CHEN TIANQIAO & CHRISSY INSTITUTE

Name **2025 NeuroPSI** - Chen Institute Joint Conference on Brain, Behavior & Beyond
Date **May 19-20, 2025**
Location **France**

Chen Institute Science Writers Fellowship

Meeting Report

2025 NeuroPSI – Chen Institute Joint Conference on Brain, Behavior & Beyond

NeuroPSI is the joint Neuroscience Institute of the CNRS and Université Paris-Saclay, the leading science-focused University in France. The 25 teams / 250 people of the institute aim to understand the organization and operation of the neural circuits that control behavior using multidisciplinary and multi-scale approaches.

This year we had the privilege to attend the third annual NeuroPSI- Chen Institute Joint Conference on Brain, Behaviour, and Beyond. The event was hosted by the Paris-Saclay Institute of Neuroscience (NeuroPSI) and generously funded by the Tianqiao & Chrissy Chen Institute (TCCI). The conference's topics spanned complex social behavior, its brain substrates and communication processes ranging from animals to machines. The breadth of ideas and data presented was inspiring. The event was attended by both young scientists and leading researchers from different countries sharing their innovative work. The symposia featured international speakers, as well as short selected talks and poster sessions allowing early-career researchers the space for networking and exchanging ideas.

Day 1: Social Cognition and Adaptive Behavior

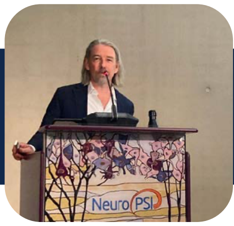
The first day included six plenary talks and three short talks, divided into two sessions, as well as a poster session during the break between them. Social cognition and adaptive behavior were discussed in the context of redent models, human studies and human-robot interaction. The psychiatric and neurological research that was presented proposed therapeutic possibilities.

Day 2: Communication and Language

The second day included six plenary talks and three short talks, divided into two sessions, as well as a poster session during the break between them. The topic of communication and language was presented through a wide lens of animal models: from Primates and pinnipeds, through songbirds to fruit flies. AI language models and their connection to cerebral processes were, of course, also discussed.

Day 1 – Social Cognition and Adaptive Behavior

Session 1 -
Social Cognition and Emotion



2025 NeuroPSI – Chen Institute Joint Conference on Brain, Behavior & Beyond

Dr. Christian Keysers – Netherlands Institute of Neuroscience, Netherland

A Cross-Species Approach to the Neural Basis of Empathy and Prosociality

Professor Christian Keysers opened the session asking - How do the experiences of others move us? And more specifically - where in the brain of humans does this reaction happen?

This talk explores the biological roots of empathy—our capacity to feel and respond to the emotions of others—across species. Using a combination of human neuroimaging and animal models, the research shows that observing others in distress activates similar brain regions as when we experience those emotions ourselves, particularly the anterior cingulate cortex (ACC) and insula.

In humans, witnessing others' actions, sensations or emotions (e.g. pain, disgust) triggers motor and sensory areas in the brain, suggesting that we internally simulate others' experiences. However, Prof. Keyser asks - Does this mirroring brain response explain empathy?

Animal studies, specifically in rodents, found that observer rats freeze in response to witnessing a conspecific in pain, a reaction that grows bigger after observers also experience shock - meaning, rats show emotional contagion. An interesting finding is that the freezing/fear reaction lowers in the shocked rats, if observers are less distressed - that is, also calmness, not just stress, can be transferred between the peers, and the demonstrator is affected by the observer as well.

Neural recordings in rodents show similar findings to humans: they reveal overlapping brain activity for observed and experienced pain. Silencing ACC activity in rodents impairs this emotional contagion without affecting direct fear responses, highlighting its role in social emotional processing.

What about the emotions of rats? Emotional contagion helps to react to the environment by using the information of other animals. For example, rats learn about locations where bad/good events occurred from observation, as shown by their place-neurons activity.

These shared mechanisms may have evolved from parental care systems and now support group survival through social buffering and prosocial behavior. Notably, some rats avoid harming others when given the choice, suggesting empathy can influence actions toward peers. However, individual differences in rats and studies of psychopathy in humans reveal that empathy can be present but not always engaged— suggesting it is a flexible, controlled process.

By integrating findings from humans and animals, this work demonstrates that empathy has deep evolutionary roots, is grounded in shared neural circuits, and plays a central role in both emotional resonance and social behavior.

