

# 10<sup>o</sup>

CHAMPALIMAUD FOUNDATION  
Lisbon, Portugal

# NATIONAL CONGRESS OF ETHOLOGY 2013

24/25  
OCT

Booklet  
of Abstracts



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**NATIONAL  
CONGRESS  
ETHOLOGY  
2013**

- . Introduction
- . Conference Agenda

# 10<sup>o</sup> National Congress of Ethology . 2013

**This month the Champalimaud Foundation will be hosting the 10th meeting of the Portuguese Ethology Society.**

**To understand the proximal and ultimate causes of behavior, which can be defined by the total movements made by the intact animal, is a daunting task that requires the intersection of a variety of research fields, which will be represented in this meeting. As Tinbergen elegantly put in his seminal book “The study of instinct”:**

“[...] why an animal behave the way it does?

This question covers a rather complex set of problems. One of them is to determine the causal structure underlying the behavior. [...] Both external stimuli and hormones ordinarily exert their influence on the behavior through the nervous system. Therefore, our next task after the study of the sensory stimulus and the hormone involved would have to be a study of what happens in the nervous system. When we make an accurate description of the particular type of behavior shown in the present case, we shall see that a great many muscles are involved, each of which contracts (1) to a certain degree, and (2) in co-ordination with the other muscles. This indicates the complexity of the nervous processes involved in this single action.

Thus the problem of causal structure underlying the behaviour leads to a study of the functions of sense organs, of hormones, of the nervous system, of the muscles, and, particularly, of the co-ordination of these functions, of their integration into the act of behavior as a whole.

[...] For, since the full-grown animal is the outcome of a developmental process beginning with the unicellular egg, the description and explanation of its development are natural extensions of our causal study. In other words, it is part of our task to study the ontogeny of behavior as well.

[...] We also want to know the animals that possess these mechanisms of growth and of adult functioning have evolved over the course of history, as we know they must have done. Thus willingly or unwillingly, we are led on to the study of the evolution of behavior.

[...] The study of the mechanism at work in an animal in action is connected with sensory physiology and especially neurophysiology, with endocrinology, and, to a lesser extent, with muscle physiology. It culminates in the study of coordination, of integration. The study of evolution is connected with taxonomy, with ecology and with genetics. The study of the functions of behaviour has ecological and sociological aspects.”

(Tinbergen in *The study of instinct*, 1951)

This meeting will bring together scientists from the several fields afore mentioned, including ecology, evolution, development, physiology, psychology and neuroscience, spanning a wide range of model organisms, from invertebrates to vertebrates. We aim to present an integrated overview of animal behavior, by bringing together investigators and students working in Portugal and abroad. Over two days we will have four keynote lectures by internationally distinguished speakers, 24 talks selected from abstract submission and two poster sessions, providing ample opportunity for formal an informal exchange of ideas.

## Thursday, October 24th

8.00 am	<b>Registration</b>
9.00 am - 9.15 am	<b>Opening Remarks</b>
9.15 am - 9.30 am	<b>Tribute to Professor Vitor Almada</b>
9.30 am - 10.20 am	<b>Plenary Talk</b> <i>Flights of fancy: sexual selection in a Neotropical songbird</i> Regina Macedo, Universidade Brasilia
10.20 - 10.40 am	<i>Sexually selected plumage coloration of Serin (Serinus serinus) is not testosterone dependent</i> Sandra Trigo, CIBIO
10.40 - 11.00 am	<i>Female preference for the most enthusiastic singer. An experimental assay with Lusitanian toadfish (Halobatrachus didactylus)</i> Maria Clara P. Amorim, ISPA
11.00 am - 11.20 am	<b>Coffee-break</b>
11.20 am - 11.40 am	<i>Does mate-choice copying modulate reproductive investment?</i> Susana A.M. Varela, FCUL-CESAM
11.40 am - 12.00 pm	<i>Site fidelity in breeding males of Lipophrys pholis (Pisces: Blenniidae)</i> Frederico Almada, ISPA
12.00 pm - 12.20 pm	<i>Social network and reproductive success in a species with alternative reproductive tactics</i> Sara D. Cardoso, ISPA
12.20 pm - 12.40 pm	<i>Swimming behavior of temperate fish larvae - implications for larval dispersal and population connectivity</i> Ana Faria, ISPA

