theory, the perception of socially isolated organisms automatically signals to an environment where they are unlikely to consider social interactions classified as mutual benefits or altruism when considering evolutionary suitability. As a result, these organisms are likely to exhibit selfish behaviors classified in terms of evolutionary suitability.

For the specific research process, we would like to first collect qualitative data using the conceptual map method known to be suitable for exploratory research, and present a picture by visualizing it through quantitative analysis. 1) We would like to conduct a brainstorming meeting in groups of men and women, mild symptoms, and serious symptoms. 2) We would like to organize the statements produced in each group and have a research team of five experts classify the statements in an integrated manner. 3) The collected qualitative data are quantitatively analyzed using multidimensional scaling and cluster analysis, and 4) the results classified by the research team are given a cluster name in consideration of previous studies and the theory of evolution of loneliness (ETL) to complete the schematic diagram of the conceptual map.

I hope that this study will be meaningful as it provides a comprehensive measure of loneliness syndrome, symptoms of loneliness syndrome, and coping factors for young people in their 20s and 30s. I believe that the use of such a concept, which is relatively easy to apply in the community, can gradually resolve seclusion and isolation and help understand the current situation.

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A single 60-minute exposure to alcohol impairs the social behavior of adult zebrafish.

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Keywords: Social behavior, shoaling, alcohol and zebrafish.

Social experiences are paramount to our quality of life. A number of clinical conditions like fetal alcohol spectrum disorders or autism spectrum disorder are marked by social deficits which impact quality of life for these individuals. Thus, understanding the biological mechanisms of social behavior is very important. Zebrafish are naturally social animals that organically combine in multimember groups called shoals, have a large genetic toolbox, share a basic brain layout and chemistry with mammals. Identifying a substance that can either enhance or disrupt a behavior is an approach that can be used as the first step in characterizing the mechanisms responsible for the behavior in question. Alcohol is a substance that is known to interact with social behavior in humans and zebrafish. The goal of our study was to characterize the effect a single 60-minute exposure to 1% ethanol had on adult social behavior using a highly reproducible behavioral paradigm that we developed. Briefly, using automated tracking software, we characterized the shoaling response of fish with and without acute ethanol exposure. Our results show that between groups there was no difference in the total distance moved, however there was a significant difference in the distance to stimulus and in the amount of time fish spent in proximity to a social stimulus. Our results provides evidence supporting our behavioral paradigm and demonstrates its effectiveness in detecting alcohol induced social deficits. Furthermore, our results show that alcohol is a substance that interacts with social behavior which can potentially be used in the future to characterize the biological mechanisms associated with social behavior.

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Neurocircuitry of the oxytocin-oxytocin receptor system in rats facilitating attachment formation to human hands

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Keywords: oxytocin receptor, attachment, pleasant sensation

During their postnatal period, rats engage in lively rough-and-tumble play with siblings, fostering sociability evident through 50 kHz ultrasonic vocalizations (USV), indicative of pleasure. While rats usually avoiding human hands, intentional handling mimicking the rough-and-tumble play during their juvenile period triggers 50 kHz USV and instigates an increased affinity for human hands. Previous studies have reported the close correlation between oxytocin and the enhancement of sociability in rats. However, the precise mechanism by which oxytocin facilitates attachment formation, particularly in relation to the sensation of pleasure, remains unclear. Thus, we investigated the role of the oxytocin-oxytocin receptor (OTR) system in the formation of attachments in juvenile rats subjected to repeated handling simulating rough-and-tumble play. Our analysis, conducted using genetically modified OTR-eYFP rats, revealed an increased OTR expression in the ventromedial hypothalamus ventrolateral part (VMHvl) and the nucleus accumbens, accompanied by an increase in c-Fos expression. Furthermore, chemogenetic inhibition of specific OTR-expressing neurons in the VMHvl resulted in a decrease in attachment-like behaviors towards human hands. This reduction encompassed a decrease in the emission of 50 kHz USV during handling and a diminished affinity for human hands. These results suggest, in rats, that the pleasant sensation induced by handling plays an important role in attachment formation, achieved through the activation of OTR neurons in the VMHvl. Here, we propose the release of oxytocin from axonal varicosities en route to the posterior pituitary, diffusing widely and potentially modulated through en passant volume transmission—a non-synaptic oxytocin release mechanism in the VMHvl.