Dr. Ewelina Knapska – Nencki Institute of Experimental Biology, Poland

Emotional Echoes: How Negative and Positive Emotions of Others Shape Environmental Adaptation

Professor Ewelina Knapska's research demonstrates that emotions such as fear and joy can spread between individuals and influence behavior through shared neural mechanisms, even in rodents. Animals are highly sensitive to the emotional states of others: for example, rats observing a stressed or fearful peer become agitated themselves, despite not being harmed. Brain scans show that these responses activate the same fear-related circuits—particularly in the amygdala—that are used during firsthand experiences.

The brain also distinguishes the immediacy of threats. When danger is near, rats freeze; when it's distant, they explore. These distinct behaviors are controlled by separate neural circuits, which can be experimentally manipulated to alter the animal's response. Remarkably, emotions can cross species lines: rats that bond with a human will show fear and avoid the person's hand if the human appears frightened, activating similar fear circuits.

Positive emotions spread too. Mice are drawn to the scent of peers who recently received rewards like sugar water. This preference is stronger in dominant mice, suggesting social status influences responsiveness to emotional cues. Additionally, memory plays a role: mice can remember and seek out locations where others have eaten, even if they haven't eaten there themselves. This is supported by activity in memory-related brain areas such as the hippocampus. When key circuits are blocked, mice lose interest in these social cues and rewards.

In summary, Prof. Knapska's work reveals that emotions are powerful social signals. They are processed by conserved brain systems and shape behavior, memory, and social interaction. Emotional contagion and social learning are not unique to humans—they help animals adapt, survive, and thrive in complex social environments.

Dr. Jacqueline Clauss - Maryland Psychiatric Researcher Center, USA

Mapping Fear Generalization as Risk for Psychiatric Disease

Professor Jacqueline Clauss explores how the brain learns fear and how this process may go awry in individuals at clinical high risk for psychosis (CHR-P). Her research centers on fear generalization—the tendency to extend fear from a specific threat to similar but non- threatening situations. While some generalization is adaptive, excessive or impaired fear discrimination can contribute to anxiety, paranoia, and social withdrawal.

CHR-P individuals, who may experience early symptoms like hallucinations, paranoia, emotional detachment, and difficulty interpreting emotions, represent about 3% of the youth population. Yet only around 20% of them go on to develop full psychotic disorders. This highlights the need for more accurate diagnostic tools beyond clinical interviews.

To uncover the mechanisms behind this vulnerability, Prof. Clauss's team uses behavioral tasks and brain imaging. In fear-conditioning experiments involving faces that gradually change in appearance, participants learn to associate certain faces with mild electric shocks. Healthy individuals typically show reduced fear as the faces become less similar to the threatening one. However, CHR-P participants struggle to distinguish between threatening and safe cues—both behaviorally and neurologically.

Brain scans reveal altered activation in areas like the anterior insula and frontal cortex in high-risk individuals, especially those with more severe negative symptoms such as emotional flatness and social disinterest. These findings suggest that abnormal fear learning and generalization may underlie core aspects of psychosis risk. Prof. Clauss's work aims to identify early neural and behavioral markers of vulnerability, which could help refine early detection strategies and inform new therapeutic targets—not just for treating symptoms, but for addressing the underlying brain processes before full illness develops.

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Dr. Marion Rivalan - Paris-Saclay Institute of Neurosciences, France

Short Talk: Mouse Aggression and Socialization in the Home Cage: A Role for Central Serotonin

PDoctor Marion Rivalan's research investigates how brain serotonin regulates aggression and social behavior in mice, highlighting its essential role in maintaining social balance and emotional control. Serotonin, a neurotransmitter involved in mood and behavior, has been shown to be critical for adaptive aggression and social communication. While aggression can be beneficial for defending territory or establishing dominance, it must be context-appropriate and regulated to preserve group cohesion.

Dr. Rivalan' talk focused on mice genetically modified to lack the enzyme TPH2, which is necessary for serotonin synthesis in the brain. Although these knockout mice still produce serotonin in the body, they lack it in the central nervous system. As a result, the mice displayed impulsive and excessive aggression, especially toward unfamiliar peers, and showed significant deficits in social behaviors like sniffing and grooming—key elements of mouse communication.

