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Lyon 1

DOCTORAL SCHOOL NEUROSCIENCE AND COGNITION
ANNUAL SCIENTIFIC MEETING

29th april 2015

– Institut des Sciences Cognitives –

67 Boulevard Pinel, BRON

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PROGRAMME

Annual Scientific Meeting
of the doctoral school Neuroscience and Cognition
29th april 2015
Institut des Sciences Cognitives - 67 boulevard Pinel - 69500 Bron

8h30 - 9h	Posters and slideshows installation
9h - 9h15	Welcome - *Rémi Gervais*
9h15 - 9h30	Introduction of the candidate for student representative election Announcement about upcoming students' events
9h30 - 10h15	Students' talks, session 1 *Léo Varnet*, Auditory Classification Images: Finding the acoustic cues used in a phoneme categorization task *Claire Bradley*, Stimulating the brain for pain relief: mechanisms and new targets *Mani Saignavongs*, Combining electrophysiology and imaging: what can we get from simultaneous icEEG-fMRI?
10h15 - 10h45	*Véronique Prudhomme*, Valoriser son doctorat
10h45 - 11h	Break
11h - 12h	Poster session 1, **odd numbers**
12h - 13h55	Lunch
13h55 - 14h30	Students' talks, session 2 *Loïc Magrou*, The role of the Exponential Distance Rule in establishing the dorsal and ventral functional streams *Julie Boulanger Bertolus*, Determining the neuronal basis of interval timing through odor fear conditioning in rats
14h30 - 15h30	Conference - *Pr. Nicolas Mathevon*, *Head of the Laboratory CNPS-ENES, Saint Etienne* Acoustic communication: how social knowledge drives the information decoding
15h30 - 15h45	Break
15h45 - 17h	Poster session 2, **even numbers**
17h	Election of student representative Closing - *Rémi Gervais*

HOW TO GET THERE?

Institut des Sciences Cognitives - 67 boulevard Pinel - 69500 Bron

Public transportation :

Bus C8, stop at "Parc Chambovet"

Bus C9, stop at "Hôpital Neurologique"

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ACOUSTIC COMMUNICATION: HOW SOCIAL KNOWLEDGE DRIVES THE INFORMATION DECODING

One of the most exciting challenges in the field of acoustic communication is to understand how social cues interact with environmental and phylogenetical constraints to drive the receiver's assessement of the information embedded in the signal. During this conference we will investigate the question by taking examples from a variety of situations (e.g. mate bonding in birds, between-males interactions in the elephant seal, communication networks in hyena and apes, and parents-baby interactions in humans). We will be specifically interested in understanding how social knowledge can modulate the way a receiver decodes information. The emphasis will be put on the interest of having a multi-levels approach, by studying processes at the brain level together with the behavioral level, both in the laboratory and in the field.

STUDENTS' TALKS

1. Auditory Classification Images: Finding the acoustic cues used in a phoneme categorization task.

VARNET Léo, Laboratory on Language, Brain and Cognition

An essential step in understanding the processes underlying the general mechanism of perceptual categorization is to identify which portions of a physical stimulation modulate the responses of our perceptual system. In the context of speech comprehension, it is still unclear what acoustic information is used to categorize a speech stimulus as one phoneme or another. Up to now, there is no turnkey solution for isolating speech cues from natural stimuli.
In this talk, I will present a psychoacoustic imaging method, inspired by recent theoretical developments in visual psychophysics, and allowing experimenters to directly see where humans listen inside natural speech utterances. This "Auditory Classification Image" technique relies on a Generalized Linear Model with smoothness priors to link categorization errors in a speech-in-noise comprehension task with the trial-specific distribution of noise, resulting in a spectrotemporal map of the acoustic cues used to categorize phonemes.

2. Stimulating the brain for pain relief: mechanisms and new targets

BRADLEY Claire, Lyon Neuroscience Research Center, NEUROPAIN team

Following a lesion or a disease of the somato-sensory nervous system, a number of patients develop chronic "neuropathic" pain, which is very debilitating and only partially relieved by current medication. Among the few alternatives that exist, direct stimulation of the motor cortex has been shown to relieve durably half of the operated patients. A less invasive option relies on transcranial magnetic (rTMS) or electrical (tDCS) stimulation of the same structure. However the mechanisms sub-serving this analgesic effect are still elusive. One hypothesis is that rTMS relieves pain by inducing plasticity in a network of cortical and sub-cortical brain areas. While most previous efforts have concentrated on the primary sensori-motor area, there is a lack of data concerning nociceptive networks. Moreover, the major target of stimulation has been motor cortex, leaving other brain regions more closely concerned with pain perception relatively un-explored. Here, I present data showing that, in healthy participants, classical motor cortex rTMS triggers

plasticity in primary somatosensory cortex, but doesn't alter acute nociceptive processing more than placebo stimulation. Given that the stimulation delivered was identical to the one relieving neuropathic pain patients, this suggests that pain relief in patients is not brought about by acute nociception dampening. In contrast, preliminary data suggests that targeting the operculo-insular cortex (a key pain-processing structure) by multi-polar tDCS seems to modify tonic cold pain perception in a polarity-dependant manner. It remains to be determined whether this observation can translate into clinically meaningful applications.

3. Combining electrophysiology and imaging: what can we get from simultaneous icEEG-fMRI?

SAIGNAVONGS Mani, Lyon Neuroscience Research Center, TIGER team

Cognitive-induced high frequency EEG activity (HFA) recorded in patients with epilepsy undergoing intracerebral EEG (icEEG) monitoring have enabled major progress in the field of cognitive neuroscience. iEEG offers a complementary approach to that offered by functional Magnetic Resonance Imaging (fMRI). While icEEG provides very high temporal resolution and spatial precision, it suffers from very low spatial sampling. For these reasons, there has been an increasing interest to combine these two techniques in humans, as previously done in animals. So far, only a few patients underwent simultaneous icEEG-fMRI with the view to record epileptic spikes and their fMRI counterpart, further suggesting the feasibility and safety of these combined acquisitions. However, investigation of HFA is more challenging due to the overlap between their band frequency and that of MR acquisition artifacts. In our study we specifically tackled this issue by recording HFA induced by cognitive tasks in the same patients, in icEEG-only and during simultaneous icEEG-fMRI.

We were able to recover in simultaneous icEEG-fMRI 72% of the averaged HFAs observed in icEEG-only. We also succeeded to detect single-trials HFAs responses during simultaneous icEEG-fMRI. Decreases in HFAs (deactivation) could also be observed, although the signal variation was subtler.

These results show that even subtle icEEG signal components can be recovered in the combined icEEG-fMRI modality. This paves the way for the use of icEEG-fMRI technique both for clinical purpose and for fundamental neuroscience. The technical challenge of accurate EEG signal recording correction during simultaneous acquisition needs yet to be solved.