## Thursday, October 24th

- 12.40 pm - 14.00 pm     **Lunch break**
- 14.00 pm - 14.50 pm     **Plenary Talk**  
*Motion vision in walking flies*  
Eugenia Chiappe, CNP
- 14.50 pm - 15.10 pm     *flyPAD: high throughput and temporal resolution feeding sensor for flies*  
Pavel M. Itskov, CNP
- 15.10 pm - 15.30 pm     *Patterns of male vocalization activity and acoustic interactions in the Lusitanian toadfish (Halobatrachus didactylus)*  
Paulo J. Fonseca, FCUL
- 15.30 pm                     **Coffee break**
- 16.00 pm - 18.00 pm     **Poster session I**
- 18.00 pm - 18.20 pm     *Coordination in rats: the use of game theory to study the proximal mechanisms of cooperation*  
Scott Rennie, CNP
- 18.20 pm - 18.40 pm     *Serotonin neuromodulation of cooperative behavior in a cleaner fish*  
José R. Paula, ISPA
- 18.40 pm - 19.00 pm     *Cortisol causes cleaner wrasse to switch from cooperation to cheating and prompts tactical deception*  
Marta C. Soares, ISPA
- 19.00 pm - 19.20 pm     *Steroid levels of male tilapia in a mirror challenge are independent of behaviors but dependent on chemical information*  
João L. Saraiva, CCMAR
- 19.20 pm – 20.00 pm     Meeting of the Portuguese Society for Ethology
- 20.30 pm                     **Dinner**

## Friday, October 25th

- 9.30 am – 10.20 am     **Plenary Talk**  
*Primate Archaeology, an Interdisciplinary Ethology: Why does it matter?*  
Susana Carvalho, Oxford University
- 10.20 am – 10.40 am     *Leaf-tool use for drinking water by wild chimpanzees (Pan troglodytes verus): ontogeny, social propagation and handedness*  
Cláudia Sousa, FCSH-UNL
- 10.40 am – 11.00 am     *When what I see is not what I hear. First data on cross modal perception of human emotions in domestic dogs (Canis familiaris)*  
Fábio Rangel, FCUP
- 11.00 am – 11.20 am     **Coffee break**
- 11.20 am – 11.40 am     *Habitat copying predicts highly aggregated colonies in birds*  
Manuel Sapage, FCUL-CESAM
- 11.40 am – 12.00 pm     *Traditional behavioral assays and aggressiveness in a gregarious avian species (Estrilda astrild)*  
Caterina Funghi, CIBIO
- 12.00 pm – 12.20 pm     *Social odors conveying dominance and reproductive information induce rapid brain transcriptome changes in a cichlid fish*  
José Miguel Simões, ISPA
- 12.20 pm – 12.40 pm     *Carotenoid-based color ornamentation predicts social dominance in serins, Serinus serinus*  
Ana V. Leitão, CIBIO
- 12.40 pm – 14.00 pm     **Lunch break**

## Friday, October 25th

- 14.00 pm – 14.50 pm     **Plenary Talk**  
*Soundscapes and the evolution of hearing: a case study using Malagasy and South Asian Cichlids.*  
Chris Braun, CUNY
- 14.50 pm – 15.10 pm     *The role of signaling mistakes in communication: testing new hypothesis using dark-eyed junco (*Junco hyemalis*) song*  
André M. Ferreira, FCT-UC
- 15.10 pm – 15.30 pm     *The behavior repertoire of zebrafish larvae*  
João Marques, CNP
- 15.30 pm                     **Coffee break**
- 16.00 pm – 18.00 pm     **Poster Session II**
- 18.00 pm – 18.20 pm     *Interplay between value and confidence in an olfactory guided decision*  
Gil M. Costa, CNP
- 18.20 pm – 18.40 pm     *Elucidating the computational strategies behind nutritional decisions in *Drosophila**  
Verónica M. Corrales, CNP
- 18.40 pm – 19.00 pm     *Parasitic infection changes exploratory and risk behaviors on *Toxoplasma* hosts*  
Cristina Afonso, CNP
- 19.00 pm – 19.20 pm     *Toxin and antitoxin proteins on the bacterial social behaviour*  
Rita Ponce, CBA-FCUL
- 19.20 pm                     Awards and closing



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## Thursday, October 24th . Invited speakers