In a naturalistic group setting with burrows, tunnels, and food zones, the serotonin-deficient mice were hyperactive, particularly at night, and preferred staying near food areas instead of resting in communal spaces. They also initiated more frequent and intense fights and had difficulty disengaging from conflict. Although social hierarchies eventually formed, they took longer to stabilize and involved more violence. Furthermore, these mice struggled to recognize familiar group members outside of the test environment, pointing to impaired social memory. This work further indicates that while serotonin is not strictly required for establishing dominance, it is crucial for maintaining a stable and functional social hierarchy. When serotonin is lacking, group dynamics become disorganized and more conflict-prone. Overall, the findings show that central serotonin is essential not only for controlling aggression but also for supporting social recognition, communication, and the long-term stability of social groups.

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Dr. Diane Picard - Sorbonne University, France

Short Talk: Effect Of Smile Impairment in Facial Emotion Perception

Bell's Palsy is a facial nerve disorder that impairs voluntary muscle control, often resulting in asymmetric or restricted smiles. This condition has significant emotional and social consequences, as facial expressions—especially smiles—are central to emotional communication, empathy, and social interaction.

PhD candidate Diane Picard's talk highlighted how smile impairment disrupts embodied cognition, a process where shared neural networks and automatic mimicry (e.g., facial expressions, body posture, and eye contact) facilitate emotional contagion and recognition. Patients with Bell's Palsy often struggle to perceive and mimic others' emotions, particularly positive ones. Smile asymmetry is directly associated with decreased ability to recognize joy in others and increased feelings of social isolation and anxiety. Misinterpretation of facial expressions is common— others may read an impaired smile as anger or contempt—leading to awkward or negative social interactions. This feedback loop further erodes patients' sense of connection and emotional well- being.Research suggests that effective treatment should extend beyond physical rehabilitation to include emotional and social retraining. Improving smile symmetry (e.g., through facial nerve surgery or targeted exercises) enhances emotional recognition and reduces anxiety. Therefore, rehabilitation should integrate interventions that restore facial feedback mechanisms and retrain emotional perception, helping patients regain not only motor function but also emotional and social competence.

Day 1 – Social Cognition and Adaptive Behavior

Session 2 - Social Decision Making

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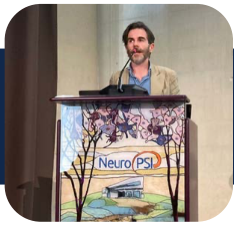
Dr. Sylvie Granon - Paris-Saclay Institute of Neurosciences, France

Interplay Between Social and Non-Social Decision-Making

Professor Sylvie Granon's research investigates how animals, particularly mice, make decisions under uncertainty, offering insights into the neural and behavioral mechanisms that shape risk-taking and social choices. Even in genetically identical mice raised in the same conditions, individual differences emerge in decision style, suggesting that personality-like traits can arise naturally and influence behavior.

In one set of experiments, mice faced choices between familiar options and uncertain, potentially rewarding ones—similar to human gambling tasks. Some mice consistently preferred risky options, while others were more cautious. These tendencies were tied to activity in decision-related brain areas such as the prefrontal cortex and dopamine pathways. Notably, environmental factors like sugar or artificial sweeteners altered these behaviors: sugar increased risk-taking and slowed decisions, while sweeteners sped up responses but reduced behavioral flexibility. Social context also played a key role. Mice normally prioritize exploration over social contact, but social isolation changed their preferences, showing how internal state can shift decision priorities. Neural recordings showed increased activity in the prelimbic cortex (PRL) during social interactions, while lesions or receptor disruptions in this region unbalanced social and exploratory behavior, indicating monoaminergic involvement in uncertainty processing.

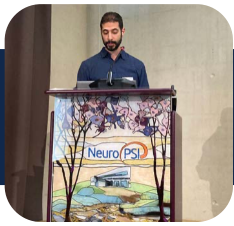
Different decision types—risky, safe, or mixed—activated distinct neural circuits in the prefrontal cortex, including the PRL, nucleus accumbens, and orbitofrontal cortex. Factors like sleep deprivation, sugar intake, and receptor function altered neural activation in these areas and influenced decision speed, flexibility, and strategy learning. Overall, Prof. Granon's research reveals that decision-making depends on a complex interplay between brain circuits, neurochemistry, and experience. Both social and non-social decisions are shaped by how the brain processes risk, uncertainty, and reward, highlighting the delicate balance between internal states and external influences in shaping behavior.