4. The role of the Exponential Distance Rule in establishing the dorsal and ventral functional streams

MAGROU Loïc, Stem-cell and Brain Research Institute

There is a large body of evidence showing that foveal and peripheral representations of the early visual areas possess major differences in their connectivity (Falchier et al., 2002, Ungerleider et al., 1986). The Exponential Distance Rule (EDR), discovered in the macaque brain (Markov et al., Science 2013 ; Ercsey-Ravasz et al., Neuron 2013), describes a predictive relationship between distances and connexion strength (FLN). Random networks, constrained by EDR exhibit a number of local and global statistical properties observed in the cortico-cortical inter-areal connectome (Markov et al., 2013, 2014). These successful predictions argue for the EDR constituting an important organisation principle of the cortex. We here explore whether the EDR also predicts the differences in the organization of visual functional streams (Mishkin et al., 1983).
Inspection of a flat map of the visual cortex shows that peripheral parts of V1 and V2 are localised in proximity with the dorsal stream areas, while foveal regions of these areas are nearer the ventral stream. Here we investigate if EDR sets up the two networks. We observe that, while injections performed in territories corresponding to the central (i.e. foveal) representation of the visual hemifield preferentially receive inputs from areas belonging to the ventral pathway, injections placed in peripheral representations preferentially labels neurons in areas known to be part of the dorsal pathway. Analysis of the relationship between FLN values and inter-areal distances from injections at different eccentricities return an exponential decay of FLN with increasing distances similar to that reported in our previous work.

5. Determining the neuronal basis of interval timing through odor fear conditioning in rats

BOULANGER BERTOLUS Julie, Lyon Neuroscience Research Center, CMO team

Interval timing refers to the ability to perceive, estimate and discriminate durations in the range of seconds to minutes. Very little is currently known about its ontogeny throughout development. On the other hand, the striatum has been suggested to be an important component of the interval timing network and its maturation occurs around the third post-natal (PN) week in rats. The global aim of the present study was to investigate interval timing abilities at an age for which the striatum is not yet mature. We used odor fear conditioning, as it can be applied to very young animals. In odor fear conditioning, an odor is presented to the animal and a mild foot shock is delivered

after a fixed interval. Adult rats have been shown to learn the temporal relationships between the odor and the shock after a few associations. We assessed the activity of the striatum during odor fear conditioning using 2-deoxyglucose autoradiography and showed that although fear learning was displayed all tested ages, activation of the striatum was observed in adults but not in younger rats. We then assessed the interval timing abilities in ages before and after the inclusion of the striatum into the fear conditioning circuit. We used an experimental setup allowing the simultaneous recording of freezing and respiration that have been demonstrated to be sensitive to interval timing in adult rats. This enabled the detection of duration-related temporal patterns for freezing and/or respiration curves in infants as young as 12 days PN during odor fear conditioning. This suggests that infants are able to encode time durations as well as and as quickly as adults while their striatum is not yet functional.

POSTERS

1. Cortical networks for encoding near and far visual space in the non-human primate

CLÉRY Justine, Center for Cognitive Neuroscience

While extra-personal space is often erroneously considered as a unique entity, early neuropsychological studies report a dissociation between near and far space processing both in humans and in monkeys. In the present study, we use functional magnetic resonance imaging (fMRI) in a naturalistic 3D environment to describe the non-human primate near and far space cortical networks. Overall, we describe two extended functional networks respectively encoding near and far space processing. These two networks are highly overlapping, indicating that several areas involved in visual processing are activated by both near and far visual stimuli. While some of these areas encode visual stimulations irrespectively of depth, others show a preference for either far or near objects. In addition, we identify a subset of areas exclusively involved in the processing of either near or far visual objects. The selective near space activations define a dorsal parieto-frontal network as well as a ventral temporo-frontal network. The selective far space activations include large portions of the striate and extrastriate visual cortex as well as restricted parietal and dorso- temporal regions. Overall, this suggests a continuous encoding of relative distance to the body, in the form of a far-to-near or near-to-far gradient. Such cortical gradients in space representation do not preclude the existence of a physically delineable peripersonal space, as described in numerous psychology and psychophysics studies.

2. Assessment of the attentional capacities and working memory of older blind persons

PIGEON Caroline, Laboratory Ergonomics and Cognitive Sciences applied to Transport

Blindness might result in the enhancement of cognitive processes. For example, recent studies have shown that attentional processes and working memory are enhanced in blind persons compared to sighted persons, probably by their larger mobilization during navigation without vision.
A large number of studies have shown that normal ageing results in the decline of cognitive processes (attention, working memory, executive functions and information

processing speed) and the decrease of mobility in older sighted persons, the issue about ageing effects on blind persons has to be explored. However, no study seems to have been conducted on attentional and working memory processes of aged blind persons. The aim of this study was to assess the attentional capacities and working memory of older blind persons. 30 blind participants aged less than 60 years (from 18 to 57) and 12 blind participants older than 60 years (from 62 to 80) completed neuropsychological tests (assessing selective attention, sustained attention, divided attention, inhibition, attentional switching and working memory) that were designed or adapted to be achievable in the absence of vision.
The results showed that older blind participants obtained lower performances than younger ones (excepted for the attentional switching test). Therefore, these results are in favor of the existence of a decline of cognitive processes with ageing in blind persons and need to be extend with comparisons with performances of sighted participants.
These results allow to suggest recommendations for the design of cognitive training programs, which can be useful for limiting the age-related attentional decline in blind persons.

3. Sleep spindles do not inhibit behavioural and cortical responses to nociceptive stimuli: a surface and intracerebral electrophysiological study.

CLAUDE Léa, Lyon Neuroscience Research Center, NEUROPAIN team

Generated by thalamic reticular nuclei, sleep spindles are transmitted into the thalamocortical network during slow wave sleep. They are supposed to have a sleep-protecting role by inhibiting sensory inputs. The aim of the present study was to test their inhibitory effect on behavioural and cortical responses evoked by nociceptive stimuli. Two electrophysiological experiments were conducted, using surface recordings in 9 healthy subjects, and intracerebral recordings in 9 epileptic patients. Thermo-nociceptive stimuli, calibrated slightly above the individual pain thresholds, were delivered during the whole night. The presence of arousal reactions and cortical responses were analysed in sleep stage 2, according to whether stimuli were delivered during or apart from sleep spindles.
In both studies, behavioural results showed no significant difference in arousal reactions proportions between the two stimulus conditions (during spindles 26%; apart from spindles 31%). Electrophysiological results showed that cortical evoked responses had comparable latencies and amplitudes whether stimuli were delivered during or apart from sleep spindles. This was the case on surface recordings as well as on intracerebral ones in the posterior insula, known to systematically respond to nociceptive stimuli. Thus,

the hypothesis of a spindles inhibitory effect on sensory inputs, suggested by studies performed with auditory stimuli, does not apply to nociceptive ones. The specificity of spino-thalamic pathway, with few inhibitory modulations at thalamic level, and the crucial role of nociceptive information for homeostasis may explain these unexpected results.