### 9.30 am . Plenary Talk

*Flights of fancy: sexual selection in a Neotropical songbird*

Regina Macedo, Universidade Brasília

In recent decades a host of studies have supported the idea that sexual selection provides the evolutionary force shaping the evolution of traits involving communication, behaviour, morphology, and reproductive strategies. In general, these traits cannot be easily explained by natural selection mechanisms, and are more easily understood through the prism of sexual selection. Despite the impressive biodiversity of the Neotropics, research on different aspects of its avifauna, in general, has been greatly neglected. This is unfortunate because the tropics provide an extraordinary testing arena for many concepts, given that tropical birds differ markedly from temperate birds in terms of ecological conditions and, consequently, in their natural history. I will discuss the evolution of sexually selected ornamental and behavioural traits in the blue-black grassquit, a small passerine abundant in central Brazil, and how these are associated with the bird's mating system. Sexual communication in this species involves an iridescent, nuptial plumage and the exhibition of an acrobatic mating display. Grassquits breed in small, aggregated territories, are socially monogamous, but have high rates of extrapair fertilization with intensive paternal care. We are currently investigating the links between this species' genetic mating system and its breeding ecology. I hope that the insights gained so far through the study of this bird exemplify the variability of traits and mechanisms to be found and studied in Neotropical birds.

### 14.00 pm . Plenary Talk

*Motion vision in walking flies*

Eugenia Chiappe, Champalimaud Neuroscience Programme

The natural stimuli of the retina of a mobile animal consist of a 2D, spatio-temporal pattern of luminance with dynamics depending on the eye's movement, the animal's locomotion and the visual properties of the world. To understand vision and its transformation into oriented behavior, one critical question needs to be addressed: how motor activity modulates visual processing. For this, we developed a physiological system where we record from a genetically identified population of neurons in simultaneous with ongoing walking in *Drosophila melanogaster*. In our first experiments we targeted the expression of a genetically encoded calcium indicator in horizontal-system neurons (HS cells), which are thought to aid course control in flies. We used two-photon imaging to record the responses of HS cells to large-field moving stimuli while the fly was walking. Our data shows three behavioral-state related physiological modulations. First, HS cells showed greater responses during walking. Second, the amplitude modulation of HS cell responses to visual stimuli correlated with the fly's walking speed. Third, the increased response amplitude was stimulus-dependent: the temporal frequency sensitivity of HS cells peaked at higher stimulus velocities during walking. These activity modulations may provide a more accurate visual control of locomotive behaviors. Increasing a system's sensitivity specifically during walking may also be beneficial from an energy minimization standpoint. The temporal-frequency gain modulation we observe may additionally be used to accommodate the increased optic flow caused the animal's own locomotion. These results demonstrate the importance of studying visual neurons during ethological relevant behaviors.

## Friday, October 25th . Invited speakers

### 9.30 am . Plenary Talk

*Primate Archaeology, an Interdisciplinary Ethology: Why does it matter?*

Susana Carvalho, Oxford University

Primate Archaeology advocates and implements the need for combining the theory and methods of different disciplines, in order to understand further human evolution. We examine chimpanzee tool-use and the earliest hominin tool-use sites, seeking to understand the origins and development of primate technological behaviour, and to refine models of early human material culture. Long-term, systematic research at Bossou, in Guinea, West Africa, has focused on chimpanzee elementary technology, both under natural conditions and in a field experimental setting (the so-called “outdoor laboratory”). Since 2006, my research at Bossou has combined archaeological methods with direct observations and indirect data on individual chimpanzees and their assemblages of artefacts (e.g., Carvalho et al. 2008, 2009, 2012, 2013). These studies have sought to elucidate for the first time the natural behavioural patterns and contexts that generate assemblages that can be compared with those recovered from the past, for both apes and humans. Can we find non-human primate “signatures” in the archaeological record, for example, of a ‘Chimpanzee Stone Age’? And, as convergence is a likely explanation for variation in primate tool-use, are the only technologically proficient non-human primate species those that are alive today? Answering these complex and challenging questions is possible only by genuinely combining theories and methods from primatology, paleoanthropology and archaeology.