Dr. Diego Scheggia - Milan University, Italy

Neural Circuits for Social Decision Making

Dr. Diego Scheggia's research explores how mice make prosocial choices—like sharing food—and how observation, effort, and brain circuits shape these behaviors. Mice were placed in a version of the "dictator game," where one mouse (the actor) could choose to share a reward with another (the recipient) or keep it all. About 70% preferred to share, but only when they had social contact. When a divider blocked visual cues, sharing behavior decreased, showing that direct observation—not just smell or sound—is necessary. Prosocial choices came at a cost: mice had to make more effort to share. Male mice were more willing to pay this cost, while females tended to switch to selfish choices sooner. Over time, even initially prosocial mice became more selfish, showing that social decisions shift with experience and effort. Mice that watched others performing the task were able to learn by observation. These observer mice developed similar prosocial preferences—even if they had never done the task themselves. However, when they could not see the demonstrator, this observational learning disappeared. Behavioral automated tracking showed that observers looked more at prosocial demonstrators, and this attention correlated with better learning. Key brain areas involved include the prefrontal cortex (PFC), basolateral amygdala (BLA), and the dorsal CA1 region (dCA1) of the hippocampus. Silencing dCA1 during the observationphase blocked learning, while silencing it later had no effect, proving its role in forming—but not executing—social decisions. Using light-based stimulation, researchers could even bias mice to act more prosocially or selfishly by mimicking dCA1 activity. In summary, Dr. Scheggia's research reveals that mice can learn prosocial behavior by watching others, and that specific brain regions, especially dCA1, are essential for encoding these decisions. It highlights how effort, experience, and social cues shape helping behavior—not just in humans, but in animals too.

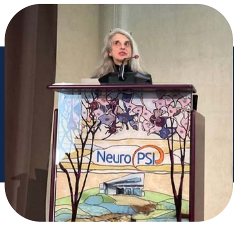


Dr. Marween Belkaid - Etis Lab - Cy Cergy Paris - Cnrs, France

Short Talk: Subjective Valuation from Individual Decision-Making to Joint Action

Joint action requires individuals to make decisions while considering their partner, involving sensorimotor coordination. In such contexts, subjective valuation plays a key role—decisions are not based solely on objective rewards but are shaped by context and individual tendencies. The presented research investigates how people evaluate rewards when acting jointly, using reinforcement learning paradigms with varying reward distributions (binary or trinary: low, medium, high). The goal was to understand if people consider their partner's outcomes during decision-making. In an experiment, pairs of human participants played a game where the first player's choice constrained the second's options. They were instructed to maximize total reward. Later, the same setup was used with a robot partner, which was reward-insensitive. Results showed that participants did not significantly change their strategy based on whether the partner was human or robot. However, three distinct social strategies emerged: antisocial (prioritizing own reward), neutral and prosocial (prioritizing the partner's or joint reward). Interestingly, similar patterns of social strategy appeared in both human-human and human-robot interactions, and even explicit instructions to collaborate did not strongly alter behavior.

Overall, the study shows that subjective valuation in joint action is context-dependent and that even if people do take partners into account, choices depend more on their individual strategy than the nature of the partner (human vs robot).



Dr. Lola Canamero- Etis Lab - Cy Cergy Paris - Cnrs, France

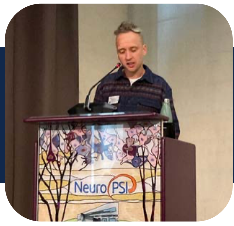
Emotion, Social Cognition, Decision Making and Communication: Where can Robots and Neuroscience Meet?

Professor Lola Canamero's research explores how robots can act as experimental tools to study emotion, decision-making, and social behavior—providing a controlled, flexible way to test neuroscience theories. Robots serve both as data collectors and as artificial "organisms" that help simulate emotional and cognitive processes, bridging robotics, neuroscience, and psychology. Although robots do not feel emotions, they can be programmed with internal models that mimic key emotional functions—such as motivation, urgency, and adaptation—through simulated systems akin to hormones or neurotransmitters. These artificial emotional states influence behavior and can be externally expressed through gestures or responses, enabling robots to display features like fear, attachment, or compulsivity. Such models allow researchers to study how internal states guide decisions or social behavior, and even replicate features of mental health conditions. For instance, robots exposed to stress may show grooming-like behaviors, mimicking biological responses to anxiety. Differences in "caregiver" interaction also shape a robot's development, with robots raised in more nurturing environments displaying more adaptive behaviors— mirroring human attachment and emotional learning. Robots have also been used in applied settings, such as teaching diabetic children how to manage care by looking after a robot's health.

