

# **MESAS REDONDAS**

**TEMA DA MESA: FALA E PERCEPÇÃO**

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FALE UFMG

**ELETROFISIOLOGIA DA PRODUÇÃO E PERCEPÇÃO DA LINGUAGEM: EVIDÊNCIAS A PARTIR DE REGISTROS INTRACRANIANO**

Flinker A

Berkeley University – EUA

An abundance of research has tried to elucidate the neurobiological basis of language processing in the human cortex. Neuroimaging and lesion studies have provided great insight into what functions different brain structures subserve. While these techniques provide a high spatial resolution they are limited in the temporal domain. Conversely, contributions from non-invasive electrophysiology provided a high temporal resolution with a limited ability to localize cortical sources. The combined spatial and temporal dynamics of cortical processing during language perception and production remains largely unknown. The data described here address this issue by employing unique neuronal population recordings from neurosurgical patients performing linguistic tasks. Electrocorticographic (ECoG) activity recorded directly from the surface of cortex was used to elucidate the timing, magnitude and spatial extent of cortical processing during perception and production of language. I will first address response in the human accessory auditory cortex to self produced speech. During vocalization, auditory cortex activity is reported to be suppressed, an effect often attributed to the influence of an efference copy from motor cortex. Single unit studies in non-human primates have demonstrated a rich dynamic range of single-trial auditory responses to self-speech consisting of suppressed, non-suppressed and excited auditory neurons. However, human research using non-invasive methods has only reported suppression of averaged auditory cortex responses to self-generated speech. Data recorded during auditory repetition tasks showed that the degree of suppression varied across different regions of auditory cortex, revealing a variety of suppressed and non-suppressed responses during vocalization. Importantly, single-trial high gamma power ( $\gamma$ High: 70-150 Hz) robustly tracked individual auditory events and exhibited stable responses across trials for suppressed and non-suppressed regions. I will continue by addressing electrophysiological responses on a finer sub-centimeter scale. The human temporal lobe is well known to be critical for language comprehension. Previous physiological research focusing on noninvasive neuroimaging and electrophysiological techniques have implicated extended anatomical regions in peri-sylvian cortex and typically report a spatially homogenous functional pattern of activity across several centimeters of cortex. The spatiotemporal dynamics of word processing was examined using signals acquired from high-density electrode arrays (4 mm spacing) placed directly on the human temporal lobe. ECoG activity revealed a rich mosaic of language activity, which was functionally distinct at four mm separation. Cortical sites responding specifically to word and not phoneme stimuli were surrounded by sites that responded to both words and phonemes. Other sub-regions of the temporal lobe responded robustly to self-produced speech and minimally to external stimuli while surrounding sites at 4 mm distance exhibited an inverse pattern of activation. Lastly I will review novel data linking these responses to the frontal lobe during production of speech. These rich and unique sets data taken together provide evidence for a rich network of independent and spatially distinct functional sub-regions of cortex subserving perception and production of language. Furthermore, sub-regions 4 mm apart exhibit inverse functional specific responses to linguistic stimuli and self produced speech. These results suggest that language is supported by a complex network of independent sub-regions, with a surprising role of Broca's area in speech production.

**INVESTIGATING NEURAL PREDICTIONS OF EXEMPLAR ACCOUNTS OF SPEECH RECOGNITION**

Wolmetz M

Johns Hopkins University – EUA

There are two major accounts of long-term phonological memory used for spoken word recognition: abstractionist and exemplar. In abstractionist accounts entries in the phonological lexicon are words composed of abstract segments, while in exemplar accounts entries are detailed memory traces of heard words. Using functional Magnetic Resonance Imaging, we tested a neural prediction of exemplar accounts: speaker-specific information is encoded in lexical memory. To test this prediction, we (1) recorded neural responses while participants listened to items spoken by three different speakers, (2) identified lexical processing regions corresponding to voxels with different responses to high frequency words as compared to phonotactically-matched low frequency words and pseudowords, and (3) used multi-voxel pattern analysis to test whether speaker information was present within responses from these voxels. Speaker information was found in the responses of lexical processing voxels as demonstrated by successful speaker classification.

**PHONEME DISCRIMINATION AND SEGMENTATION IN BRAZILIAN PORTUGUESE**

Rothe-Neves R

FALE – UFMG

We report some results by our research group on phoneme discrimination and segmentation. Phoneme discrimination refers to the ability to discriminate between two different sounds that are distinctive in our language. We used a behavioral task in a same-different paradigm consisting of pairs of heavy syllables. In some pairs the first consonant in both syllables differ in either voicing, place or manner of articulation, all other things being equal. The subject's task is to respond if the first sound is the same in both syllables. In phoneme segmentation, the whole syllable is different, but some syllables share the same first consonant. That is, while in the phoneme discrimination task any acoustic difference could trigger a "no" response (indicating that the first sounds are not the same in both syllables), in the phoneme segmentation task subjects must rely on the phonetic representation of the syllables, because acoustically they are always different. Thus the discrimination task taps into the ability to discriminate the acoustic input whereas the segmentation task taps into the acoustic-phonetic mapping. Since 2004 we have been able to investigate different groups (normal adult subjects, aphasic subjects and children). We are now investigating which is the best set of sound to use among all 56 possible pairings in phoneme discrimination and 196 possible pairings in phoneme segmentation in our language. Since some sounds differ mainly in temporal characteristics, we are also interested in how subjects' responses relate to temporal discrimination abilities.

## TEMA DA MESA: PERCEPÇÃO AUTO-REGULADORA: METACOGNIÇÃO

Coordenador: Prof. Cristiano Gomes  
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### **METACOGNITION PERCEPTION IN MUSIC: METHODS AND EVIDENCES**

Sampaio RT

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This study presents partial results of a literature review within the subject of Metacognition and Music regarding different areas such as Music Education and Professional Training, Musicology, Music Therapy and Neurosciences. Metacognition is usually conceived as a component of the mind that processes self-monitoring, self-representation and self-regulation. Musicological studies have demonstrated that the term may be recent but the recognition of this ability and its importance to both music appreciation and performance &#8211; including composition, conducting and improvising &#8211; can be easily tracked down to the ancient greek writings of Aristoxenus, Boethius and Plato, among others, limiting the research to occidental history. Recent publications about Metacognition and Music may be divided in three groups: studies regarding the effects of musical training and musical appreciation in the human body, specially with cerebral processing of the musical stimulus both with healthy and clinical subjects; studies conducted with people within rehabilitation settings, regarding plasticity and development in musical abilities and cognition and their relation to health and well being; and, studies within educational and professional training settings dealing with development of musical skills in specific areas of performance, composing, appreciation, conducting and improvisation. It has been found that music listening and music performing activates a wide-spread bilateral network of brain regions related to attention, memory, motor functions, semantic processing and emotional processing, both in healthy and clinical subjects. Music education and instrumental training have been related to acquisition and practice of a variety of complex motor, auditory, visual-spatial, verbal and mathematical skills. However, the underlying neural bases of these enhancements did not have been completely and consistently described.

### **WORKING METACOGNITIVE PERCEPTION: MONITORING AND JUDGMENT: METHODOLOGY AND EVIDENCE**

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The present research hypothesize that self-report questionnaires do not necessarily indicate real interactions, but people's perceptions about their own functioning. We postulate that perceptions about subject-object interaction are a type of metacognitive knowledge, labeled academic metacognitive knowledge (AMcK). In order to test our hypothesis, we have administered two tests of working metacognition (WMC), and two distinct scales, indicators of AMcK, in a sample composed of 684 ten-to-eighteen-years-old Brazilian children and adolescents. Annual grades in Math, Portuguese, Geography and History were used as indicators of general academic achievement (GAA). We've used Structural Equation Modeling to verify the relationship between WMC, AMcK and GAA. The results show that: (1) the latent variable AMcK explains the variance of the scales used; (2) AMcK is distinct from the latent variable WMC, and (3) has incremental validity, beyond WMC, on the explanation of the GAA variance. Implications to psychology and education will be discussed. **Keywords:** Metacognition; Learning approaches; Cognition.

### **PERCEPÇÃO METACOGNITIVA DE LONGO-TERMO – AUTO-CONCEITO E AUTO-EFICÁCIA: METODOLOGIA E EVIDÊNCIAS**

Costa BCG

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O presente trabalho tem como objetivo discutir a produção atual acerca do autoconceito e da auto-eficácia, argumentando a importância de um maior entendimento desses conceitos enquanto relacionados entre si e com outros componentes do funcionamento cognitivo. Nesse sentido, será apresentado o modelo proposto pelo Psicólogo do Desenvolvimento Andreas Demetriou, que busca explicar as interrelações entre os diferentes aspectos da mente, do self, da personalidade e da inteligência em um modelo único e abrangente da arquitetura cognitiva. Demetriou propõe a construção de um modelo consistente, que integre os achados da área do Self em uma teoria mais robusta, capaz de explicar tanto os componentes do self de maneira isolada, bem como em sua relação dinâmica. O trabalho de Demetriou contempla o autoconceito e a auto-eficácia enquanto parcelas da chamada Hiper cognição de Longo-termo. Esta, refere-se aos processos e formulações feitos sobre si mesmo, ou seja, auto-julgamentos, auto-valores, auto-descrições, auto-representações etc. Englobando assim conceitos tradicionalmente investigados na Psicologia, como o autoconceito e a auto-eficácia, porém permitindo um entendimento destes fatores em sua relação com as demais dimensões cognitivas. Serão apresentados nesse trabalho algumas das principais evidências empíricas do modelo de Demetriou, bem como discutidas as implicações da Hiper cognição de Longo-Termo para a tradição de investigações sobre o auto-conhecimento.