### 14.00 pm . Plenary Talk

*Soundscapes and the evolution of hearing: a case study using Malagasy and South Asian Cichlids.*

Chris Braun, CUNY

How do sensory systems evolve new functions? What is the function of hearing? Hearing, the ability to perceive sound by detecting fluctuations in ambient pressure, has a restricted distribution within vertebrates. The tympanic ear of terrestrial vertebrates converts pressure fluctuations to motions of endolymph, which is the proximate stimulus to the inner ear. Teleost fishes do not have a tympanic ear, so responses to sound sources are generally mediated by direct detection of fluid motion by inertial sensors. Most fish have a similar density to the water surrounding them, so the hydrodynamic effects surrounding acoustic sources accelerate the fish along with the water. This bodily acceleration is detected by the otolithic inner ear and is the primitive mechanism for the detection of sound sources. Without specialized transduction mechanisms analogous to the tympanic ear, fish are insensitive to the fluctuating pressure field comprising a sound wave. Some taxa, however, have peripheral structures that transduce pressure fluctuations into motion of the endolymph, and these taxa can detect sounds. The ability to detect pressure itself (i.e. hearing sensu terrestrial vertebrates, ‘sonic audition’) occurs in select fish taxa and appears to have evolved repeatedly in teleost evolution. This lecture will present a theoretical framework for understanding the origin and diversification of sensory functions and describe a series of transformation in the auditory system of Malagasy Cichlids. Malagasy and South Asian (but not the African or Neotropical) cichlids exhibit modifications of the

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ear, skull and gas bladder, which create a direct mechanical linkage between the gas bladder and inner ear. Similar structures in other fishes are known to bestow enhanced hearing ability. A high degree of variability of these structures in cichlids suggests that hearing abilities have evolved and diversified within this group of fishes, and provides us with a uniquely powerful model system to explore the origin of new sensory abilities and the subsequent evolutionary diversification of a new sense. The results of comparative morphological studies of accessory hearing structures and experimental studies of hearing ability will be presented to evaluate the evolution of hearing within this group. Field and laboratory studies are used to document the diversity present in this group and test hypothesized relationships between perceptual ability, anatomical and ecological features. Malagasy-South Asian cichlids present an ideal case to test the hypothesis that new sensory systems evolve in low-noise habitats to exploit new sensory opportunities, rather than evolving in high-noise habitats to conserve function in the face of increased noise.

### 10h20 am

*Sexually selected plumage coloration of Serin (*Serinus serinus*) is not testosterone dependent*

Sandra Trigo, CIBIO

Secondary sexual traits are assumed to have evolved as honest signals of individual quality and an assumption of models of sexual selection is that androgens regulate male secondary traits and reproductive behavior. In the Serin, *Serinus serinus*, carotenoid-based plumage coloration is a sexually selected trait and this species have only one postnuptial moult. In this experiment, we want to test if the plumage coloration is testosterone-dependent. We manipulated testosterone during molt, implanting males with an empty or testosterone filled capsule. After molt, body condition, plumage coloration and extension was measured. The control and testosterone-implanted males present no differences in the extension of the yellow patch neither in body condition. We found that testosterone-implanted males have less UV-chroma plumage coloration than control males. Our results suggest that the sexually selected carotenoid-based plumage coloration of the Serin is not testosterone-dependent.

### 10h40 am

*Female preference for the most enthusiastic singer. An experimental assay with Lusitanian toadfish (*Halobatrachus didactylus*)*

Maria Clara P. Amorim, ISPA

Previous studies showed that in Lusitanian toadfish (*Halobatrachus didactylus*) males calling rate reflects body lipid content and seems to predict male reproductive success, assessed by the number of eggs in the male's nest. Using round-the-clock sound recordings during the breeding season in the Tagus estuary (Portugal), we tested the relation between acoustic signalling and male reproductive success by comparing the number of eggs obtained by 11 muted, 11 sham-operated and 9 intact (control) males. Calling rate was quantified at the minute level for each male using a matched filter available in the software Ishmael and with an automatic pattern recognition methodology based on

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the Hidden Markov Model. We did not find significant differences in the number of eggs among male groups probably because the sample size for muted fish was small (6 of the 11 males recovered from the muting surgery during the experiment). However, fish that did not sing did not get any eggs. In addition, the number of eggs in the nest was significantly correlated with calling activity ( $r=0.53$ ,  $P=0.002$ ) but not with male length or weight, suggesting that acoustic communication is key to reproductive outcome in the toadfish and possibly in many other fish species.