These interactions offer insight into bonding, empathy, and responsibility. Ultimately, by giving robots affective systems and social experiences, scientists can explore how emotion-like mechanisms affect behavior, learning, and development. Prof. Canamero's work not only sheds light on human and animal emotion but could also inform new strategies in education, mental health, and human–robot interaction.

Day 2 – Communication And Language

Session 3 - Language



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Dr. Simon Townsend - Warwick University, Uk

Evolution of Syntax: Insight from Great Ape Communication

Where did human language come from? This research explores that question by looking at our closest animal relatives—chimpanzees and bonobos—to see if they share some of the same building blocks of communication that we use in language today.

Human language is made up of different parts—like words that carry meaning (semantics), grammar that helps us combine them (syntax), and the social context that shapes how we use them (pragmatics). One of the key abilities in language is putting sounds or words together to create more complex and meaningful messages. Professor Simon Townsend believes studying ape communication can shed light on human communication and language, as our closest relatives to a distant common ancestor. Comparative research of great apes can provide critical insights into the evolutionary origins of these linguistic components. To this end, scientists observed wild chimpanzees in the forests of Uganda. Chimpanzees use many different vocalisations to communicate things like danger, food, or asking for help. They are one of our two closest relatives and have a varied range of specifically meaningful calls. However, it is not clear if they use structures close to human syntax.

Can chimpanzees combine calls from their repertoire to create higher meaning ('syntax')?

Evidence from chimpanzees included a vocal repertoire comprising at least 15 call classes and 37 distinct call types, with statistically significant non-random call combinations occurring within short temporal windows. These combinations show compositional properties, as evidenced by playback experiments. In those experiments, the chimps paid more attention and reacted more strongly to the call combinations than to the calls alone—showing that they likely understood the combined meaning. This indicates comprehension of meaning beyond individual calls. Such findings imply the presence of proto-syntactic structures in the last common ancestor (LCA) of humans and great apes.

Testing bonobos - our other closest relatives

Bonobos are more collaborative than chimps and less territorial. Investigations in bonobos corroborate results found in chimpanzees, revealing that approximately 25% of their vocal production is compositional. Advanced analyses using distributional semantic approaches (e.g., Multiple Correspondence Analysis) show that calls produced in similar contexts cluster functionally, supporting the hypothesis that great apes possess foundational semantic structuring abilities.

Collectively, these data suggest that rudimentary syntax predates the emergence of fully developed human language. That is, the ability to combine sounds into meaningful messages—something at the core of human language—might not be unique to us. Instead, this ability may have existed in a common ancestor shared by humans, chimps, and bonobos millions of years ago. This might serve as the evolutionary substrate for the development of human syntactic communication.

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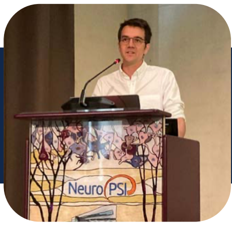
Dr. Adrien Meguerditchian - Centre De Recherche En Psychologie Et Neurosciences – Cnrs, France

The Origins of Human Language: Insight from Neuroethology of Gestural Communication in Nonhuman Primate

Where did human language begin? Recent studies of baboons offer compelling clues. Like human infants, baboons use purposeful hand gestures—such as reaching, pointing, or touching—to communicate with others. These gestures are intentional and flexible, often aimed at getting attention, requesting something, or initiating social interaction. This mirrors early human communication, which was also gesture-based before the emergence of spoken language. CNRS Senior scientist Adrien Meguerditchian's research also explores how baboons' brains support these behaviors. In humans, language is typically processed in the left hemisphere, especially in Broca's and Wernicke's areas. Similarly, baboons show left-hemispheric dominance for gesture use, particularly among right-handed individuals. Interestingly, arboreal primates tend to be more left-handed, while terrestrial species—like baboons—are more right-handed, aligning with broader evolutionary patterns. These brain asymmetries have been confirmed through various methods, including fMRI scans and biochemical markers. For instance, Broca's-like areas in baboons show structural and functional differences depending on handedness, suggesting an evolutionary continuity in how primates' brains support communication.

A key point in language evolution is the shift from egocentric gestures ("give me that") to triadic communication ("look at that!"), which involves shared attention and signals a developing theory of mind. This shift—from requesting to sharing—was likely foundational in the emergence of symbolic language. In summary, baboons not only gesture in ways similar to early humans, but their brains are also organized in ways that parallel our own. Dr. Meguerditchian' findings suggest that the roots of human language may lie in the gestural systems of our primate ancestors, supported by shared neural architecture and communication strategies.