# TEMA DA MESA: AUTISMO E PERCEPÇÃO: ASPECTOS CLÍNICOS E EXPERIMENTAIS

Coordenador: *Prof. Arthur Kummer*  
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## EXPERIMENTAL MODELS OF AUTISM

Gottfried C  
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Scientific evidence clearly shows that prenatal environmental factors such as infections, alcohol, thalidomide and valproic acid (VPA), may influence the development of Autism Spectrum Disorders (ASD). Prenatal exposure of VPA during the first trimester of pregnancy is associated with significantly increased risks of autism. Animal model systems can provide insight into the underlying biology and development of ASD and allow investigators to model some of the core symptoms of autism, including deficits in social interactions, aspects of social communication and stereotyped, repetitive behaviors all modeled in rodents. Prenatal exposure to VPA was speculated as a possible alternative research tool to study the mechanism involved in the etiology and pathophysiology of ASD. Construct, face, and predictive validities are present in this model, ensuring its effectiveness as a trustworthy research tool. In summary, the main interest of animal models is to generate new pertinent hypotheses relevant to humans opening the path to innovative research. Acknowledgments: CNPq, CAPES, Propesq-UFRGS.

## NEUROBIOLOGIA DO AUTISMO: UMA ABORDAGEM TRANSLACIONAL

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O autismo infantil foi descrito em 1943 por Leo Kanner e por algumas décadas era atribuído exclusivamente a problemas emocionais. Trata-se de um grupo de transtornos do desenvolvimento infantil que se caracteriza pela "Tríade de Wing": problemas na linguagem e no relacionamento interpessoal, aliados a um repertório de interesses muito restrito. Dentro do ambiente acadêmico, está bem clara sua base neurobiológica. A quantidade de publicações tratando de autismo em revistas indexadas aumentou em mais de 500% nos últimos cinco anos. Atualmente, admite-se que atinja a aproximadamente 1% das crianças, o que não é pouco. Pesquisas estão em curso, no sentido de entender a neurobiologia do autismo, que é multifatorial e complexa. Em decorrência desta complexidade, existe uma premência para que seja construída uma ponte unindo a experiência clínica com a oriunda dos laboratórios de pesquisa experimental. A pesquisa originária desta união de forças é chamada pesquisa translacional. No nosso entendimento, a abordagem translacional permite uma sincronia de forças e uma celeridade na obtenção de respostas, o que seria muito mais demorado caso a pesquisa experimental ficasse desconectada da pesquisa com pacientes. Neste sentido, dentro a Universidade Federal do Rio Grande do Sul (UFRGS) a Unidade de Neuropediatria (<http://www.ufrgs.br/neuropediatria>) e o Grupo de Pesquisa de Plasticidade Neuroglial (<http://www.ufrgs.br/png>) uniram suas equipes. Já temos pesquisas em cultura de células, em modelos animais de autismo, em pacientes, e também na área da bioquímica quântica, com vários artigos publicados, patentes requeridas e uma série de pesquisas em franco desenvolvimento. No que se refere à neurobiologia do autismo, atualmente admite-se de que se trate mais de um problema da conectividade cerebral do que uma alteração em uma específica região cerebral. Não temos dúvidas de que existe envolvimento das células gliais, além dos neurônios. Uma das tendências atuais, dentro da esfera clínica, é de admitir uma relação entre autismo e epilepsia, mesmo que ainda não muito bem entendida. No que se refere às possíveis relações entre autismo e epilepsia, tanto a conectividade cerebral quanto as células gliais certamente têm participação. Apesar de ainda não haver uma resposta única e satisfatória para a neurobiologia do autismo, nosso grupo está apostando em eventos precoces na vida da criança, principalmente os da esfera da neuroimunomodulação.

## IMUNOLOGIA NO AUTISMO

Rodrigues D  
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Transtornos do espectro autista (TEA) são doenças do neurodesenvolvimento caracterizadas por interesses restritos, comportamentos repetitivos, linguagem deficiente e habilidade social comprometida. Inicialmente, o autismo era considerado uma desordem rara, mas estudos recentes mostram que sua incidência pode chegar a 1 a cada 110 crianças. No Brasil, estima-se que as TEA afetem mais de 1 milhão de brasileiros e causem impactos social e econômico relevantes. Embora seja evidente o substrato neural para a manifestação das TEA, a etiopatogênese destas ainda é desconhecida. A busca pelos mecanismos etiopatogênicos das TEA levou à investigação do sistema imunológico. De fato, existe uma intensa rede de interações entre o sistema imune e o sistema nervoso central, e, em consequência, distúrbios em um dos sistemas podem gerar alterações no outro. Em pacientes com TEA, esses distúrbios poderiam ser permanentes, por isso a persistência dos sinais clínicos. Vários autores relatam alterações importantes em parâmetros imunológicos diversos de pacientes com TEA, como níveis de citocinas, quimiocinas, ativação celular, susceptibilidade e resposta a infecções e autoimunidade. Relata-se, também, melhora dos sinais clínicos em alguns pacientes durante episódios de febre, condição na qual é quebrada a homeostase imunológica, e é pouco provável que essa melhora seja devido ao aumento de temperatura corporal. Resultados preliminares de nosso grupo de pesquisa corroboram alguns desses achados. Apesar das evidências de que há alterações notáveis no sistema imune de pacientes com TEA, ainda se desconhece a relevância desses achados para a compreensão da etiopatogênese delas. Entretanto, tais achados podem ser importantes no desenvolvimento de terapias para TEA. Assim, nesta apresentação, serão mostrados vários estudos que mostram alterações do sistema imune em pacientes com TEAs, assim como resultados preliminares e perspectivas de estudo de um grupo de pesquisa em autismo da pós-graduação em Neurociências.

## TEMA DA MESA: VIOLÊNCIA E PERCEPÇÃO

Coordenador: *Prof. Fernando M.V. Dias*  
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### VIOLÊNCIA E TRANSTORNOS PSIQUIÁTRICOS: CENÁRIO ATUAL

Dias FMV  
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A relação entre fatores ambientais e o potencial genético podem determinar o aparecimento de transtornos psiquiátricos nos indivíduos. A investigação dos fatores ambientais envolvidos com transtornos mentais oferece campo vasto de investigação neurocientífica, permitindo contribuir para compreender melhor o funcionamento do Sistema Nervoso Central e fenômenos como, plasticidade cerebral e, também, determinantes culturais de comportamentos. A violência aparece, atualmente, como um importante fator ambiental relacionado aos transtornos mentais, principalmente nos meios urbanos. Nessa apresentação buscaremos definir, a partir de estudos epidemiológicos, quais são os principais transtornos psiquiátricos que possuem algum tipo de relação com a violência e, quais são as hipóteses para explicar como ocorrem essas associações. O Transtorno de Estresse Pós Traumático origina-se após a vivência, ou melhor, a percepção de um trauma intenso que rompe com a estabilidade do funcionamento mental, resultando em sintomas do espectro da ansiedade. Assim, considerando o Transtorno de Estresse Pós Traumático como modelo da relação entre “percepção” da violência e funcionamento do Sistema Nervoso Central, iremos revisar as alterações evidenciadas, através de diversos métodos - neuroimagem e neuroimunologia - em estudos desse transtorno. Por fim, iremos avaliar a proposta de como a violência pode ser considerada um determinante cultural do comportamento, uma vez que a sua percepção pode criar e reforçar hábitos e costumes na sociedade contemporânea.

### SAÚDE MENTAL DE POPULAÇÕES DE REGIÕES EM CONFLITO OU PÓS-CONFLITO

Kamitsuji C  
HC – USP

Como é percebida a violência em regiões de conflitos armados? E qual o impacto da percepção desta violência na saúde das pessoas que vivem nessas regiões? Estas são perguntas muito difíceis de serem respondidas. Palavra que vem do latim, perceber significa: 1) Adquirir conhecimento por meio dos sentidos. 2) Abranger com a inteligência; compreender, entender. 3) Enxergar, divisar. 4) Ouvir, escutar. Esta palestra tem como objetivo expor a experiência de uma médica psiquiatra brasileira que trabalhou na área de saúde mental com a ONG Médicos Sem Fronteiras em Uganda, Iraque e Cisjordânia, e com Comitê Internacional da Cruz Vermelha na Tchetchênia. Todos, principalmente, os três últimos são lugares considerados muito violentos. Conflitos armados estiveram ou estão presentes nesses contextos, fazendo parte do dia-a-dia da população local. Há uma diferença grande da percepção da violência entre locais e estrangeiros, pois os primeiros adquirem conhecimento por meio dos sentidos, isto é, vivenciam, experimentam a violência na pele. Ao mesmo tempo, a população local encontra maneiras diversas de lidar com essa violência e continuar vivendo. Esse aprendizado tem um impacto na saúde de cada sujeito. Ao trabalhar nesses contextos, é possível aprender com a população local que viveu ou vive exposta ao conflito armado sobre o impacto da violência na saúde. Em alguns momentos é possível até “perceber” a violência. Grandes aprendizados foram:

1. Angústias humanas são universais.
2. Trauma é transmitido de geração para geração se a “ferida” não for cuidada.
3. Resiliência se desenvolve bastante frente aos conflitos.
4. Não é possível generalizar a percepção de um grupo de pessoas, pois a experiência é única.
5. A relação colonizador-colonizado ainda é muito presente e existem inúmeras explicações das “metrópoles” (países desenvolvidos) para as percepções da violência vividas nas “colônias” (países em desenvolvimento). É necessário haver uma desconstrução do saber adquirido no contexto acadêmico de “condições normais de pressão e temperatura”, ouvir e aprender com aqueles que “percebem” a violência nos conflitos armados, para que haja uma troca de conhecimentos efetiva na construção de um programa integral de cuidado à saúde.