### 11.20 am

#### *Does mate-choice copying modulate reproductive investment?*

Susana A.M. Varela, FCUL-CESAM

When choosing mates, animals may use innate preferences and personal experience, but also social information extracted from the breeding performance of conspecifics. Mate-choice copying (MCC) is a situation in which females use male mating performance as cues to choose mating partners. This type of social information improves female accuracy in appraising male quality, allowing more adaptive decisions. Given the costs of reproduction, we can additionally expect females to increase their current reproductive investment (differential allocation of resources) when mating with the preferred male after MCC. Here we tested this hypothesis in female *Drosophila melanogaster*. Using males of contrasting phenotypes (good- versus poor-condition), we found that female egg-laying rates increase in a MCC context, but only when mated with good-condition males. This suggests that social information was used conjointly with females' personal appraisal of male quality. Furthermore, females' local reproductive investment also increased, as they laid more eggs in the territory of the copied males. These results reinforce the adaptive value of MCC by associating mate quality assessment with reproductive habitat choice. They also highlight the role of MCC in female reproductive investment, which in turn affects male reproductive success and the rate and direction of sexual selection.

### 11.40 am

#### *Site fidelity in breeding males of *Lipophrys pholis* (Pisces: Blenniidae)*

Frederico Almada, ISPA

The blenniid fish *Lipophrys pholis* presents several adaptations to the rocky intertidal. The most remarkable adaptation is the ability of males to breed inside holes or crevices that remain emersed for several hours during low tide. Physiological constraints and the fact that this species is near its southern distribution limit in Portugal probably explain why they breed in the winter (from December to May). Nevertheless *L. pholis* is one of the most common intertidal fish in Portuguese rocky shores. More than 100 adult fish were marked with electronic tags and were followed during two consecutive breeding seasons in Cabo Raso, Portugal. Contrarily to expectations for such a large population, the rate of recapture was surprisingly high. Our findings showed that a large proportion of adults are highly attached to a specific area with some males returning to the same nest or one nearby (usually within 1 m<sup>2</sup>) in successive breeding seasons. Males remain in their nests approximately

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33,6 days which corresponds approximately to two breeding cycles. Site fidelity and homing behavior argue in favor of considering this blennid a model species to detect environmental changes. It also suggests that MPAs can be an effective mean of protecting these populations.

### 12.00 pm

*Social network and reproductive success in a species with alternative reproductive tactics*

Sara D. Cardoso, ISPA

Social organization of animal populations plays a central role in ecological and evolutionary processes. In this study, we used the information on social interactions collected in a wild population of the peacock blenny *Salaria pavo*, a fish species that exhibits ecological modulation of reproductive traits. In this species sex-role reversal in courtship and alternative reproductive tactics (ARTs) are expressed in response to changes in nest-site availability that increase male intra-sexual competition. The data collected in the field was obtained by monitoring during two months all individuals, previously tagged, in four transects composed of approximately 100 bricks. Furthermore, these individuals were genotyped and eleven bourgeois males also had their eggs removed from the nest and genotyped using microsatellites, in order to determine the success of reproduction of the male ARTs, in particular the sneaker form. A social network was obtained and its structure analyzed in order to complement the paternity results.

### 12.20 pm

*Swimming behavior of temperate fish larvae - implications for larval dispersal and population connectivity*

Ana Faria, ISPA

It is clear from recent studies on the behavioural abilities of late-stage coral reef fish larvae that they are strong, enduring swimmers. Larval swimming abilities are important for survival, influencing the ability to avoid predators and capture prey, settle to suitable juvenile habitat, control dispersal, and recruitment. Studies on swimming performance of temperate fish larvae are, nevertheless, scarce, relative to tropical reef environments. We herein provide an overview of the studies we conducted so far to fill this gap and a comparison with published information.

Using swimming chambers we examined the ontogeny of critical swimming speed (Ucrit) of fish larvae which occur near temperate reefs: *Atherina presbyter* (Atherinidae, Atheriniforms), *Lepadogaster lepadogaster* and *L. purpurea* (Gobiesocidae, Gobiesociforms), *Sardina pilchardus* (Clupeidae, Clupeiforms), *Sciaenops ocellatus* (Sciaenidae, Perciforms), *Solea senegalensis* (Soleidae, Pleuronectiforms), and *Sparus aurata* (Sparidae, Perciforms). Results show that perciforms are better swimmers, while pleuronectiforms and clupeiforms larvae are poor swimmers. The future integration of these results in biophysical models will provide much insight into the realities of dispersal and retention of these systems. This is critically important to our understanding of population connectivity and to management decisions, including the design of Marine Protected Areas networks.