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Dr. Jean Rémi King - Ecole Normale Supérieure – Meta Ai, France

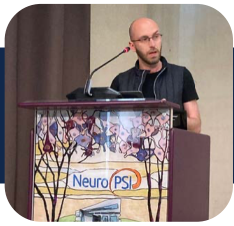
Towards A Neural Code for Language

Understanding how we make sense of language—from recognizing sounds to grasping full meanings—is a central goal of Neuroscience and AI research. In the human brain, this process unfolds step by step: We start by perceiving basic sound patterns, then identify words, and ultimately comprehend entire sentences. Key brain regions like the temporal lobe play an active role during this process. To better understand these mechanisms, researchers are increasingly comparing the brain's language functions with how artificial intelligence (AI) systems, like deep neural networks and models such as ChatGPT, process language. As explained by CNRS Junior Scientist Jean-Rémi King, despite fundamental differences between humans and machines, both appear to organize language processing hierarchically: simple sounds are handled in lower layers or regions, while more complex structures like syntax and meaning are managed higher up. Studies using fMRI and MEG have shown that different layers of AI networks resemble the brain's own layered language hierarchy. For example, comparing AI activations with brain scans using linear regression reveals correspondences between specific network layers and brain regions. This suggests that AI systems can model the brain's stepwise approach to language understanding.

Dr. Jean-Rémi King's research also examines how we produce language—whether through speech or typing. The brain seems to start with an overall idea, then form words, and finally produce the sounds or letters—a clear flow from thought to expression.

In children, especially those who have undergone brain surgery, brain imaging shows how language development changes with age. Like AI systems that improve at processing complex sentences over time, children's brains also become more efficient at understanding and producing language as they grow.

Both human brains and AI show layered representations of language. By studying these parallels, scientists can deepen our understanding of communication.



Dr. Tadeusz Kononowicz - Paris-Saclay Institute of Neurosciences, France

Short Talk: Spatio-Temporal Dynamics of in Groups Interactions in Macaques

Territorial behavior is widespread among primates, with varying strategies such as lethal defense in chimpanzees and chemical marking in marmosets and lemurs. Recent research on macaques using high-resolution tracking technology has revealed detailed spatial use patterns within social groups. Each individual maintains a stable and distinctive spatial "footprint" over time, allowing identification based solely on location data.

Social factors strongly influence spatial organization: Inter- individual distances correlate with social bonds and dominance rank. Removal of a monkey affects group spatial structure primarily when a close social partner is absent. The distribution of distances between individuals is bimodal and can be modeled by a random walk with a proximity preference parameter linked to social affiliation and hierarchy.

CNRS Junior Scientist Tadeusz Kononowicz's findings indicate that primate spatial behavior is shaped not only by environmental factors but importantly by social relationships, underscoring the role of social dynamics in space utilization within groups.

Dr. Alexandra Martin - Paris-Saclay Institute of Neurosciences, France

Short Talk: Is the Mouse Auditory Cortex Necessary for Discriminating Communication Sounds in Noise?

Discriminating communication sounds in noisy environments, such as in "cocktail party" context, is essential for both humans and animals. Historically, the auditory cortex (ACx) has been considered the primary neural substrate enabling robust sound discrimination, based on numerous studies linking cortical activity to auditory perception and behavioral performance.

Recent research on guinea pigs and mice, however, challenges this cortical-centric view. Using neuronal recordings from three auditory regions—the auditory cortex, the thalamus (medial geniculate body, MGv), and the inferior colliculus (IC)—researchers found that neurons in the IC exhibited superior and more noise-resistant discrimination of conspecific vocalizations compared to cortical and thalamic neurons. PhD candidate Alexandra Martin's findings were consistent across species and sound degradation levels.

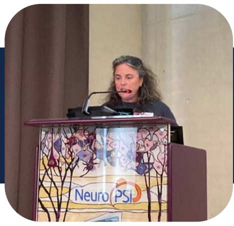
This raises the question - is the auditory cortex necessary forbehavioral discrimination?

To test the functional significance of these neural responses, Alexandra Martin conducted behavioral Go/No-Go discrimination tasks in head-fixed, water-restricted CBA/J mice. When the auditory cortex was pharmacologically inactivated using muscimol, mice retained their ability to discriminate sounds accurately, even in noisy environments.