### FATORES CONTEXTUAIS, INDIVIDUAIS E COGNITIVOS: EFEITOS SOBRE A SENSAÇÃO DE MEDO E INCIDÊNCIA DE CRIME EM MINAS GERAIS

Caminhas DA  
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O medo do crime desponta como uma das fortes características do espaço urbano e, cada vez mais, ocupa posição central nos discursos dos mais diversos grupos sociais, tais como jornalistas, políticos e a população em geral. De forma recorrente, em tais discursos, o medo do crime é entendido como uma mera resposta individual às taxas de criminalidade. Contudo, há algumas décadas, pesquisadores internacionais tem verificado que o medo é estimulado por variáveis outras que não dizem respeito necessariamente ao crime de fato. No entanto, é importante reconhecer que ainda são raras as pesquisas nacionais que examinam as raízes que fomentam e estimulam tal medo, sobretudo no que se refere a estudos que mensuram quantitativamente quais variáveis teriam (ou não) efeito sobre essa sensação e em que grau. Nesse sentido, o Centro de Estudos de Criminalidade e Segurança Pública (CRISP/UFMG) realizou um survey em 2009, com um total de 5006 entrevistas, em 29 municípios de Minas Gerais, sobre Percepção de Risco e Medo do Crime. Com base nesses dados, foi testada a capacidade preditiva de sete tipos de teorias/hipóteses presentes na literatura (vulnerabilidades sociodemográfica, meios de comunicação de massa, incivildades física e social, vitimização direta e indireta, diferenças entre cidades/regiões e percepção de risco) para a sensação Medo Geral de Crimes. Para tanto, utilizou-se como método um modelo estatístico de regressão linear multivariada. Os resultados demonstram que os aspectos individuais, ecológicos, experiências pessoais indiretas com crimes, fontes de informação sobre crimes, a cidade/região onde reside e percepção de risco foram de fundamental importância para determinar a sensação de medo do indivíduo. De uma forma geral, o estudo demonstra que o medo do crime não deve ser entendido como um produto estanque ou como uma consequência trivial da incidência de crimes. É preciso interpretá-lo como um resultado de vários processos, buscando explicações no bojo das relações sociais, nas condições espaciais de vida dos sujeitos e, sobretudo, da forma como as pessoas percebem e se informam sobre a criminalidade em seu contexto.

## TEMA DA MESA: NEUROMARKETING, NEUROECONOMIA: NOVAS PERSPECTIVAS EM CIÊNCIAS SOCIAIS APLICADAS

Coordenadores: Prof. Carlos Alberto Gonçalves e Prof. José Edson Lara  
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### DELINEAMENTO DO CONSUMIDOR EM NEUROMARKETING

Costa EC  
FIOCRUZ – MG

**Introdução:** A Análise de Componentes Principais (PCA) é uma ferramenta matemática que tem como objetivo converter um conjunto de observações de variáveis possivelmente correlacionadas a um conjunto de valores de fatores, linearmente descorrelacionadas. Em Neuromarketing, esse procedimento é utilizado para delinear o perfil do consumidor por meio da análise exploratória dos dados ou originando modelos preditivos capazes de contribuição na construção dos experimentos de neurofisiologia ou de imagem. **Objetivo:** Nesse estudo, usou-se como exemplo, o delineamento do perfil projetado para os consumidores dos veículos médios Bravo (FIAT), Focus (FORD) e I-30 (HYUNDAI). **Metodologia:** PCA seguida da rotação ortogonal Varimax, determinando os fatores somente aqueles que apresentaram autovalores (eigenvalues) superiores a 1. **Resultados:** Foram avaliadas 17 variáveis para cada veículo, totalizando 51 observações de uma amostra de 339 questionários respondidos por meio de um inquérito online. Para os consumidores do Bravo, encontrou-se um modelo com 4 fatores (uso-situação, estilo de vida, personalidade e padrão de vida) enquanto que para os veículos Focus e I-30, modelos com 3 fatores. **Conclusão:** Apesar de pertencerem ao mesmo segmento de veículos médios, os consumidores dos três modelos apresentam perfis diferentes dos consumidores.

### NEUROEVOLUTIONARY TRAPS AND IMPULSIVE CONSUMPTION DECISIONS

Haase V  
FaFiCH – UFMG

Modern capitalist economy has two sides: production and consumption. Impulsive consumption is reviewed from a neuroevolutionary perspective. Human species evolved in an environment of scarcity. Powerful motivational mechanisms were developed, biasing the organism towards immediate consummatory behavior. The epicenter of such mechanisms is represented by opioid and dopaminergic mechanisms in the ventral striatum. Opioid regulation is related to the “liking” or enjoying of goods, while dopaminergic mechanisms are involved in the “wanting” or appetitive behaviors. In the contemporary environment of abundance, considerable degree of effort and control is required to counteract the immediate consummatory bias. It is ironic that, dopamine, the same neurosubstance involved in appetitive behaviors, also contributes to curiosity, learning and working memory performances related to behavior and cognitive control by prefrontal circuits. A maturational mismatch in adolescence, between dopaminergic appetitive and control mechanisms may explain proneness to an impulsive consummatory orientation. The picture is compounded by the fact that our ancestral time and magnitude estimation mechanisms are extremely imprecise. The degree of imprecision in human quantity estimations increases as the magnitudes involved grow. People experience considerable difficulty estimating prices and interest rates. Human immediate consummatory bias and imprecision of magnitude estimate constitute the evolutionary traps employed by marketing strategies to increase sellings.

### NEUROMARKETING E CIÊNCIA COGNITIVA: UMA NOVA ABORDAGEM NOS ESTUDOS DO COMPORTAMENTO DO CONSUMIDOR

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**Introdução:** Os avanços provenientes da engenharia médica têm permitido pesquisar e desenvolver equipamentos mais sofisticados, que têm contribuído para o melhor diagnóstico e tratamento de determinadas patologias, e, não obstante, aberto espaço para o desenvolvimento do conhecimento em outras áreas, tais como as Ciências Sociais. A partir das argumentações acerca da possibilidade de maior entendimento das decisões de consumo que não são explicitamente percebíveis surgiram, há aproximadamente duas décadas, o Neuromarketing e a Neuroeconomia. **Objetivos:** (i) Identificar, por meio do rastreamento ocular, pontos de saliência para os veículos Bravo (FIAT), Focus (Ford) e I30 (HYUNDAI); (ii) introduzir uma abordagem para identificar a utilidade cardinal dos três veículos; (iii) analisar a utilidade cardinal de três filmes publicitários do Bravo (FIAT), produzindo um sistema para a sua edição, com vistas à produção de versões enxutas, compostas estritamente dos aspectos de valência e saliência elevados. **Metodologia:** Nesse estudo, realizaram-se dois experimentos. No primeiro ( $n = 30$ ), aplicou-se um teste de rastreamento ocular (eyetracking), que foi precedido por uma fase qualitativa, permitindo a comparação entre as medições e as informações declaradas dos sujeitos de pesquisa. No segundo experimento ( $n = 40$ ), realizaram-se coletas de dados de neurofisiologia periférica (RGP, HRV) e neurofisiologia central (EEG). **Resultados:** Para o experimento de rastreamento ocular percebeu-se que a variável diâmetro pupilar não apresentou relação estatisticamente relevante com a variável carro (Bravo, Focus e I30) isoladamente, contudo, a comparação carro, item e esses conjugados permite a observação de pontos de saliência diferenciados. Em relação aos experimentos de neurofisiologia periférica e central, observou-se um caráter desinteressante das marcações periféricas (HRV e RGP), enquanto a medição de neurofisiologia central (EEG) permitiu identificar níveis de engajamentos diferenciados entre um dos filmes. **Conclusão:** As medições neurofisiológicas podem contribuir com os estudos em ciências sociais na identificação de aspectos não facilmente declarados pelos indivíduos, que são representados por níveis de valência e saliência elevados.