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A comparative analysis of theory of mind computations in large language models and single neurons in the human brain

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Keywords: Theory of Mind, single neuron, human brain, large language model

Theory of Mind (ToM) is a core foundation of human social cognition that enables us to form detailed inferences about the hidden thoughts, beliefs, and perspectives of others, and to understand that another's beliefs may be false and distinct from one's own. This complex cognitive capability is sub-served by activities from several interconnected brain areas in the frontotemporal cortices, including single neurons in the dmPFC that have been shown to directly change their firing rates in response to the perspective of others. While Large Language Models (LLMs) have recently displayed the capacity for ToM and have surpassed that of earlier artificial models, the precise processes through which this ability emerges and how it may relate to biological processes in the human brain are unknown. Here, we employ a novel 'parallel task' methodology to investigate the process by which recently developed LLMs form representations of others' beliefs and how they compare to those of single neurons in the human brain. Our analysis reveals that hidden embeddings in the LLMs encode others' beliefs across widely varying naturalistic scenarios, and that those representations can be accurately decoded from the LLMs' middle layers. Further, we show that trial-by-trial variations in the LLMs' embeddings are closely aligned to those of human neuronal activities in participants performing the same ToM tasks and that their ToM capacity can be explained, in part, by sparse single units (i.e., artificial embeddings in LLMs and single neurons in humans) tuned to reflect others' beliefs. The proportion of such belief-tracking embeddings correlates with ToM performance and is significantly higher in larger LLMs. Together, our findings offer initial evidence for a parallel between the activities of neurons in the human brain and the artificial models underlying ToM capability, which provides an alternative perspective on the neural computation of human social cognition and its dysfunctions.

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Neural computations underlying pragmatic reasoning in referential communication

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Keywords: referential communication, theory of mind, fmri

Human communication can be understood as a process of a speaker encoding thoughts into words and the listener decoding words back into thoughts. The ability to understand others' intended meaning and infer conclusions beyond what they say is crucial for smooth communication. The process to give a unique interpretation of an utterance that is appropriate to the conversational context, known as pragmatic inference, has long been hypothesized to rely on the flexible and efficient use of language in context (Grice, 1975). The ability to attribute independent mental states to explain and predict others' behavior, referred to as theory of mind (Wimmer & Perner, 1983), plays an important role in the formation of linguistic conventions and social communications (Goodman & Frank, 2016; Grice, 1975; Mi et al., 2021). Based on the Gricean ideas that the speaker and listener are cooperative and rational, researchers recently proposed a rational speech act (RSA, see Fig. 1A) computational framework using Bayesian inference to provide quantitative predictions for language understanding (Frank & Goodman, 2012).

Here, we aimed to assess the potential individual differences in pragmatic reasoning at both behavioral and neural levels by adapting the general computational mechanisms in the RSA model (Frank & Goodman, 2012; Franke & Degen, 2016). Specifically, we focused on a heterogeneous model that can accommodate the probabilities of individual differences in three types of pragmatic reasoning (level-0, level-1 and level-2 ToM-reasoners) as previous studies had shown that individuals had limited theory of mind reasoning capacities in strategic rational thinking (Coricelli & Nagel, 2009; Zhen & Yu, 2021).

Using a reference game combined with model-based functional magnetic resonance imaging (fMRI) to test 29 participants' inference abilities, we showed that an individual-level pragmatic inference model was a better predictor of listeners' performance than a population-level model. Our fMRI results (Fig.2) showed that Bayesian posterior probability was positively correlated with activity in the ventromedial prefrontal cortex (vmPFC) and ventral striatum and negatively correlated with activity in dorsomedial PFC, anterior insula (AI), and inferior frontal gyrus (IFG). Importantly, individual differences in higher-order reasoning were correlated with stronger activation in IFG and AI and positively modulated the vmPFC functional connectivity with AI. Our findings provide a preliminary neurocomputational account of how the brain represents Bayesian belief inferences and the neural basis of heterogeneity in such reasoning.

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Predictability alters information flow during action observation in human electrocorticographic activity

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Keywords: predictive coding, mirror neuron, anticipation, active inference, feedback, top-down, action understanding, prediction, premotor

The action observation network (AON) has been extensively studied using short, isolated motor acts. How activity in the network is altered when these isolated acts are embedded in meaningful sequences of actions, remains poorly understood. Here we utilized intracranial electrocorticography (ECoG) to characterize how the exchange of information across key nodes of the AON - the precentral, supramarginal and visual cortices - is affected by such embedding and the resulting predictability. We found more top-down beta oscillation from precentral to supramarginal contacts during the observation of predictable actions in meaningful sequences compared to the same actions in randomized, and hence less predictable, order. In addition, we find that expectations enabled by the embedding lead to a suppression of bottom-up visual responses in the high-gamma range in visual areas. These results, in line with predictive coding, inform how nodes of the AON integrate information to process the actions of others.