4. Differential involvement of lateral entorhinal cortex and dorsal hippocampus in the memory processes underlying acquisition and flexibility of cross-modal learning task

BOISSELIER Lise, Lyon Neuroscience Research Center, CMO team

Even though olfaction and touch are two essential sensory modalities for object exploration, cross-modal olfactory-tactile (OT) learning and memory processes are still poorly understood. The present study was aimed at characterizing the neurobiological substrate involved in the associative processes underlying acquisition and flexibility of OT learning. To this aim, freely moving rats bilaterally implanted in the lateral entorhinal cortex (LEC) or in the dorsal hippocampus (DH) received d-APV (NMDA antagonist) or scopolamine (cholinergic antagonist) during the phases of a new developed OT task consisting in finding one baited cup among three, each of the cups presenting a different OT combination. The results showed that NMDA receptor blockade in the LEC induced a deficit in the OT acquisition and flexibility that was only partially observed with scopolamine. In contrast, our data showed that only scopolamine infusion in the DH induced a deficit in the OT flexibility. Moreover, four control groups of rats infused with lidocaine in LEC or DH revealed no deficit in acquisition and flexibility of unimodal olfactory and tactile tasks. Taken together, our data suggest that the LEC is involved in the formation of OT representations through an NMDA glutamatergic and partially cholinergic process. In contrast, the DH cholinergic system is involved in the process underlying the OT flexibility that can be either the inhibition of responses to previously reinforced stimuli or/and the formation of new OT pairs composed by familiar items. These data suggest a network model according to which OT learning and memory processes are supported by an interaction between the LEC and the DH.

5. Cortical markers of motor awareness in the human brain

CORAZZOL Martina, Center for Cognitive Neuroscience

The ability to monitor and correct our movements is fundamental for motor adaptation and it is under the control of an action-monitoring system. However, motor adaptation doesn't always need consciousness. This is shown by the fact that limited conscious monitoring has been related to motor adaptation in conflict tasks. In this study, participants (N=7) performed a straight movement to reach a target without seeing their hand while they were looking at the ongoing trajectory on a computer screen. The set-up allowed the introduction of perturbations by adding different degrees of angular deviations on the feedback. After each trial, participants reported if they felt something in a five point scale. The behavioral results suggest that participants were not always aware about their compensation. EEG signals were recorded during the task. ERPs, computed over different neurological sources, showed higher activation in the supplementary motor area SMA and in parietal cortex PC regions in the aware condition compared to the unaware one. These findings show that SMA and PC are markers of conscious correction of the ongoing movement.

6. The selective laziness of reasoning

TROUCHE Emmanuel, Laboratory on Language, Brain and Cognition

Reasoning research suggests that people use more stringent criteria when they evaluate other's arguments than when they produce arguments. To demonstrate this 'selective laziness,' we used a choice blindness manipulation. In two experiments, participants had to produce a series of arguments in answer to reasoning problems, and they were then asked to evaluate other people's arguments about the same problems. Unknown to the participants, in one of the trials, they were presented with their own argument as if it was someone else's. Among those participants who accepted the manipulation and thus thought they were evaluating someone else's argument, more than half (56% and 58%) rejected the arguments. Moreover, participants were more likely to reject their own arguments for invalid than for valid answers. This demonstrates that people are more critical of other people's arguments than of their own, and that they are better at evaluating other people's arguments than their own.

7. Cortical markers of pain memorisation– A study with intra-cerebral recordings in Humans

CHAPON Anaïs, Lyon Neuroscience Research Center, NEUROPAIN team

Short-term memorization of nociceptive events seems to involve cortical regions implicated in the sensory and cognitive dimensions of pain. However, the timing of these activations and how these regions interact are not known.
This study proposes to highlight cortical regions involved in a short-term memory painful task and their interactions by using intra-cerebral recordings from 7 epileptic patients. In order to emphasize pain memory specificity, three different stimulations were used: painful, somatosensory non-painful and auditory. Two different intensities were delivered in each condition, and patients had to compare stimulation from the previous one, delivered 8 to 10 seconds before. In a control task, patients had to read numbers on a screen between two stimuli, in order to ensure that they did not memorize anything about the stimulation. Data were analysed in terms of evoked potentials and time frequency during retention phase.
When painful stimuli had to be memorized, early components of evoked potentials showed an increased amplitude as compared to the control task, in regions involved in affective aspects of pain (anterior insula, prefrontal cortex). Moreover a specific late negativity was observed only for painful stimuli memorisation, which suggests an enhanced arousal. Time-frequency analysis showed an alpha desynchronisation in memory tasks during retention phase in regions involved in cognitive and affective dimensions of pain (anterior insula, anterior cingulate cortex, prefrontal cortex) which might be related to cognitive processing and mechanisms of attention.

8. A chronic animal model to study the long-term effects of human anti-N-Methyl-D-Aspartate receptors (NMDAr) antibodies on synaptic plasticity

BOST Chloé, Lyon Neuroscience Research Center, ONCOFLAM team

Anti-NMDA receptor encephalitis is a neuropsychiatric disorder in which patients exhibit motor dysfunction, cognitive impairment and memory loss. The presence in LCR of antibodies (Ab) directed against the NR1 subunit of NMDAr is the trademark of the disease. NMDAr is an ionotropic receptor for glutamate involved in synaptic plasticity, such as long-term potentiation. Patient's anti-NMDAr Abs induce a decrease of surface expression of NMDAr and surface mobility. Effects of these Abs on synaptic transmission are mostly described in vitro or in vivo with acute administration protocols. The aim

of this work was to develop a chronic Abs infusion animal model to investigate the long-term alterations of synaptic plasticity. To obtain Ab suitable for our experiments, serum from patients and healthy donor were purified on column chromatography. Abs were infused in the hippocampus of C57BL/6 mice for 7 days via a cannula implanted in the medial septum and connected to an osmotic pump. Diffusion of antibody was tested by immunohistochemistry. Short-term and long-term synaptic plasticity was then evaluated on acute hippocampal slices obtained from mice infused with Abs. Immunohistochemistry revealed diffusion of the Abs mainly in the hippocampus. Our preliminary data do not show any significant differences in short or long-term potentiation between non-implanted mice and mice in which PBS was infused. This indicates that the presence of the osmotic pump does not alter synaptic plasticity. To conclude, we dispose of an animal model presenting chronic Ab infusion in the hippocampus suited to study the effects of control and anti-NMDAr antibodies on synaptic plasticity.