**TEMA DA MESA: DROGAS E PERCEPÇÃO**

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**CANNABINOIDS AND THE BRAIN**

Moreira FA

ICB – UFMG

The herb *Cannabis sativa* (“hemp”, “marijuana”) is known for centuries as a drug of abuse. Its main acute effects are typically described as feelings of pleasure and relaxation, as well as delusion, hallucinations and memory impairment. Its long term consumption may be correlated with occurrence of neuropsychiatric disorders. In addition, this herb has potential therapeutic applications, which have been considered since ancient times, particularly due to its properties as an analgesic, anxiolytic and antiseizure drug. However, the knowledge on its chemical content and its mechanisms of action is quite recent. At the present time, it is known that the main substances accounting for its effects are delta-9-tetrahydrocannabinol (THC) e cannabidiol, members of a group of substance termed cannabinoids. THC and its synthetic analogs act upon specific receptors in the central nervous system. Physiologically, these receptors are activated by endogenous substances known as endocannabinoids. The endocannabinoids, its receptors, as well as their metabolizing enzymes, represent a system for intercellular communication termed the endocannabinoid system. The aim of the presentations in this round table is to illustrate the perspectives for the development of drug that act on this system, which may have implications for the treatment of neuropsychiatric disorders, such as anxiety and epilepsy. The problems and limits of cannabinoid research will also be discussed, as well as potential strategies to circumvent them.

**ROLE OF THE ENDOCANNABINOID SYSTEM IN EXTINCTION OF FEAR MEMORIES: LESSONS FROM ANIMAL STUDIES**

Wotjak C

Max Planck – Instituto de Psiquiatria – Alemanha

Generalized avoidance belongs to the core symptoms of a variety of anxiety disorders such as Panic disorder or Posttraumatic stress disorder. However, therapy for avoidance behavior still bears many obstacles. Even though exposure-based approaches are the method of choice, they suffer from inferior patient compliance. This can be ascribed to patients' inability to stand the high emotional load experienced during the therapeutic sessions. The situation could be much improved if (1) learning about the safety of a feared situation could be enforced, while (2) the negative affect inherent to the exposure is decreased. This would allow for the number/duration of the exposure sessions to be restricted to a minimum and at the same time, the emotional load of the therapeutic sessions could be dampened, with direct consequences on compliance rates. So far, however, most of the treatments with anxiolytic capabilities (e.g. benzodiazepines) lead to state-dependency or amnesia, with the consequence that safety learning is attenuated, if not completely blocked. I will introduce the endocannabinoid system of the brain as an interesting new target for the pharmacoenhancement of exposure-based therapies. I will provide evidence that endocannabinoid signaling via cannabinoid CB1 receptors is essential for acute fear relief and safety learning. Moreover, I will demonstrate that inhibition of endocannabinoid uptake/degradation promotes safety learning and attenuates the risk of relapse. Therefore, drugs promoting endocannabinoid signaling via CB1 receptors may represent a new class of compounds which combine the advantages of “happy pills” (in terms of fear and stress relief) with those of “smart drugs” (i.e. facilitated safety learning), thus increasing compliance rates and success of exposure-based therapies.

**CANNABINOIDS FOR THE TREATMENT OF ANXIETY DISORDERS**

Crippa J

USP – RP

The plant *\*Cannabis sativa\** (cannabis) has been used to relieve anxiety symptoms, primarily as sedatives and hypnotics, for thousands of years by different peoples and distinct cultures, although cannabis is known to have adverse effects. However, after the 1930s, the medical use of *\*cannabis\** declined, particularly in psychiatry due to several reasons: (i) the active principles of *\*cannabis\** had not yet been isolated; (ii) the extracts varied in potency and composition, resulting in inconsistent and undesirable effects; (iii) new hypnotic and sedative substances were developed; (iv) *\*cannabis\** was considered an illegal substance, which further limited its use. With the identification of the chemical structures of the main components of *\*cannabis\**, including  $\Delta^9$ -tetrahydrocannabinol ( $\Delta^9$ -THC) and cannabidiol (CBD), then later discover of cannabinoid receptors (CB1 and CB2) in the central nervous system, as well as the isolation of the endogenous ligands 2-arachidonoylglycerol and anandamide, the use of cannabinoids in anxiety was renewed. We concentrate particularly on recent findings, both ours and others', related to the possible applications of CBD, a non-psychoactive cannabinoid. CBD's anxiolytic effects are apparently similar to those of approved drugs to treat anxiety, although its effective doses have not been clearly established and the mechanisms underlying these effects are not fully understood. Most studies on CBD have been conducted with rodents, but studies with human samples have also provided promising results, particularly using neuroimaging techniques. The low affinity of CBD for cannabinoid neuroreceptors and its agonist properties at 5-HT<sub>1A</sub> receptors have been repeatedly demonstrated. Moreover, the actions of CBD have shown to be biphasic, thus the adequate therapeutic window for each anxiety disorder remains to be determined. The results from laboratory animals, healthy volunteers, and patients with anxiety disorders support the proposition of CBD as a new drug with anxiolytic properties. SPECT and fMRI neuroimaging studies have shown CBD acts in the brain throughout limbic and paralimbic areas, such as the left parahippocampalgyrus, the left amygdala-hippocampus complex, including the fusiform gyrus, which is compatible with an anxiolytic action. CBD was shown to reduce anxiety in patients with social anxiety disorder, using the simulated public speaking test. CBD also reduced anxiety in a patient with cannabis withdrawal syndrome. Because it has no psychoactive effects and does not affect cognition; has an adequate safety profile, good tolerability, positive results in trials with humans, and a broad spectrum of pharmacological actions, CBD appears to be the cannabinoid compound that is closer to have its preliminary findings in anxiety translated into clinical practice. Future studies should test this possibility in larger clinical trials involving patients with different anxiety disorders, especially panic disorder, obsessive-compulsive disorder, social anxiety disorder, and post-traumatic stress disorder.

## ENDOCANNABINOIDS SYSTEM AS A STRATEGY TO PREVENT CONVULSIVE SEIZURES

Vilela LR

*Doutorando do Programa de PG em Neurociências – UFMG*

**Aims:** Epilepsy is a severe neurological disorder characterized by excessive or synchronous neuronal activity, which may lead to convulsive seizures. The substances present in the plant *Cannabis sativa*, as well their synthetic counterparts (termed cannabinoids), have been proposed as a treatment for this disorder. They act mainly through the cannabinoid (CB1) receptor in the brain, which is also activated by endogenous substances, such as anandamide, termed endocannabinoids. However, their effects in models predictive of anti-convulsive activity have remained controversial. Thus, the present study was designed to further investigate the modulatory potential an anandamide-hydrolysis inhibitor, URB597, on seizures induced by infusion of PTZ and cocaine overdose. **Methods:** PTZ: Male Wistar rats (6-8/group) received intraperitoneal injections of vehicle or URB 597 (0.3-1.0-3.0 mg/kg). Thirty minutes later they received intravenous infusion of PTZ, at a concentration of 10 mg/mL. The “threshold” of PTZ to induce a myoclonic seizure, as well as electroencephalographic (EEG) seizure duration, were compared between groups through analysis of variance followed by the Newman-Keuls test. Cocaine: Male swiss mice (9/group) received intraperitoneal injections of vehicle or URB 597 (1.0mg/kg). Thirty minutes later they received intraperitoneal injection of cocaine (75 mg/kg). The myoclonic seizure latency, as well as EEG seizure duration, were compared between groups through analysis of variance followed by the Newman-Keuls test. **Results-** PTZ: Treatment with URB597 (3.0 mg/kg) increased the threshold of PTZ required for myoclonic seizure and reduced an EEG seizure duration revealed an anticonvulsant effect. Cocaine: Treatment with URB597 (1.0 mg/kg) increased the latency and reduced duration required for myoclonic seizure. On the other hand, pre treatment with CB1 antagonist, AM251, reversed the effect of anandamide-hydrolysis inhibitor on the cocaine-induced behavioural seizure in mice showed an involvement of CB1 receptor on cocaine-induced convulsive seizures. Similarly, URB597, at the same dose, exhibited and anticonvulsant profile on cocaine-induced EEG seizure parameters, an effect reversed by AM251. **Conclusion:** Anandamide hydrolysis inhibition produced anticonvulsive effects, as revealed by both behavioral and EEG analysis and represent a promising target for the development of antiepileptic drugs. **Financial Support:** FAPEMIG. **Authors:** Vilela LR (1), Medeiros, DC (2), Rezende, GHS (2), Oliveira AC (3), Moraes MF (2), Moreira FA (3). Graduate Programs in Neurosciences (1) and Physiology and Pharmacology (2,3); Departments of Physiology (2) and Pharmacology (3), ICB, Federal University of Minas Gerais (UFMG), Belo Horizonte-MG, Brazil. E-mail: llucianofisio@yahoo.com.br

## TEMA DA MESA: ESTIMAÇÃO DE MAGNITUDE E DECISÕES INTERTEMPORAIS

Coordenador: *Prof. Vitor Haase*  
*FaFiCH- UFMG*

### FINGER REPRESENTATIONS – AN ADDITIONAL ROUTE TO ADDITION?

Krinzinger H

*Universidade de Aachen, Alemanha*

A possible supporting role of finger representations for the development of early numerical cognition has been the subject of recent debate. Working from recent studies in the field, several possible functional links between fingers and numbers will be presented. Analogue one-to-one correspondence of fingers might be one helpful cognitive aspect of finger counting, the symbolic processing of canonical finger patterns to show numbers may be another one. In an own fMRI study in children aged 6-12 years we were able to show that a large network of finger-related brain areas (aIPS, ventral precentral sulcus, supplementary motor area, DLPFC, insula, thalamus, midbrain, cerebellum) was active during (particularly non-symbolic) exact addition, but not during magnitude comparison. Moreover, a finger-related activation cluster in the right ventral precentral sulcus was only present during non-symbolic addition and magnitude comparison, but not during symbolic number processing tasks. In conclusion, finger counting may critically mediate the step from non-symbolic to symbolic and exact number processing. I will argue why the symbolic representation of canonical finger patterns is thought to be the crucial supporting cognitive aspect of finger counting for the development of numerical cognition. Furthermore, possible future studies to directly test this hypothesis will be presented.