This evidence suggests that subcortical structures—particularly the inferior colliculus—play a critical and perhaps primary role in maintaining sound discrimination under challenging acoustic conditions. Consequently, the auditory cortex may not be necessary for basic perceptual discrimination in noise, shifting the understanding of hierarchical auditory processing.

Day 2 – Communication And Language

Session 4 - Social Communication



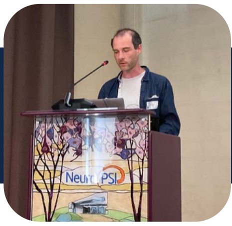
Dr. Isabelle Charrier - Paris-Saclay Institute of Neurosciences, France

Onset of Individual Vocal Recognition in Pinnipeds

Pinnipeds (seals, sea lions, and walruses) provide a valuable model for studying vocal communication in mammals due to their diverse habitats, social systems, and advanced acoustic capabilities. Across the three pinniped families, social and mating systems range from solitary to densely colonial and from monogamous to highly polygynous. Notably, increased colony density often correlates with stronger polygyny and more complex vocal communication. However, across all pinniped species, they exhibit a strong mother- pup bond. A critical aspect of pinniped communication is individual vocal recognition, especially between mothers and pups. Both parties use multi-parameter vocal signatures to identify each other over long distances. CNRS Senior Scientist Isabelle Charrier differentiates between species' needs for individual recognition systems - the need varies depending on the age the mother first has to leave the pup, and how social the seal species is.

Dr. Charrier asks: Will this varying need affect the development ofrecognition, and how?

Her team studied 4 different species of pinnipeds that exhibit a range of first separation time and social structures. Recognition development varied with other characteristics of the species. In general, pups progressively improve their recognition of maternalcalls over days, while mothers can identify their pups as early as 2 to 48 hours post-birth. In Australian sea lions, mothers begin learning their pup's vocal signature within the first 48 hours, often before any separation occurs. In the highly colonial Cape fur seals, mothers could recognize the pups' call from 2 hours post-birth and the pups developed recognition at 4 hours after birth. This rapid mother–pup vocal recognition is among the fastest documented in mammals, exceeding human recognition speeds. High selective pressures in dense colonies may initiate this process even prenatally, suggesting a role for in utero vocal imprinting. To summarize, recognition patterns are asymmetrical: mothers reliably identify their pups within two days, prior to the first extended separation, and might be less driven by selective pressure. However, pups' recognition of mothers is more variable and probably driven by selective pressure: In species facing lower selective pressures, pup recognition develops more slowly, whereas in high-pressure environments, it is established early. It occurs before the separation only in species where it is crucial for the pup's survival. To further confirm this finding, the team plans to study solitary species in the future.



Dr. Arthur Lefevre - Cognitive Sciences Institute – Cnrs, France

Short Talk: Primate ACC Encodes the Cocktail Party Effect During Natural Communication

How do primates manage meaningful vocal interactions in chaotic, noisy environments — much like humans do at a crowded party? This ability, known as the Cocktail Party Effect (CPE), remains a mystery at the neural level, particularly in natural settings. Research addressed this by studying freely moving marmosets, highly social primates known for their rich vocal repertoires. Focusing on the anterior cingulate cortex (ACC), a brain region involved in vocal production, perception, and monitoring others' actions, the team recorded neural activity while the animals engaged in natural social interactions within a noisy colony environment.

Studies showed that ACC neurons encode vocalizations abstractly,responding both to self-produced and perceived calls regardless of the source. Some neurons were selectively tuned to specific partners' calls, while others responded more broadly to social sounds, indicating functional specialization in distinguishing individual voices from background noise. Remarkably, certain ACC neurons activated even before a vocalization occurred, predicting the type of call — suggesting the brain prepares messages in advance rather than merely reacting. The ACC also tracked vocal turn-taking, with monkeys timing their responses during quiet moments, reflecting an internal coordination of dialogue in noisy conditions.

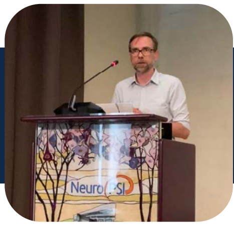
Together, these findings position the ACC as a central neural hub supporting the Cocktail Party Effect in primates. It aids in caller identity discrimination, temporal coordination of communication, and filtering relevant from irrelevant sounds, offering a compelling window into the evolutionary roots of complex social conversation.