9. Compréhension de mots nouveaux et mécanismes d'inférences chez des enfants atteints de dysphasie, de trouble du spectre de l'autisme et de dysharmonie psychotique

RIOU Anne-Sophie, Dynamique du Langage Laboratory

The study deals about the comprehension of new words for three different kinds of children: kids with specific language impairment, kids with autism and kids with psychotic disharmony. For all these pathologies, language difficulties impact communication. Even if the lexical understanding and logical thinking are normal, these kids face important difficulties to understand new words. So our work is mainly to analyze inferential mechanism underlying process to word comprehension.
Experimental protocol is based on language testing and deductive and inductive non-verbal logical testing. Language testing consists in lexical understanding and new words comprehension from inferences based on word morphology (compound words and derived words) and from inferences based on concept principle. Non-verbal inferences testing are only visual logic test and pictorial stories comprehension test.
From the partial results already available, it seems that kids with specific language impairment are significantly having difficulties with all the language proposed tests. However kids with autism are struggling to understand new words from their morphology only if these words are made of two names, and to understand new words after inferred belonging to a conceptual category.

10. No sniff, no smell

LEFÈVRE Laura, Lyon Neuroscience Research Center, CMO team

Sensory function depends on a combination of feedforward flow of information from sensory organs to the brain and the ensuing readjustment of sense organs by feedback from the brain. An example of this process is eye movements to gather information about the relevant parts of visual environment, an active process that is integral to vision. In olfaction, the active sampling process is sniffing. We recently showed that sniffing is adjusted as a function of odorant molecules in a discrimination task (Courtiol et al., 2014) suggesting that sniffing could be considered as a true sensorimotor act.
In the present study, we aimed at understanding to what extent such sniff adjustment could be spontaneous (determined by the perceptive quality of the odors) or acquired by learning. For this purpose, rats were trained to discriminate odors in a double choice discrimination task while neuronal signals (Local Field Potentials, LFP) were simultaneously recorded in olfactory, limbic and motor areas. Sniffing activity was recorded in parallel using a whole-body plethysmograph. We showed that sniff modulations largely evolved with learning. Sniff parameters and performances were clearly correlated. We evidenced that sniff adjustments were necessary for the acquisition of the task. However, once the discrimination was acquired, they were no more necessary.
These data show that sniffing adjustment is not spontaneous but acquired by experience, and is necessary for discrimination. These characteristics are those of a sensorimotor act. Looking for neuronal correlates of the sensorimotor act, analyses of LFP signals are in progress.

11. Characterization of non-visual photoreception in humans

PRAYAG Abhishek, Stem-cell and Brain Research Institute

Objective: In the retina, intrinsically photosensitive ganglion cells (ipRGCs) are the neuroanatomical substrate of the non-visual (NV) effects of light including on alertness and cognition. These cells do not function independently: while they can encode light, they are also modulated by cone and rod input. Our objective is to investigate which photoreceptor informs NV brain regions and contribute to elicit NV functions.
Methods: Our strategy relied on the differential spectral and spatial properties of cones vs. ipRGCs. In a within-subject design, 28 participants were exposed consecutively to 4 light stimuli of 50 min each, from 19-23h. The stimulus was composed of a central white light (CWL, 7000 lux) centered on the fovea (20°) to activate cones specifically, and a peripheral light (20-220°, 300 lux) either enriched in blue (BE) for ipRGCs activation, or

enriched in red (RE) to limit ipRGCs activation. The EEG was recorded continuously at 256 Hz and submitted to FFT analysis.
Results: There was no effect of RE light on the beta band (13.5-32 Hz). Under BE conditions, beta power rose significantly after 2 min, increased further after 5 min (+35%) and remained elevated until the end of the light exposure.
Conclusion: These preliminary results suggest that a light stimulus presented in the peripheral visual field, at low intensity (300 lux) and with a sub-optimal polychromatic spectrum can activate the EEG in the beta band. Given 1) the dynamics of beta activation is in line with the ipRGC activation pattern and 2) the lack of effect of the cone-directed CWL, we propose that light activates the EEG through ipRGCs and not rods and cones.

12. Cortical network involved in implicit perception of pain facial expressions. A depth electrode ERP study in human

CZEKALA Claire, Lyon Neuroscience Research Center, NEUROPAIN team

Pain facial expressions are complex stimuli encoding both the affective and the sensory dimensions of pain. They have communicative value and should be detected rapidly, possibly subliminally, to protect the self and avoid a possible dangerous situation. To understand which cortical regions are early involved in pain facial recognition, we recorded event-related potentials (ERPs) in 9 epileptic patients with intracerebral electrodes during observation of painful facial expressions and neutral faces. Our task was an implicit recognition task requiring attention to gender and ERPs were analyzed in the 1000 ms after the face presentation. We compared electrophysiological responses to painful facial expressions and neutral faces in cortical regions known to be involved in sensorial and emotional pain aspects as well as executive regions. Our results showed that ERPs to pain or neutral faces were similar in terms of latency and amplitude in the fusiform areas (involved in faces recognition) and in the posterior insula. On the contrary, we observed ERPs with higher amplitudes for painful faces in the anterior insula at 164 ms after the pictures onset, and later, in the frontomedial lobe (BA 9) between 299 ms and 633 ms and in the inferior orbitofrontal area (BA 47) from 500 ms. This suggest that, at a very early stage of face processing, cortical regions involved in sensory aspects of pain are not involved in the decoding of pain expression as compared to neutral faces. Implicit pain expressions might be rather governed by pain emotional regions and higher executive functions areas.

13. Running the Number Line: Operators Elicit Horizontal Shifts of Attention During Single-Digit Arithmetic

MATHIEU Romain, Laboratory on Language, Brain and Cognition

It has been recently proposed that adults might solve single-digit addition and subtraction problems by rapidly moving through a mental representation of numbers. In the present study, we tested this hypothesis by measuring whether solving single-digit arithmetic problems is associated with concomitant shifts of attention. In two experiments, adult participants were presented with single-digit addition, subtraction and multiplication problems. Operands and operator were presented sequentially on the screen. Although both the first operand and the operator were presented at the center of the screen, the second operand was presented either in the left or in the right hemifield. We found that addition problems were solved faster when the second operand appeared in the right than the left hemifield (Experiments 1 & 2). In contrast, subtraction problems were solved faster when the second operand appeared in the left than in the right hemifield (Experiment 1). No side preference was observed for multiplication problems (Experiment 2). Therefore, our results demonstrate that solving single-digit addition and subtraction, but not multiplication, involves horizontal shifts of attention. These shifts are likely induced by the arithmetic operators themselves. Thus, our findings cast doubt on the idea that single-digit arithmetic problems are unequivocally solved by direct retrieval of arithmetic facts in adults. Rather, they suggest that solving single-digit subtraction and addition problems requires mentally moving to the left or right of a sequential representation of numbers.