### SOLVING A RIDDLE – HOW THE BODY AND BRAIN CREATE OUR EXPERIENCE OF TIME

Wittmann M

*Instituto de Psicologia e Saúde Mental – Alemanha*

Philosophers and scientists of all times have been intrigued by of our sense of time and the nature of temporality. This fundamental question of how we as humans perceive duration might soon find an answer. Over the last decade a set of functional models of time perception has been developed, resulting from empirical evidence in animals and humans, which point to a specific neural mechanism: the experience of duration might emerge from climbing neural activity, the monotonic increase of neural firing rate across time. Here I present fMRI and psychophysiological evidence of neurophysiological activity in circumscribed areas of the human brain which appears to be involved in the encoding of duration: (1) Time-activity curves of neural activation during an fMRI duration reproduction task show that activity within bilateral posterior insula represents duration of multiple seconds. Given the close connection between the posterior insula and ascending body signals, it is suggested that the accumulation of physiological changes in body states constitutes our experience of time; (2) a positive relationship was detected between duration reproduction accuracy and the subjective awareness of the heartbeat. Moreover, timing accuracy was related to the slope of cardiac slowing, which showed a monotonic increase over time during the encoding of temporal intervals. These findings are discussed in a framework within which physiological changes of the body, the basis of our feeling states, form an internal signal to encode the duration of external events.



## **WHAT DO WE KNOW ABOUT THE DEVELOPMENT OF AFFECTIVE DECISION-MAKING IN PRESCHOOLERS?**

Mata F

*Mestranda do Programa de PG em Neurociências – UFMG*

Affective decision-making, or decision-making for events that have emotionally significant consequences such as rewards and losses, develops rapidly in the preschool years. Studies using the Iowa Gambling Task and its age-appropriate versions as an index of affective decision-making in childhood and adolescence have demonstrated a great interindividual variability of scores. Firstly, I am going to examine whether this performance variability is related to general intellectual functioning and socioeconomic status in the preschool years. Secondly, I am going to investigate the association between socioeconomic status and performance on a working memory task and whether poorer performance on this measure will impact affective decision-making as measured by the Children Gambling Task. Finally, I am going to investigate if there is a positive relation between performance on a Delay of Gratification Task and the Children Gambling Task in the end of the preschool period.

## **PERCEIVING NUMBERS AND OTHER MAGNITUDES: HOW DO WE QUANTIFY THE WORLD?**

Pinheiro-Chagas P

*Mestre pelo Programa de PG em Neurociências – UFMG*

Human infants and adults share an approximate number system (ANS), dedicated to the perception and representation of numerical magnitudes in an abstract fashion. The ANS allows for approximately grasp how many objects are present in a scene, compare different magnitudes and manipulate quantities using simple arithmetic operations, such as addition and subtraction. This talk will be divided in three parts. Firstly, I am going to investigate the development of the ANS as a foundational capacity for the acquisition of mathematical reasoning. Secondly, I am going to explore the idea that the ANS is part of a broader magnitude system, which also includes the perception of time and space. Finally, the possible cognitive pathways by which this magnitude system interacts with decision-making processes are going to be discussed.

## TEMA DA MESA: O OLHO E O CÉREBRO

Coordenador: *Dra. Maria Frasson*  
*Oftalmologista do Hosp.S.Geraldo – UFMG*

### WHAT THE EYE SEES AND WHAT THE BRAIN UNDERSTANDS: VISION NEUROPHYSIOLOGY

Picaud S

*Institut de la Vision, INSERM – França*

Photoreceptors degenerate in different retinal diseases including retinal dystrophies like retinitis pigmentosa or more complex diseases such as age macular degeneration. Unfortunately, it remains very difficult or impossible to stop these degenerative processes. After the photoreceptor loss, the residual retina is still composed by two neuronal layers. Clinical trials with visual prostheses have demonstrated the possibility to restore some visual perception in patients. At the clinical trial unit headed by Pr Sahel in the National centre for Ophthalmology (Paris, France), one blind patient was able to read text on a computer monitor at a speed of 10 words/minutes. These performances were obtained with a retinal implant containing only 60 electrodes generating thereby at best 60 pixel images. The challenge is now to increase the pixel number and the pixel density. To achieve a cellular resolution, another strategy was recently proposed based on the expression of light-sensitive channels or pumps, the optogenetic strategy. In this case, gene therapy is used to target expression of the microbial proteins into specific neurones. Sight was recovered in blind mice and expression was obtained in postmortem human retinal tissue. This strategy is therefore getting close to clinical trials. The talk will illustrate these strategies (retinal implants and optogenetic strategy) to explain future challenges including: 1) preserving the residual retinal tissue from further degeneration, 2) increasing pixel density and pixel number, 3) encoding visual information in a biomimetic manner, 4) defining the best cell targets for optogenetic therapy. Financial supports: the European Economic Community (projects : DREAMS, RETICIRC, TREATRUSH), Agence National de la Recherche (MEDINAS, RETINE), Fondation ophtalmologique A. de Rothschild, Université Pierre et Marie Curie, INSERM, CNRS, Ile de France, Paris city.

### TEMPORAL ILLUSIONS: THE EFFECTS OF ATTENTION AND VOLUNTARY ACTIONS ON VISUAL PERCEPTION

Haddad H

*UFABC – SP*

Perception is the active construction of a neural state that correlates with biologically relevant elements present in the environment. However, the world we perceive is delayed in relation to its flowing content, as well as the outcome of our actions on the world in relation to the moment we decide to act. This mosaic of different latencies permeating both perception and action has to be taken into account critically in order for us to cope with everyday temporal challenges. On the one hand, behavioral timing is a crucial issue in survival, as adaptive success may depend on reasonably accurate judgments of temporal order and durations, as well as on precisely timed motor commands. On the other hand, differential transmission and processing latencies create a collection of temporal patterns spreading through the pathways and networks underlying both perception and action. Therefore, the physical timing of events is translated to the neural timing of neuronal processes, which is then somehow represented as a particular mental timing of experiential percepts. From the pioneering work of Wundt, Titchener, and Libet to recent findings and ideas related to the employment of visual illusions as psychophysical probes (such as the flash-lag effect), we will try to expose some problems inherent to the act of measuring the time of both perception and action, and devise possible solutions as well. **Authors:** Hamilton Haddad, Andre M. Cravo, Marcus Vinicius C. Baldo

### ILUSÃO DE ÓPTICA: O QUE OS OLHOS VÊM E O CÉREBRO SE ENGANA

Weisberg V

*Oftalmologista – Hospital São Geraldo – UFMG*

A percepção visual de um objeto é uma hipótese gerada pelo cérebro, sugerida através dos dados sensoriais recebidos, somados ao aprendizado e conhecimento prévios. A forma como vemos o mundo depende das limitações do nosso sistema cognitivo. É impossível tentar separar o que realmente vemos e o que inferimos. O sistema de percepção visual é programado para organizar os dados sensoriais de forma que eles tenham significado. Isto pode ser bem demonstrado no caso das ilusões de figura-fundo irreversíveis, também chamadas de figuras escondidas. Nestes casos, no início, o sistema de percepção tem dificuldade em achar significado na imagem, mas quando o sistema agrupa alguns pontos e os diferencia do fundo, a imagem é reorganizada. Após atribuir significado a uma determinada imagem a interpretação com significado predomina. O principal objetivo do sistema de percepção visual é achar o significado das imagens. A percepção visual do mundo à nossa volta geralmente não gera dúvidas, pois existe informação suficiente chegando ao cérebro e fica fácil interpretar as informações. Sem informação suficiente algumas leis que regem o sistema de percepção visual entram em conflito. É possível retirar algumas informações de uma cena de forma que o cérebro tenha dificuldade em decidir entre interpretações diferentes. As ilusões de óptica podem ser criadas retirando-se informações importantes utilizadas pelo cérebro ou acrescentando-se informações conflitantes na cena. Este fenômeno pode ser bem exemplificado com as figuras ambíguas. Muitas das ilusões visuais envolvem relações espaciais e por isso são chamadas de ilusões geométricas. Outras ilusões, como as de contraste e de cor, são criadas pelo contexto e iluminação da cena. A maioria das ilusões de óptica ainda é pouco compreendida. Algumas ilusões só recentemente começaram a ser desvendadas uma vez que passamos a conhecer como os neurônios da do sistema visual interagem e inibem uns aos outros. Este é o caso da Ilusão da Grade Cintilante, na qual vemos pontos escuros cintilando no centro. Esta Ilusão tem sua explicação baseada na rede de inibição lateral que ocorre entre os neurônios da retina. As ilusões de óptica mostram as falhas do nosso sistema de percepção visual e são ferramentas importantes, que nos ajudam a desvendar os mecanismos neurosensoriais utilizados para que possamos obter uma interpretação rápida e concisa do mundo a nossa volta.