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Observer-agent kinematic similarity modulates neural activity in regions of the action observation network

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Keywords: Action understanding, mentalising, action-observation network, fMRI, predictive processing

Body movement conveys important information about agents' internal states, such as their emotions or intentions. But how do humans use body movement cues to understand others? A growing body of behavioural and neuroimaging work suggests that we map observed actions onto our own motor system to successfully interpret others' movements, and that movement similarity between an agent and observer facilitates accurate inferences about the agent's internal state. A network of frontal, parietal and occipitotemporal regions, termed the action-observation network (AON), is presumed to subserve this coupling between action observation and -execution. However, it is currently unclear how exactly the AON supports action understanding and how movement similarity modulates putative motor mapping processes.

We used a well-established Theory of Mind task and fMRI to investigate whether regional blood flow in AON regions during mentalising is modulated by movement similarity. 31 participants first created their own animations of interacting triangles, depicting three mental state words, while their finger movements were recorded. Subsequently, individuals viewed animations created by an independent sample, which varied in the degree of kinematic similarity between animator and observer, while undergoing fMRI scanning. ROI analysis revealed a parametric decrease of neural activity within the right angular gyrus with increasing movement similarity. FWE-corrected whole-brain analyses additionally revealed a decrease in bilateral insular activation along with movement similarity. Results are in support of a predictive processing view of action understanding, wherein observers invert a generative model linking their own actions to affective outcomes to infer the internal states underlying others' actions.

Representation of behaviour of other idividuals: A novel task in preschool children

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Keywords: Theory of Mind, Children, Ontogeny

The ability to predict the behaviour of other individuals is highly adaptive and develops in early childhood.
Here, we want to introduce a novel behavioral test in which children anticipate the behavior and choices of their peers or experimenters. In this test, the first individual chooses among several options that include a small or larger reward. The child being tested makes the second choice, knowing that the first individual has already made his or her choice. We assume that if the child can make a representation of the behavior of another individual, he or she will choose the smaller reward - assuming that the first individual has already chosen the larger reward..
We tested 35 children (aged 4-6 years) and looked at whether performance on this test correlated with performance on other cognitive tests, e.g., the Saly-Ann test, the Emotion Expression Recognition Test, and Memory tests („Episodic-like Memory Test, Sentence Repetition Task“).

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Introducing an open dataset to examine single-dose intranasal oxytocin effects in healthy younger and older adults

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Keywords: Open science, fMRI, neuropeptide

Oxytocin (OT) is a neuropeptide critically involved in social cognition and behavior. Intranasal administration of OT has modulatory effects on both the brain and behavior with the potential for therapeutic benefit perhaps especially in individuals with deficits in socioemotional functions. The effects of intranasal OT on social behavior and cognition have been well-investigated in younger adults as well as in some clinical populations (e.g., autism, schizophrenia), but comparatively less is known about OT function in older adults. To foster more research on OT and aging, the following dataset was made publicly available and includes data from generally healthy younger (n = 44, age range = 18-31 years [M(SD) = 22.4 (3.0)], 48% female) and older (n = 43, age range = 63-81 years [M(SD)= 71.1 (5.3)], 56% female) adults who self-administered a single dose (24 international units) of either intranasal OT or a placebo (IND100860; NCT01823146) in the context of a study on oxytocin and aging. The study adopted a randomized, double-blind, between-subject design. The dataset consists of anatomical and functional resting-state neuroimaging scans (eyes open) acquired after nasal spray administration as well as study-specific phenotypic and demographic data. This dataset using OT administration and neuroimaging is unique in its size and inclusion of both younger and older adults as well as women and men. This data has resulted in published work on OT modulation of cognition, behavior, and neural activation/connectivity. Open access to this data will provide the scientific community with the opportunity to investigate individual differences in the neurocognitive effects of single-dose intranasal OT in younger and older adults.

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Validation of an innovative task to assess decision making in bribery situations

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Keywords: Personal-social decision-making, bribery, neuropsychological process

1. Personal-social decision-making in humans is a neuropsychological process dependent on neurobiological resources, psychological development and from the sociocultural environment in which people develop. The objective of this work was to validate a decision-making task modeling a bribery situation with applicability for neuroimaging studies. For it, 40 economically active people between 25 and 58 years old performed the experimental task, which consists in matching to sample choices with three matching options: color, shape and a non-relatable one. The task involves two players. Participant must follow the rule of matching by color to obtain a standard gain shared with the other player, control condition. The experimental condition is builded when virtual player invites participant to break the rule in order to obtain a higher gain, breaking the rule now consists in matching by shape instead of color (taking the bribe). The obtained gain is substracted from the support to a foundation that appears as an affected third party. The findings indicate that shape matching is 1.9 times more likely when associated with bribe. Response times are higher in choice by shape (accept bribe) and are lower when choosing by color (resist bribe) with respect to control condition. Finally, participants execute moral judgements to those choices made by color or shape during this task. Thus, this task can be a useful experimental tool for the study of social decisions.