14. Evidence that glutamatergic neurons of the supramammillary nucleus are responsible for the activation of the dentate gyrus during paradoxical (REM) sleep in the rat

BILLWILLER Francesca, Lyon Neuroscience Research Center, SLEEP team

Paradoxical sleep (PS) is characterized by muscle atonia, rapid eye movements (REM) and cortical activation. The supramammillary nucleus (SuM) might play a role in such activation, in particular for the hippocampus. Indeed it projects to the dentate gyrus (DG) and this projection is issued from glutamatergic neurons. Besides, we demonstrated by means of Fos labeling that the lateral part of the SuM (SuML) contains a large number of neurons specifically activated (cFos+) during PS hypersomnia. We also showed that

a SuM lesion drastically decreases the number of cFos+ granular neurons in the dorsal DG during PS hypersomnia. In view of these data, we hypothesized that the SuML-DG pathway activated during PS is glutamatergic.
To test this hypothesis, we used a combination of Fos immunostaining and in situ hybridization of vesicular glutamate transporter 2 (vGLUT2) mRNA in 3 groups of rats: control (PSC), deprived of PS for 72h (PSD) and allowed to recover during 150 min after such deprivation (PSR). We also performed vGLUT2 immunohistochemistry in PSR control animals and PSR rats with an iontophoretic injection of ibotenic acid in the SuM. In PSR rats, we found that 85% of the SuML Fos-labeled neurons also express the vGLUT2 mRNA. No or only a few double-labeled neurons were observed in PSC and PSD rats. In PSR rats with a SuM lesion, we found a disappearance of the vGLUT2 labeled fibers in particular in the dorsal DG compared with PSC.
These results indicate that the SuML-DG pathway selectively active during PS is glutamatergic in nature and thus responsible for the activation of a subset of DG granular cells during PS.

15. Spontaneous preference for human trustworthy faces by macaque monkeys

COSTA Manuela, Center for Cognitive Neuroscience

Trust is a basic prerequisite of group living in numerous species. As it does not come without a risk, the ability to select trustworthy partners is an essential survival skill. Research in social psychology has demonstrated that judgments of trustworthiness based on facial appearance are robustly related to specific perceptual features, processed in a fast and automatic way. However, it is not known if this ability has an evolutionary origin. Here we show that macaque monkeys, like humans, have a preference for trustworthy human faces. This differential looking pattern for trustworthiness was selective and did not extend to the social dimensions of attractiveness, extroversion, and competence. Prior work has shown that the best predictors of trustworthiness judgements are faces' subjective degree of "femininity" and "happiness". We found positive correlations between these two traits and trustworthiness preference. Our findings suggest the presence of an evolutionary link for this ability and confirm the importance of facial cues in providing social information.We anticipate that our results may be a starting point for more sophisticated social cognition model that take into account the evolutionary dimension.

16. Oxytocin modulates serotoninergic neurotransmission through different ways in primates

LEFEVRE Arthur, Center for Cognitive Neuroscience

Oxytocin, a neurohormone of high interest for its therapeutic potential in psychiatric disorders, has been shown to impact the functioning of other neurotransmitters. Notably, we know that in rodents, serotonin (5-HT) is released following oxytocin administration. Our team has recently found, using PET scan in humans, that 5HT 1a receptor (5ht1a-r) function is modified after intra nasal oxytocin. However, because of the difficulty to fully explain the mechanism underlying this effect, we repeated this experiment in non human primates using several 5-HT radioligands.
We injected oxytocin or placebo directly into the lateral ventricle of macaques before scanning them with [18F]MPPF and [11C]DASB, PET markers of the 5ht1a-r and the serotonin transporter, respectively.
Preliminary results in one monkey (12 scans), are showing that oxytocin significantly reduced [11C]DASB binding potential in the right hippocampus and posterior putamen, and some trends could be found in other regions of interest. Additionally, [18F]MPPF binding potential was increased (not significantly yet) in the same way as found in humans.
These results indicate that oxytocin administration in primates influences serotoninergic neurotransmission via at least two ways: first by provoking a release of serotonin in key limbic regions and second, by increasing the number of available 5ht1a-r receptors in both limbic and cortical areas. Getting a full picture of the interaction effects between these two systems would help to elaborate new therapeutic strategies.

17. Investigating sleep features and circadian rhythms to improve awaking prognosis after coma

GOBERT Florent, Lyon Neuroscience Research Center, CAP team

Patient surviving after traumatic, anoxic or vascular brain injury can evolve through many clinical status from coma to recovery of consciousness until they can communicate. These evolutions concern both the level (wakefulness) and the content (awareness) of consciousness. We can define 3 clinical statuses:

- coma consist in an abolition of wakefulness
- vegetative state is synonymous of an unresponsive wakefulness syndrome
- minimally conscious state could present inconstantly conscious representations.

The actual contribution of EEG sleep patterns in coma prognosis is dramatically limited, when compared with other clinical, electrophysiological and radiological data. Sleep spindles could predict a better prognosis value; the persistence of sleep-wake cycles could be more frequent during the minimally conscious state. However, studies focusing on the acute stage (during the first month in intensive care unit) are rare. We aim at improving the reliability of awakening prognosis using a polysomnographic analysis in ICU using a large co-registration of environmental data (light and sound levels), eye-opening time (video recordings) and the cycles of circadian rhythms (urinary levels of melatonin and cortisol). We actually propose:
- to precise the boundaries between coma and sleep-wake cycles' reappearance using an analogy between coma, sleep and general anaesthesia
- to confirm the presence of sleep-wake cycles in the vegetative state confronting behavioural (eye-opening time) versus electrophysiological data
- to explore the relationship between the fluctuations of light environment in ICU, eye-opening periods and the respect of circadian rhythms according to the injury's severity

18. Composing the self with music

CASTRO Maïté, Lyon Neuroscience Research Center, CAP team

Music maintains a close relationship with personal experience through everyday life and autobiographical events, and hearing musical pieces from one's past often evokes vivid memories and strong emotions. Recollecting autobiographical memories relies on a distributed set of brain regions such as the hippocampus, prefrontal cortex, restrosplenial cortex, cingulate cortex, precuneus, thalamus and cerebellum. Moreover, the retrieval of autobiographical memories triggered by familiar songs engaged similar structures than self-related linguistic stimuli, including the dorsal medial prefrontal cortex. The aim of the present study is to investigate whether a self-related and/or autobiographical musical context may boost self-referential processing in language. We conducted a functional magnetic resonance imaging procedure in 16 music composers. Participants listened to musical excerpts and names stimuli in interleaved sequences of music and series of names. Each type of stimuli was categorized on three levels: 1) self-related stimuli, 2) personal familiar stimuli and 3) unfamiliar stimuli. Thus, music composers listened to their own music and own name, to their favorite music and their best friend's name, compared to unfamiliar music and unfamiliar name.