## TEMA DA MESA: NEUROFISIOLOGIA DA PERCEPÇÃO AUDITIVA

Coordenador: Prof. Christopher Kushmerick  
ICB -UFMG

### ABOUT SELECTION, DECISIONS AND ATTENTION IN THE AUDITORY SYSTEM OF THE BARN OWL

Gutfreund Y  
Technion, Israel

In everyday life we are constantly bombarded by sensory stimuli. However, we pay attention and react only to stimuli which are behaviorally relevant and ignore the rest. This raises a challenging and important question in neuroscience, how the brain selects the most important stimuli for proper behavior? In our lab we investigate neural mechanism that may contribute to this selective attention process. We use the barn owl as a model system. The barn owl is an ideal species for such an investigation because it is a highly efficient nocturnal predator that uses excellent auditory and visual capabilities to detect its small prey in acoustically noisy and dimly lit conditions. In this research, which I intend to present in the 6th symposium of Neuroscience UFMG, we have recorded the activity of neurons in the auditory pathways of the barn owl. We have discovered a population of neurons that prefer to respond to novel or rarely presented auditory stimuli. Interestingly, these neurons also prefer stimuli that contain both visual and auditory elements over auditory stimuli alone, particularly if the visual and auditory elements matched in time and space. We hypothesize and provide evidence that these neurons are part of the brain circuitry that selects the most relevant stimulus for behavior. Current research addresses mechanisms of this computation.

### HEARING NON-EXISTENT SOUNDS – THE NEUROPHYSIOLOGICAL BASIS OF TINNITUS

Leão R  
FMRP – USP

Tinnitus is the perception of a continuous phantom sound, like a ringing or buzz in the ears. Tinnitus is a consequence of diverse conditions, mainly hearing loss resulting from old age, acoustic trauma and intoxication with specific drug-like nonsteroidal anti-inflammatory drugs, including salicylate. Whereas almost all individuals experience some form of temporary tinnitus at some point in life, chronic tinnitus can be a cause of extreme auditory discomfort and psychological stress. Although there are reports in the media of “alternative” medications to cure or alleviate tinnitus, there is currently no known pharmacological treatment to relieve or eliminate chronic tinnitus. Most forms of tinnitus do not originate in the cochlea, but in the central nervous system. They are thought to result from hyperactivity of specific auditory areas such as the Dorsal Cochlear Nucleus (DCN), Inferior Colliculus (IC), or the auditory cortex. A leading hypothesis is that an imbalance of excitatory and inhibitory neurotransmission in these regions produces the abnormal firing activity that generates the experience of tinnitus. In this talk we will discuss the leading hypothesis for the genesis and expression of tinnitus and possible therapeutic interventions.

### SYNAPTIC SPECIALIZATION IN THE AUDITORY BRAINSTEM

Kushmerick C  
ICB –UFMG

The auditory system is specialized for fast and accurate transmission. This is accomplished by the presence of specialized synapses, which allow a very accurate preservation of timing information. An example can be found in the Medial Nucleus of the Trapezoid Body (MNTB), which is an important relay nucleus that projects glycinergic inhibition to several auditory nuclei in the auditory brainstem. MNTB neurons receive a giant synaptic input called the calyx of Held, which is probably the largest synaptic terminal in the brain. The large size of the calyx of Held permits direct patch clamp recordings from the presynaptic terminal, a property that has attracted electrophysiologists. Recordings from the MNTB in rodent slice preparations have become an important experimental model to study neurotransmission in the CNS. However, recent studies in vivo have indicated significant differences in the behavior of this synapse when compared to in vitro recordings that are likely to have important functional consequences.

## TEMA DA MESA: PERCEPÇÃO CODIFICADA POR UM GRUPO NEURONAL

Coordenador: Prof. Márcio F. Moraes  
ICB -UFMG

### THE INFLUENCE OF LATERAL INTERACTIONS ON CORTICAL CODING

Schmidt K  
UFRN

Visual information is likely to be encoded in the distributed and simultaneous activity of many neurons at different cortical stages. In agreement, response modulation by visual context from outside the classical receptive field or top-down attention occurs already in early visual areas. Modulatory influences are probably mediated by lateral or feedback connections from higher visual areas (Angelucci and Bullier, 2003; Gilbert and Sigman, 2007). We aim to characterize the nature of the modulatory influence by the feedback and lateral network. By combining reversible thermal deactivation of remote interconnected areas with optical and electrical recordings in V1 we can experimentally compare neuronal responses in primary visual cortex in four different states: intact versus interrupted lateral network with or without (spontaneously driven) visual input. When interrupting the lateral network by cooling we observe stimulus-dependent differences in the ratio of excitatory and inhibitory influences and also in the influence on stimulus-driven response variability. Responses to stimuli of lower saliency as opposed to high-contrast oriented gratings benefit more from the intact network in the sense of receiving more excitatory lateral input. In general, firing rate changes can be described by a linear model revealing a dominant multiplicative and a minor additive scaling of the baseline tuning curves. Thereby, a more in excitatory drive seems to be mediated by an increase of the multiplicative component without significant shifts of feature selectivity. The above description of the possible range of lateral influences on spike rates can serve as a basis for discussing input-network relationships and timing-based neuronal codes interacting with the rate code.

## TOPICS IN ANIMAL COMMUNICATION: FROM CALLS TO SYMBOLS, FROM SONGS TO PSYCHOGRAPHS

Ribeiro S

UFRN

The amazing complexity of the human capacity for communication has often been taken as evidence that human language reflects a true evolutionary leap, bearing little resemblance to any other animal communication system. The putative uniqueness of the human language poses serious evolutionary and ethological challenges to a rational explanation of animal communication. To paraphrase Ludwig Wittgenstein, if a lion could speak, would we understand him? In this talk I will review ethological, neuroanatomical, molecular and computational results from humans, old and new world primates, as well as songbirds, as an attempt to delimit boundaries for these challenges. Analytical tools from neuroscience, semiotics and graph theory will be employed to argue that human language shares many features with other animal communication systems, and that the most substantial difference lies in the enhanced human capacity for symbolic recursion. I will also present recent data showing that differences in recurrence and other structural features of speech can be used to quantitatively discriminate schizophrenic and manic subjects from non-psychotic subjects, pointing to automated psychiatric diagnosis based not on what is said, but on how it is said. I will end by proposing that the graph-theoretical analysis of vocalizations across species may be a key to the understanding of the phonological, syntactic and semantic structures of non-human languages.

## A QUESTÃO TEMPORAL NO PROCESSAMENTO VISUAL

Neuenschwander S

UFRN

Respostas neuronais gama (ritmos oscilatórios entre 25 e 90 Hz) estão associadas a processos visuais como a ligação perceptual e a atenção seletiva. Neste estudo investigamos na área visual primária (V1) do macaco-*resus* os efeitos da expectativa temporal na modulação de padrões de atividade oscilatória gama. Para isto macacos foram treinados em uma tarefa visual que consistia em indicar uma mudança súbita de contraste de um ponto central (ponto de fixação, PF) ou na mudança de contraste de um padrão de grades em movimento (estímulo visual) apresentados em uma tela de computador. Registros da atividade elétrica de populações locais (LFP) e atividade multi-unitária foram feitos simultaneamente através de 3 a 10 eletrodos posicionados nas regiões de representação central e periférica de V1 de um ou dos dois hemisférios cerebrais. Três paradigmas visuais foram usados. No primeiro, as mudanças de contraste no PF ocorriam em um ponto fixo no tempo, proporcionando ao macaco prever com certeza o tempo de ocorrência da mudança. No segundo, as mudanças no PF ocorriam em blocos de testes, que podiam ocorrer no início ou no final de cada ensaio, o que nos permitiu comparar épocas de baixa ou de alta expectativa temporal. Por último usamos uma pista para indicar a proximidade da mudança do PF. Em todos os três paradigmas podemos observar um aumento importante das respostas gama, associado a uma supressão da atividade alpha (10-20 Hz), quando os macacos esperavam a ocorrência de um evento no tempo. Estes efeitos eram globais em V1, já que achados comparáveis foram obtidos em registros simultâneos tanto para as regiões de representação central e periférica de V1. No seu conjunto estes resultados indicam que a expectativa associada a decisões perceptuais, respostas motoras ou reforço de comportamento tem um efeito importante na atividade neuronal do córtex visual primário, levando a uma modulação global espacial não-seletiva das respostas oscilatórias gama.