Dr. Richard Hahnloser - Institute of Neuroinformatics – Eth Zurich, Switzerland

Algorithm of Birdsong Learning

The presentation of Professor Richard Hahnloser focused on songbirds as a powerful model for understanding how complex behaviors are learned, in particular how the observation of others and sensorimotor feedback guide learning processes. Using information provided by others characterizes imitation. The ability to imitate others allows not only humans to learn how to speak, but also songbirds to learn how to produce songs. Like children, juvenile songbirds acquire their songs by listening to adults, called tutors, memorizing their vocalizations and practicing over time. Adult songs result from a self-guided learning process, supported by social and sensory experience. Auditory feedback is crucial for vocal learning, allowing to match what is vocally produced to memorized adult songs, used as an internal model to make adjustments. When auditory feedback is disrupted—by deafening or playing back white noise— the song deteriorates but recovers when disruption stops. Interestingly, birds are able to modify their songs in a reinforcement-learning paradigm using visual feedback as a substitute of auditory feedback. Using information provided by others through visual observation may efficiently influence behavior. Juvenile birds watching demonstrators can quickly learn how to adjust their songs to avoid negative outcomes, like an air puff. However, they only benefit from watching the demonstrator if the model is competent—just observing another bird does not help.

While learning based on observation is fast, it lacks flexibility, making it harder for birds to generalize to new situations compared to birds that learn through a trial-and-error process. Song learning and learning by observation requires a conversion of sensory information provided by both others and the sensory feedback into a motor command for generating a similar action than that generated by others. Prof. Hahnloser proposed that such matching involves a basal ganglia-cortical pathway, especially a brain nucleus, the LMAN. This brain nucleus could support motor control via a causal inverse model that can invert the rich correspondence between motor exploration and sensory feedback. In that framework, dopamine in basal ganglia, known to play a role in reward prediction error, could drive changes to song. In addition, Prof. Hahnloser raised the question of the role of sleep in vocal learning with a focus on replay mechanisms. When birds are singing, a gating of auditory information in LMAN prevents a comparison between auditory feedback information and the internal model. The re-occurrence of the neuronal patterns of activity underlying song generation during sleep, but also during rest, could play a role in vocal learning. In contrast to studies performed in other animal species, sleep does not appear involved in song consolidation in songbirds, although targeted brain stimulation during rest can influence learning performance, suggesting a delicate balance between rest and sleep. Overall, Prof. Hahnloser's research shows that learning in songbirds reflects mechanisms shared across species. His work highlights how sensory feedback, imitation and observation of others, social motivation, and even rest, all may shape how complex behaviors are acquired — with parallels to speech acquisition in humans — and, furthermore, may offer new insights for artificial intelligence as well.



2025 NeuroPSI – Chen Institute Joint Conference on Brain, Behavior & Beyond

Dr. Jan Clemens - European Neuroscience Institute, Germany

Uncovering the Secret Social Life of Fruit Flies With Computational Tools

Professor Jan Clemens's talk highlighted that fruit flies may be small, but their courtship behavior is surprisingly sophisticated. Male Drosophilae produce two types of songs—pulse and sine—by vibrating their wings, adjusting them based on the female's distance and behavior. When the female is far away and moving, the male sings a rhythmic pulse song to slow her down. If the female is nearby and calm, the male switches to the smoother sine song to maintain the female's attention.

This adaptability is based on a few simple internal rules, which areapplied flexibly depending on the social context. During male– female courtship, flies rely heavily on the pulse song. In male–male interactions, they shift toward sine song and show more direct engagement, like facing off or pushing. The same rules are reused, but interpreted differently depending on the partner.

Prof. Jan Clemens's research unveiled that specific neural circuits drive this flexibility. For example, some neurons in males respond to the movement or position of a partner—whether in front or behind— and help select the appropriate song. Auditory feedback also plays a vital role: flies that cannot hear produce less effective courtship and fail to get proper responses from partners. In one experiment, the female's behavior was altered using optogenetics, making them behave more like males. Male flies adjusted their songs accordingly—treating the altered females as if they were males.

This suggests that flies respond to behavior rather than biological sex, tailoring their actions based on moment-to-moment cues.

Overall, fruit fly courtship shows how complex, socially responsive behavior can emerge from simple rules guided by feedback and dedicated brain circuits—offering insights into how flexible communication evolves, even in tiny brains.