19. The role of attention in emotional memory enhancement for pathological and healthy aging

SAVA Alina-Alexandra, Cognitive Mechanisms Laboratory

In healthy participants, memory performance is better for both emotionally negative and positive stimuli, than for neutral stimuli. As far as healthy young participants are concerned, divided attention paradigms suggested that this emotional enhancement of memory (EEM) is caused by different attention mechanisms involved during the encoding, namely: automatic processing for negative stimuli, and controlled processing for positive stimuli. Moreover, along with attention, organization and primary distinctiveness could also account for EEM. As far as we know, no studies on attention resources for encoding, as well as for organization and primary distinctiveness of emotional stimuli, were conducted on patients suffering from Alzheimer's , and mild cognitive impairment (MCI) patients, as compared to healthy younger and older controls. Thus, the goal of this study was to ascertain whether the EEM in Alzheimer and MCI patients, as well as in normal aging, depends on the attention resources available at the time of encoding. Participants completed two study phases: full attention (FA) and divided attention (DA), followed by two retrieval phases (recognition tasks). Our results showed EEM for negative and positive pictures only in healthy young participants, regardless of the type of encoding used (FA or DA). On the contrary, no EEM was observed in Alzheimer and MCI patients, nor in healthy older participants, either with or without memory complaints. Our results are discussed in relation to recent findings about the influence of emotion on memory in both normal and pathological aging, due to Alzheimer's.

20. Suffix activation through morphosyntactic features

ESTIVALET Gustavo, Laboratory on Language, Brain and Cognition

Orthographic word recognition and production is mediated by morphological processing representation, therefore, verbs are early decomposed in stem and suffixes for further semantic activation (e.g. aimions -> [[aim]v[[i]ImpPast[ons]1st Pl]T]TP 'we loved') (Rastle & Davis, 2008). However, it is not obvious which pieces of words are potential affixes and how they are represented in the reader's mental lexicon (Taft, 2004). Hence, this research investigates through two experiments which French verbal inflectional suffixes and/or nodes are represented in the mental lexicon for orthographic word recognition and production. Two questions guided this study: 1. Can French native speakers discriminate verbal inflectional suffixes? 2. Which are the behavioral differences in accessing the different suffixes? Afterwards, these differences should be analyzed in function of a. graphotactic composition, b. morpheme frequency, c. morpheme features, d. node

structure, and e. entropy. Experiment 1 was a computerized visual lexical decision task which tested the recognition of French suffixes in isolation. Experiment 2 was a pencil-and-paper task which tested the use of suffixes in overt written French production. Results in both experiments correlated and showed that some specific suffixes, as [ons], [ent], [ai], are easily recognized and used in word production, while other, as [x], [mes], [i]) are hardly recognized as verbal suffixes. Overall, our results suggest a full-decomposition model (Marantz, 2013) where all French verbal inflectional suffixes are activated through morphosyntactic features in function of morpheme frequency and entropy.

21. The Influence of Power and Reason on Young Maya Children's Endorsement of Testimony

CASTELAIN Thomas, Laboratory on Language, Brain and Cognition

Two important parenting strategies are to assert one's power and to use reasoning. The effect of these strategies on children's evaluation of testimony has received very little attention. Using the epistemic vigilance framework, we predict that when the reasoning cue is strong enough it should overcome the power cue: strong enough arguments from a subordinate should trump weak arguments from a dominant. We test this prediction in a population for which anthropological data suggest that power is the prominent strategy while reasoning is rarely relied on. When power and reasoning are presented independently, 4- to 6-year-old children from a traditional Maya community grant them equal weight in evaluating testimony (Experiment 1 and Experiment 2). However, when the cues conflict, so that the subordinate gives a stronger argument than the dominant, reasoning completely trumps power (Experiment 3).

22. Using tablets to stimulate early literacy skills in kindergarten

NAVARRO Marion, Cognitive Mechanisms Laboratory

Phonological skills and oral comprehension are 2 of the best predictors of good reading skills. But some children don't meet these criteria and have reading difficulties. How to stimulate these children? Tablets can be a relevant educational tool for children at-risk thanks to its mobility, motivational qualities and ease-in-use. They permit individual and autonomous work: children at-risk of reading difficulties can progress at their own pace and save individual extra-learning-time they need. To our knowledge, tablets

are rarely used in a prevention context. Our study aims to determine the effects of individual tablet-assisted early interventions on early literacy skills. With a classical experimental design pre-test/intervention/post-tests, we assessed 51 kindergarteners on phonological skills and oral comprehension. Children were randomly assigned to 3 groups: the Phonological-Training Group (PTG), the Comprehension-Training Group (CTG) and the Control Group (CG). PTG and CTG were trained for daily-30min sessions, for 6 weeks while the CG was following mainstream instruction. Groups were assessed before (t0) and immediately after intervention (t1). We expected PTG to outperform other groups on phonological task and CTG to outperform other groups on oral-comprehension task. No global effect of training was found on targeted skills. However, inter/intra-variations on performances highlighted responsive and unresponsive children to intervention. Significant effects were found in phonological skills for PTG and in oral comprehension for CTG at t1. Tablets could be helpful to prevent early literacy difficulties but results underline the limits of this kind of interventions.

23. Construals of meaning: The role of attention in robotic language production

MEALIER Anne-Laure, Stem-cell and Brain Research Institute

In the certain applications of robot language systems, there is a direct mapping between language and meaning. For example, if the human wants to ask the robot to perform a very specific action, then it is desirable that there is no ambiguity. The simplicity of this direct mapping breaks down almost immediately, however, precisely because language allows one to focus on specific aspects of an event. This is particularly the case in language production. Given a meaning, one should generate a sentence that produces that meaning in the listener. The issue is how to generate the meaning. A given event can be described from different perspectives, and so the notion of characterizing the corresponding meaning from a scene is not trivial. Here we address aspects of these interactions between perspective and meaning. One of the great liberties in language use is the ability to express different perspectives on the same event. These different perspectives correspond to subtly different meanings derived from the same event. We can consider that different perspectives can be expressed by different grammatical constructions, where constructions represent the correspondence between sentence form, and meaning. We have developed a system which includes a physical interaction and an interaction system where a robot can speak with an interlocutor adapting grammatical constructions based on a point of interest (a focus). The system allows the human to ask questions, which direct attention of the robot.