## TEMA DA MESA: MODELOS COMPUTACIONAIS: EMOÇÕES E PERCEPÇÕES

Coordenador: Prof. Ronald Dickman

ICEX – UFMG

## MODELAGEM COMPUTACIONAL DE SISTEMAS CEREBRAIS ENVOLVIDOS NA ANSIEDADE, NO MEDO CONDICIONADO E NA ATENÇÃO SELETIVA

Salum C

UFABC – SP

Nos últimos anos, a modelagem computacional tornou-se uma abordagem versátil e eficiente para o estudo dos processos cognitivos e fisiológicos das emoções e do comportamento. Em nosso trabalho desenvolvemos um modelo computacional com um enfoque cognitivo na determinação dos comportamentos exploratório e de medo em um modelo animal de ansiedade, o labirinto em cruz elevado. A correlação dos módulos considerados neste modelo com sistemas cerebrais de motivação e de defesa conduziu a um estudo mais profundo de algumas conexões cerebrais envolvidas nos comportamentos observados. O segundo modelo propõe circuitos responsáveis pelos processos de aprendizagem associativa e atenção seletiva durante o condicionamento do medo, onde a dopamina foi considerada substância moduladora fundamental. Foram simulados mecanismos de liberação dopaminérgica e uma regra de aprendizagem heterossináptica, envolvendo a amígdala, núcleo accumbens e área mesencefálica tegmental ventral. Este modelo é capaz de simular mecanismos dopaminérgicos envolvidos nos processos de condicionamento aversivo e atenção seletiva, oferecendo assim uma ferramenta nas pesquisas sobre desordens mentais relacionadas, tais como a esquizofrenia e a ansiedade.

## COMPUTATIONAL MODELS OF PSYCHOPHYSICAL RESPONSES

Copelli M

UFPE

There is a substantial gap in our theoretical understanding of collective neural phenomena, due to the difficulties in treating nonlinear interactions, noise, and, more importantly, the huge number of interacting units. I shall discuss how progress in this area has been realized recently with the help of very simple theoretical and computational models. Such “toy models” show that the response of an excitable medium (that is, a system of excitable neurons with lateral interactions) to an external stimulus has certain general properties that may be important for sensory systems. Specifically, the model response involves amplification of weak stimuli, and a large dynamic range, properties remarkably similar to those observed in psychophysics experiments since the 19th century. Stevens’ psychophysical exponent also emerges naturally from the model.

## COMPREENDENDO O CÉREBRO HUMANO: UMA NOVA MATEMÁTICA SERÁ NECESSÁRIA?

Köberle R

USP – São Carlos

The detection of danger signals has obvious adaptive advantage. These signals activate neural networks that have evolved in animal nervous systems to organize different defensive reactions. Malfunction of these detection systems can contribute to the development of psychiatric disorders. Some examples: 1) every species reacts to a set of innate fear stimuli, and it was suggested that phobias are exaggerated reactions to fear stimuli specific to our species, such as heights, poisonous animals, confinement, and the sight of blood; 2) stimuli from our own body (interoception) can activate neuronal circuits that organize defense against imminent danger, patients with panic disorder being especially sensitive to them; 3) in social animals, detection of movement and of expressive postures of conspecifics is essential for coexistence, and social phobia has been attributed to an exaggerated response of submission in the presence of others; 4) the perception of emotions in the human face is important for understanding the mood of others and anticipating their behavior. Research using functional neuroimaging has shown that in patients with anxiety disorders, the amygdala is more activated by pictures of faces expressing fear; these patients also recognize such expressions with greater accuracy than do healthy individuals.

### DETECTION OF DANGER SIGNALS: IMPLICATIONS FOR PSYCHOPATHOLOGY

Graeff F

USP – RP

The detection of danger signals has obvious adaptive advantage. These signals activate neural networks that have evolved in animal nervous systems to organize different defensive reactions. Malfunction of these detection systems can contribute to the development of psychiatric disorders. Some examples: 1) every species reacts to a set of innate fear stimuli, and it was suggested that phobias are exaggerated reactions to fear stimuli specific to our species, such as heights, poisonous animals, confinement, and the sight of blood; 2) stimuli from our own body (interoception) can activate neuronal circuits that organize defense against imminent danger, patients with panic disorder being especially sensitive to them; 3) in social animals, detection of movement and of expressive postures of conspecifics is essential for coexistence, and social phobia has been attributed to an exaggerated response of submission in the presence of others; 4) the perception of emotions in the human face is important for understanding the mood of others and anticipating their behavior. Research using functional neuroimaging has shown that in patients with anxiety disorders, the amygdala is more activated by pictures of faces expressing fear; these patients also recognize such expressions with greater accuracy than do healthy individuals.

## TEMA DA MESA: MÚSICA E PERCEPÇÃO

Coordenador: Prof. Paulo Caramelli  
Fac. Medicina – UFMG

### MUSIC, LANGUAGE, AND MODULARITY FRAMED IN ACTION

Peretz I

*University of Montreal – Canadá*

I will examine to what extent music and speech share processing components by focusing on production, that is, singing, speaking and dancing. In shaping my views and research, the modularity concept has been and continues to play a determinant role. Thus, I will first provide a brief background on the contemporary notion of modularity. Next, I will present evidence that musical abilities depend, in part, on modular processes. The evidence I will cover comes mainly from selective cognitive disorders, such as tone deafness and beat deafness. These conditions are particularly informative for the comparative study of music and language because these deficiencies appear innate, music-specific and associated to anomalous brain connectivity. In this perspective, music disorders are as interesting as language disorders because both types of disorder will provide unique and complementary answers to fundamental questions of innateness and modularity, such as: how can genetic abnormalities lead to domain-specific disorders while genes code for brain growth not cognition? Such questions can only be answered by studying the full complexity of the relations from cognition to brain to gene and vice versa.

### EFFECTS OF LONG-TERM MUSICAL TRAINING ON VISUAL ATTENTION AND VISUAL MEMORY

Caramelli P

*Fac. Medicina – UFMG*

Recognition of the influence of music on cerebral function has incited neuroscientists and musicians to investigate the connections between these two areas since the 1990's. Many studies have demonstrated structural and functional cerebral neuroplastic processes as a result of long-term musical practice, which in turn may produce cognitive differences between musicians and non-musicians. We aimed to investigate if intensive musical training could be associated with improved visual cognitive abilities: visual attention ability, on three different modalities – selective, divided and sustained attention – and visual memory ability. Musicians (n = 38), permanent members of two major Brazilian orchestras, and non-musicians (n = 38), professionals and students from several fields, matched on age, gender and education, were submitted to five neuropsychological tests: three visual attention tests, one visual memory test and one simple reaction time test, which measured reaction time and accuracy. Musicians showed better performance relative to non-musicians on four variables of the three visual attention tests, involving reaction time and accuracy, and on three variables of the visual memory test, involving only reaction time. Such advantage could not be explained by better sensorimotor integration, since there was no difference between groups in the simple reaction time test. Moreover, significant correlations between variables related to musical experience – as age of beginning of musical studies and daily individual instrumental practice – and some variables of visual attention and visual memory tests were verified. Our results mainly suggest augmented visual attention ability, on different modalities, in musicians. The better performance of musicians in the visual memory test may also indicate greater efficiency of attentional processes, since differences were observed only on reaction times. This study may contribute to demonstrate possible cognitive benefits of long-term musical training. **Authors:** Ana Carolina Oliveira Rodrigues<sup>1</sup>, PhD; Maurício Alves Loureiro<sup>1,2</sup>, PhD; Paulo Caramelli<sup>1,3</sup>, MD, PhD. 1. Post-Graduate Program of Neurosciences, Federal University of Minas Gerais. 2. School of Music, Federal University of Minas Gerais. 3. Faculty of Medicine, Federal University of Minas Gerais.

### RELATIONSHIP BETWEEN SYNESTHETIC SENSATIONS, EMOTIONAL STATES AND MUSICAL STRUCTURES

Bragança GFF

*Doutorando do Programa de PG em Neurociências – UFMG*

I intend to discourse about the habit, quite common among musicians, of employing crossmodal adjectives, like light, heavy, soft, shiny, dark, dense or ascending, whenever they want to report their musical activities, either interpretation, perception or analysis. Such a linguistic resource is denominated synesthesia, a figure of speech which consists in describing one kind of sense impression by using words that normally describe another. Synesthesia is also studied by neuroscientists as a neurological condition in which a stimulation of one sensory pathway (or cognitive) triggers, involuntarily, automatically and consistently, another sensation. The researches have demonstrated that the synesthesia happens not only in many forms, but also in variable degrees. Moreover, many patterns underlying synesthesia, as an association between light and pitched sound or size and intensity, are also universal mechanism of modal crossings, suggesting a level of latent synesthesia in non synesthetes. That latent synesthesia would be functional, and it would have fundamental role in the musical perception and even in the perceptive process in general. During this Ph.D., we will investigate the relationship between synesthesia and musical perception, verifying if there is some pattern in the synesthetic perception of musical excerpts, if there is link between synesthetic perception and induction of emotions and to investigate whether certain musical structures evoke synesthetic perceptions and emotions in way homogeneous or idiosyncratic.

## TEMA DA MESA: PERCEPÇÃO NA ESQUIZOFRENIA

Coordenador: Prof. João Vinícius Salgado  
ICB – UFMG

### THE LIPSKA-WEINBERGER MODEL OF SCHIZOPHRENIA – NEUROLOGICAL SOFT SIGNS: SENSORY DEFICITS + CONCEPTS FOR NEW TREATMENTS

Sandner G

Universidade Louis Pasteur – França

Recently, a third major review was published about the neonatal hippocampal lesion (NVHL) model of schizophrenia. Each preceding review and the latter marked an important step. My presentation will document each step in turn. The first review (Lipska & Weinberger) was aimed at justifying the methods for obtaining the model. I shall illustrate this step by presenting the technical improvements that we have promoted, especially the selection of subjects with Magnetic Nuclear Resonance Images (MRI) before doing an experiment. This imaging method allows also determining individually the evolution of the lesions: their volume increases with age. It means that the neonatal intervention has long lasting developmental effects. The second review (Tseng et al.) gathered many observations obtained with the model. This included an increasing number of minor functional consequences of the neonatal lesion, many being also observed in patients. As illustration, I present data about the modifications of sensory-motor functions. The reason for having privileged this aspect paradoxically in its diversity. This diversity may reflect some general principle stating that a minor perturbation of higher brain functions would be associated to modified top-down controls of sensory inputs. The same speculations have been done about schizophrenia. It should be further tested in patients. The third review (O'Donnell) announced the use of the NVHL model to validate new therapeutic concepts. We document this application of the model by two concepts of our own, plus an idea from a Canadian group. In this presentation we restricted our analysis to MRI data and tests about the sensitivity of the rats to dopaminergic agents. The three therapeutic concepts were: i) Helping the brain to recover from its epigenetic frozen state with an histone deacetylase antagonist => it proved efficient on both criteria, ii) countering the inflammation that contributes to the self-evolution of the lesion => it was successful in the hands of a Canadian group on behavior, and iii) limiting the consequences of the lesions by the social context of the animals => we got evidence that social interactions limit the evolution of the NVHL lesion, even if the behavioral outcome remained difficult to interpret. Even if the tendency of a number of psychiatrists is to remain skeptical about the interest of human/lower animal analogies in psychopathology, the fact that a model provides suggestions of means to limit, or reduce the effect of a perturbation of the development of the brain is of importance for brain developmental diseases in general. If, in addition, one accepts the common idea that schizophrenia belongs to such diseases, the model approach shows his usefulness.

### PERCEPÇÃO DE EMOÇÕES FACIAIS EM PACIENTES COM ESQUIZOFRENIA

Souza JPM

USP – RP

As expressões faciais de emoção são as 'placas de trânsito' do mundo social, fornecendo informações cruciais para o funcionamento interpessoal adequado. Como uma das principais características da esquizofrenia é o prejuízo no funcionamento social, levantou-se a hipótese de que portadores do transtorno teriam déficits no processamento de emoções em geral e, sobretudo, de emoções faciais. Estes prejuízos foram demonstrados repetidas vezes e o advento das técnicas de neuroimagem permitiu que os pesquisadores localizassem alguns dos substratos neurais do processamento emocional deficitário na esquizofrenia, com ênfase para o papel da amígdala. O domínio da cognição social, termo abrangente que cobre diferentes modalidades de processamento emocional e interpessoal, tem sido objeto de atenção crescente por parte de pesquisadores interessados em melhorar o funcionamento social de pessoas com esquizofrenia. O treinamento de habilidades sociais e intervenções para promover o contato olho a olho e a exploração de características faciais na esquizofrenia parecem melhorar o reconhecimento de emoções faciais e, atualmente, já fazem parte de abordagens globais de tratamento para a esquizofrenia.

### PERCEPÇÃO DO ESTIGMA NA ESQUIZOFRENIA

Oliveira K

Mestranda do Programa de PG em Neurociências – UFMG

A esquizofrenia é o mais grave e incapacitante dos transtornos mentais. Oprejuízo funcional destes pacientes resulta em dificuldades ocupacionais, sociais e na autonomia, as quais, por sua vez, se relacionam com a experiência do estigma. Estigma é um termo amplo que abrange aspectos relacionados a informação (ignorância), postura (preconceito) e comportamento (discriminação). A discriminação acarreta uma série de agravos sociais como marginalização social, falta de acesso ao tratamento, e redução na procura por ajuda (Thornicroft et al., 2007). As investigações sobre o estigma na esquizofrenia, de forma geral, têm sido baseadas em situações hipotéticas, distanciadas da realidade e, muitas vezes, com ênfase no olhar de pessoas saudáveis sobre as pessoas com transtorno mental. Isso adquire especial importância na medida em que alterações perceptivas nos pacientes (e.g. decorrentes de alterações cognitivas, sintomas psicóticos) podem influenciar a percepção do estigma. Em um estudo em 27 países, Thornicroft et al. (2009) descrevem a natureza, a direção e a gravidade da discriminação, pela perspectiva das pessoas com esquizofrenia. Por natureza entende-se se a discriminação é experimentada (i.e. vivenciada) ou apenas antecipada. A experimentada pode ser positiva (tratamento privilegiado ou mais positivo que o normal) ou negativa (tratamento injusto ou pior do que o normal). A discriminação antecipada, por sua vez, é apenas negativa e diz respeito a situações nas quais a pessoa com esquizofrenia desiste de tentar algo por temer a discriminação. A direção indica a origem da discriminação, por exemplo, advinda da vizinhança. O estudo mostrou evidências de discriminação antecipada, relacionada a procura de emprego e a relações pessoais próximas. Nossos dados, embora ainda parciais, evidenciam que os pacientes experimentam maior discriminação negativa provenientes da vizinhança, de novas amigas e de pessoas que sabem do tratamento na saúde mental. Por outro lado, os pacientes também experimentaram discriminação positiva por parte da família; e discriminação antecipada em relação a relacionamentos próximos. Entender como a pessoa com esquizofrenia percebe e vivencia o estigma e suas relações com variáveis cognitivas e sintomas parece representar passo importante nos processos de intervenção psicossocial, para melhora do funcionamento social e conseqüentemente da qualidade de vida.

## TEMA DA MESA: NEUROROBÓTICA

Coordenador: Prof. Carlos Julio Tierra Criollo  
Escola de Engenharia -UFMG

### **A HOLISTIC APPROACH TO HUMAN-ROBOT INTERACTION: DEVELOPMENTS AND PERSPECTIVES**

Adorno BV  
Escola de Engenharia – UFMG

This presentation describes our recent developments and future perspectives in the field of physical human-robot interaction. The presentation is biased toward a framework that we have been developing, the cooperative dual-task space. In this formalism, the human-robot coordination is achieved by determining the relative pose between the human and the robot, and the control system is closed loop at the cooperative level. In order to illustrate the framework, we report the result of three experiments: water pouring, simultaneous-handling, and one experiment wherein the robot achieves the coordination by controlling the human arm using functional electrical stimulation. Last, some perspectives are added regarding the use of brain-machine interfaces in order to improve the interaction.

### **CONTROLLING ELECTRICAL STIMULATION FOR MOTION RESTORATION AND REHABILITATION**

Lanari Bó AP  
UnB

There are several potential benefits of using Functional Electrical Stimulation (FES) for motion restoration and rehabilitation, both in terms of therapy effectiveness and subject comfort. Nevertheless, the stimulators commercially available today still present several drawbacks that prevent further use in real applications, such as FES-induced muscle fatigue and repeatability. In order to minimize these effects, new technologies and methods are currently being developed that may enable the design of wearable and simple-to-use devices. Considering both implantable and non-implantable systems, in this lecture an overview of electrode technology and control algorithms is presented, including a prospective analysis of future applications.

### **MENTAL PRACTICE IN THE BIOMECHANICS OF AMPUTEES: APPLICATION TO THE CONTROL OF PROSTHESES**

Cunha RG  
Mestrando do Programa de PG em Neurociências – UFMG

Amputation is defined as the withdrawal, generally surgical, complete or partial of a limb. For the majority of patients undergoing this procedure, the term amputation is related to terror, defeat and mutilation, bringing, implicitly, an analogy with disability and dependence. The stump now considered as the newest member, is responsible for control of the prosthesis during ambulation and standing position. Among the types of motors training, one can cite the Imagetics Motor (IM). The IM can be defined as a dynamic state during which the representation of a specific motor action is internally activated within a memory function without any motor response. The Mental Practice (PM) is a training method by which the internal representation of a particular motor action is repeated several times in order to improve motor performance. Thus, the PM motor is a training based on repetition of IM. The motor learning provided by mental training is possible by the repetitive activation of neural representation nets of the kinetic components of the motor act, strengthening these networks synaptic transmission. It is necessary a systematic study of the influence of mental practice on functional capacity and pattern of cortical activity for individuals with lower limb amputation undergoing walking rehabilitation. As the motion is restored, occurs the reorganization of the motor pattern for the purpose of improving the functions of the locomotor system. The difficulty in using a brain machine interface (BCI) is in the interpretation of the intent of movement that wants to accomplish. The motor imagery training can promote the improvement of "neuronal integration", identifying these patterns of stimuli in amputee walking performance for the use of the prosthesis. This study will leverage the knowledge of the PM task-oriented on variables of the biomechanics walking and patterns of cortical activation in individuals with lower limb amputation. Moreover, it could facilitate the detection of related potential of IM, which allow the use of ICM-IM in the rehabilitation process of individuals, as this will generate a feedback to the individual during the walking, guiding them through the IM, interfering in the control of the prosthesis and consequently in the motor learning. **Descriptors:** Amputees, Biomechanics, Mental Practice, Motor Imagery; Brain-Machine Interface.