24. Homeostasic Regulation of REM Sleep in Narcoleptic Mice

ROMAN Alexis, Lyon Neuroscience Research Center, SLEEP team

The symptomatology of narcolepsy suggests an impaired REM Sleep (REMS) regulation, as seen by the presence of cataplexy, sleep paralysis and sleep-onset into REMS (SOREM). To our knowledge, only one study conducted with 6 narcoleptic patients has ever looked at REMS homeostatic regulation (Vu et al., 2009), and none were done on narcoleptic mice.
Here, we looked at the homeostatic regulation of REMS in orexin Knockout narcoleptic mouse (KO) by specifically REMS depriving them for 48hrs using platforms-over-water technique. During the recovery period, KO mice showed a REMS rebound similar to wild type mice (WT) indicating that REMS homeostatic regulation is maintained in KO. However, REMS latency during recovery is much shorter in KO (20±4.2min) than WT (113±5.6min). As it could be due to a higher REMS pressure, we used our newly developed automatic REMS deprivation method to objectively evaluate it. When REMS is detected, a TTL-signal is sent by the computer to the cage floor to move it up and wake-up the mouse.
Interestingly, KO were simulated more often (782.3±60.7) than WT (367.6±42.0) revealing a stronger need to enter REMS, therefore a stronger REMS pressure. Furthermore, WT mice had a higher REMS pressure during the light phase than the dark phase in accordance to REMS circadian distribution. KO mice however accumulated REMS pressure similarly during the light and the dark phase and similarly to WT mice during the light phase. These findings may reflect a lack of inhibition of REMS during the dark phase in KO mice.

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25. Modulation of hypothalamic MCH-expressing neurons by pharmacogenetic tools strongly alters the sleep-waking cycle in mice

VARIN Christophe, Lyon Neuroscience Research Center, SLEEP team

Evidence supports a role of hypothalamic neurons secreting melanin-concentrating hormone (MCH) in sleep induction and maintenance. These neurons are indeed maximally active during paradoxical sleep (PS) based on Fos staining during PS rebound and

juxtacellular unit recordings across the natural sleep-waking cycle in rats. Intracerebroventricular MCH infusion induces an increase in both PS and Slow-Wave Sleep (SWS) in rats, whereas acute optogenetic activation of MCH-secreting neurons at PS onset extends the duration of PS, but not SWS episodes. Our aim is to decipher the precise contribution of MCH neurons to SWS and/or PS regulation with a pharmacogenetic approach using DREADD tools in mice.
Male transgenic MCH-cre mice (12 weeks old) were bilaterally injected within tuberal hypothalamus with either inhibitory (AAV-hSyn-hM4di-mCherry) or excitatory (AAV-hSyn-hM3dq-mCherry) DREADDs and prepared for polysomnographic recordings. Four weeks later, effects on vigilance states were analyzed in response to ip CNO treatments.
Inhibition of MCH neurons at light onset dose-dependently increased SWS quantities compared to saline, due to a dramatic increase in bout duration whereas PS amounts and bout numbers are only slightly reduced. Pharmacogenetic inhibition of MCH neurons after a PS-specific deprivation did not affect PS homeostasis. Moreover excitation of MCH neurons facilitates PS promotion and inhibited SWS.
The present results suggest that MCH-expressing neurons may play a key role in the fine-tuning of the sleep-waking cycle by a modulation of SWS to PS transition. Indeed MCH neurons appear to inhibit SWS to facilitate PS promotion.

26. Cortical spreading depolarization's consequences on brain metabolism after severe traumatic brain injury in rats: Glucose deprivation's correlates?

BALANÇA Baptiste, Lyon Neuroscience Research Center, WAKING team

Introduction: Cortical spreading depolarizations (CSD) can be recorded in acutely injured patients and are known to be associated with a worth outcome, especially when it occur in clusters. Nevertheless CSD pathophysiology remains unclear and if its consequences on micro-vascularization has been well studied metabolic consequences (i.e. brain glucose, lactate, oxygen...) have to be characterize.
Our aim was to measure brain metabolism after CSD either on a healthy cortex or after brain trauma in rats.
Methods. Lateral fluid percussion injury (LFPI, 3.8 ATA) is a model of severe brain trauma in anesthetized and artificially ventilated rats. CSD were either triggered by cortical KCl apposition in anesthetized rats (Control, n=6), or occurred spontaneously after LFPI (Isolated CSD, n=6). Finally CSD clusters were triggered by cortical KCl apposition after LFPI (Cluster CSD, n=6). CSD were recorded by local field potential Ag/CL electrodes in glass micropipettes. Micro biosensors covered with an oxidase

(40 µm tip) were used to measure glucose or lactate extracellular concentrations. Oxygen concentration (tPO2) was measure by a clarck type electrode (10 µm tip), and micro vascularization by laser Doppler flowmetry (LDF). All sensors were implanted in a cortical area showing maximal neuronal loss after LFPI.
Results. Brain, lactate and oxygen basal concentrations were similar between groups, as were blood concentrations. In the control group CSD induced a 0.7±0.45mM decrease in brain glucose associated with a 0.52±0.58mM lactate increase. tPO2 and LDF also increased and all the parameters returned to their initial values within 30min. Isolated CSD after LFPI induced a similar glucose decrease, although associated with a 0.39±0.55mM (p=0.004) lactate decrease. tPO2 and LDF had a biphasic pattern with and initial drop before a similar increase. Finally clusters of CSD after LFPI led to a prolonged glucose and tPO2 decrease with alternated increase and drop of lactate.
Conclusion. CSD have different metabolic consequences depending on cortical status (control or LFPI). Neurovascular coupling and brain metabolism were altered by CSDs, especially clusters of CSDs putting down brain glucose and tPO2. These observations looks alike glucose deprivation and metabolic crisis recorded in acutely injured patients with cerebral microanalysis probe. Like so CSDs seems to be under secondary brain aggression worsening patient's outcome.

27. The neural basis of momentary lapses of attention

PETTON Mathilde, Lyon Neuroscience Research Center, DYCOG team

Momentary lapses of attention (MLA) occur when attention shifts away from the ongoing cognitive task to endogenous processes (e.g. spontaneous thoughts). These lapses of attention are spontaneous, often no conscious and often short-lived.
Our study examines the neural correlates of MLA. Our working hypothesis is that MLA are due to an interference between the task-specific network (necessary and sufficient to perform the task) and the default mode network (DMN). To test this hypothesis, we have used an attention-demanding task (STABILO), described as follows: repeated visual search (letter array) task with a new target/array every trial (every 2.5 s). We investigated the neural substrate of STABILO from intracranial EEG recordings (iEEG) of 59 patients with pharmacoresistant epilepsy, using High Frequency Activity [50-150 Hz] as a marker of neural activity at the population level.
We found that STABILO involves primarily an interaction between the visual cortex and the prefrontal cortex, and a deactivation of the default mode network. The next step is to relate performance (error/reaction time) on a trial-by-trial basis with ongoing fluctuations of neural activity in the DMN.

28. Intermittent Theta Burst Stimulation of the left dorsolateral prefrontal cortex for the Treatment of Persistent Negative Symptoms in Schizophrenia

BATION Remy, Lyon Neuroscience Research Center, PSYR2 team

Introduction: High frequency repetitive transcranial magnetic stimulation (rTMS) of the left dorsolateral prefrontal cortex (DLPFC) has been shown effective for reducing persistant negative symptoms of schizophrenia [1]. Intermittent theta burst stimulation (iTBS), a new paradigm of rTMS, allows more sustained facilitation effect by the repetition of high frequency (50hz) bursts [2]. The aim of this study is to investigate the effect of intermitent theta burst stimulation applied on the left DLPFC on reduction of persistant negative symptoms in schizophrenia.
Methods: 22 patients with persistent negative symptoms of schizophrenia were randomly assigned to receive daily iTBS at 80% motor threshold, or sham TMS over the left DLPFC. The stimulation was delivered 6 cm anterior to the motor cortex during 20 sessions of 990 pulses on 10 consecutive working days. Both patients and symptoms rater were unaware of the treatment condition. Clinical assessments were conducted at baseline, after the 20 sessions of TMS, and at months 1, 3 and 6 after TMS.
Results: The effect of active iTBSon the Scale for the Assessment of Negative Symptoms score was significally superior to the effect of sham treatment. At the end of follow up (+ 6 months), negative symptoms intensity was decreased of 29,4 % in the active group versus -6,9% in the sham group. No serious adverse events were reported.
Conclusions: ITBS of the left DLPFC may be considered as a useful and relatively non-invasive treatment for persistent negative symptoms of schizophrenia.

29. Spatiotemporal Characterization of Brain Infarction by Sequential Multimodal MR Imaging Following Transient Focal Ischemia in a Rat Model of Intraarterial Middle Cerebral Artery Occlusion

GORY Benjamin, Center for Cognitive Neuroscience

Background and Purpose: Emerging endovascular technologies provide new possibilities for cerebral intervention in acute stroke. Selective occlusion of MCA is feasible by microwire intraarterial navigation in rats. Our purpose was to study spatiotemporal brain infarction by sequential multimodal MRI in rats submitted to transient MCA occlusion by this approach.
Methods: A 0.007-inch microwire was selectively placed by intraarterial approach from

the ventral tail artery in the MCA in 16 consecutives Sprague-Dawley rats during 90 minutes occlusion. Sequential multiparametric 7T MRI, including angiography, perfusion, and diffusion was performed during ischemia, immediately after reperfusion, 3 hours and 24 hours after subsequent reperfusion.
Results: MR angiography revealed complete MCA occlusion in 12 animals (75%), partial occlusion in 3 animals (18.7%), and no occlusion in 1 animal (6.3%).After withdrawal the guidewire, MCA was patent in all animals. Hypoperfusion (mean ± SD) was observed in all animals during ischemia (-59 ± 18% of contralateral hemisphere, area 31 ± 5 mm2). Infarction volume (mean ± SD) was 90 ± 64 mm3 during ischemia (ADC map) and 57 ± 67 mm3 at 24 hours (T2 map). Infarction was fronto-parietal cortical in 5 animals (31%), striatal in 4 animals (25%), and cortico-striatal in 7 animals (44%) at 24 hours. All rats survived at 24 hours.
Conclusion: This model of acute stroke in rats by selective endovascular MCA occlusion is safe and highly compatible with MRI techniques allowing spatiotemporal evolution of brain infarction. However optimization of the stroke region reproducibility needs further technical and neurointerventional tools improvements.

30. The special role of the claustrum in monkey's interareal cortical communication

RIBEIRO GOMES Ana Rita, Stem-cell and Brain Research Institute

Communication between cortical areas can be established by the formation of cortical-subcortical-cortical loops (CSCL), which exist when the afferents to a cortical area X are located in close proximity to the afferents to cortical area Y in a given subcortical structure.
By employing highly distinctive retrograde tracers in 5 pairs of cortical areas, we have (1) determined the range of subcortical structures projecting to each area and quantified the projections of each; and (2) identified which subcortical structures participate in the formation of CSCL. Because the distance separating areas X and Y is expected to influence the existence of CSCL (Shipp et al., 2003), we have examined CSCL with respect to two pairs of widely separated areas (7m-10;TEpd-8B) and three pairs of nearby separated areas (V1c-V4c;V4p-V4pc;F2-F7). All target areas receive projections from multiple subcortical sources and the projections' weights of individual subcortical structures overlap those of the values from individual cortical areas. The strongest subcortical projection arises from the claustrum, excepting to V1c which arises from the LGN closely followed by the claustrum. The maximum extent of intermingling of neurons projecting to each areal pair was consistently found in the claustrum.
Our findings demonstrate that thalamic CSCLs only contribute to interareal

communication for nearby area pairs and here the band-with is relatively low. In contrast, the claustrum CSCLs exhibit high band-widths for information exchange across areas near and widely separated. Our observations will doubtlessly contribute to the present day speculation on claustrum function (Crick and Koch 2005).

CANDIDATE FOR STUDENT REPRESENTATIVE ELECTION

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Chères doctorantes, chers doctorants,

Le 29 avril, nous sommes appelés à élire au conseil de notre école doctorale de nouveaux représentants des doctorants. Ceux-ci auront la possibilité de prendre part au conseil, de faire valoir officiellement nos intérêts, de faire entendre nos préoccupations et d'intervenir dans les prises de décisions qui nous concernent tous directement.

C'est pour porter cette voix, recueillir vos interrogations et propositions et faire valoir les intérêts, nécessairement complexes et en partie hétérogènes de notre communauté que je propose ma candidature à la fonction de représentant des doctorants au conseil de l'école doctorale. Je m'engage à poursuivre cette mission avec le souci de transparence, d'écoute, de diffusion de l'information dans les deux sens et à tous les niveaux, tout en honorant le travail des anciens représentants. Il me tient à cœur la défense de nos droits, de renforcer les liens qui unissent le doctorant à notre école doctorale et de favoriser les échanges entres les doctorants.

C'est dans cette direction que se situe mon engagement à être votre voix privilégiée. Je souhaite avoir un rôle d'écoute, de participation, de proposition et de décision afin de défendre vos idées pour le bien de notre école doctorale et de chacun de nous.

En espérant recevoir votre confiance pour vous représenter,

Abhi PRAYAG