**14.50 pm**

*flyPAD: high throughput and temporal resolution feeding sensor for flies*

Pavel M. Itskov, CNP

*Drosophila melanogaster* has become a powerful model organism in neuroscience due to its molecular genetics toolkit and due to the development of methods to monitor and annotate behavior. Feeding is a central element in a majority of behavioral assays, but its quantification is a major challenge in *Drosophila*. Conventional methods to study feeding provide limited information since they are optimized to study food intake in groups of flies and don't provide information about temporal dynamics of feeding. We have developed flyPAD - fly Proboscis and Activity detector, a method to automatically monitor feeding behavior in individual flies. Our method is based on capacitive measurement of fly's interaction with the food. By comparing capacitance traces with high resolution videos we have established the features in capacitive signal which correlate with feeding and developed algorithms to automatically extract these features from capacitive recording. The sensitivity of our device allows the characterization of fine features of motor behavior such as the duration and frequency of individual proboscis extension events and enables the study of the temporal dynamics of feeding on various timescales. We demonstrate how this technology can be used by deconstructing the effect of changes in internal state (protein deprivation) on foraging.

**15.10 pm**

*The behavior repertoire of zebrafish larvae*

João Marques, CNP

Animals often use a variety of gaits to move through their environment. It is therefore likely that the brain uses distinct neuronal substrates to control distinct sets of movements. Currently it is unknown, for any animal, its full behavioral repertoire and what are the neural programs that underlay movement choice and control. Here we describe an on-line automatic behavioral set up for quantifying the tail and eye kinematics of motor events in multiple zebrafish larvae simultaneously while presenting a large library of sensory stimuli. We are using this novel technology and unsupervised clustering algorithms to characterize the set of movements that these small vertebrates use to interact with their world and to find how sensory stimuli unleash specific behaviors. We are trying to understand the neural mechanisms that underlay gait control by recording the activity of large assemblies of reticulospinal neurons in awake behaving larvae. The reticulospinal neurons project directly to the spinal cord and are thought to be the last brain structure to encode motor programs that control behavior. By thoroughly investigating the activity of these neurons while the fish are performing a large variety of behaviors we hope to uncover general rules of vertebrate locomotion.

**18.00 pm**

*Coordination in rats: the use of game theory to study the proximal mechanisms of cooperation*

Scott Rennie, CNP

Animals must survive in an ambiguous world where the likelihood of available outcomes is reciprocally intertwined with their own choices. This is most evident in social interactions where the outcome of one's decision can be influenced by the decisions of others. To examine how rats make adaptive choices during social foraging we developed an automated double T-Maze designed for testing 2x2 social dilemma games and established a coordination task with rewards corresponding to the payoff matrix of a Stag Hunt (SH) game. By fixing the strategy of one rat and observing the choice of a freely behaving rat we found that they rapidly engage in coordination but alter their behaviour adaptively in response to changes in the payoff matrix, suggesting an understanding the economic terms of the SH game. Next, we observed pairs of freely behaving animals, where each must choose to either risk cooperating first, defect, or follow the other. In the SH game there are two Nash Equilibria: mutual cooperation, yielding the highest reward at the greatest risk and mutual defection, which provides a constant intermediate reward. Rats demonstrate flexible behaviour with robust coordinated cooperation and defection. We are currently examining the role of reward history and conspecific behavior in each animals choice.

**18.20 pm**

*Serotonin neuromodulation of cooperative behavior in a cleaner fish*

José R. Paula, ISPA

The cleaning behavior has been used as a classic example of mutualism, with benefits to cleaners and clients. Although much has been studied on the behavioural aspects of these mutualistic interactions, little is known about physiological processes that underlie these interactions. The neurotransmitter serotonin or 5-hydroxytryptamine (5-HT) is involved in the regulation of vertebrate social behaviour while its activity is usually related with social status and aggressive behaviour. We've found that exogenous administration of 5-HT agonist 8-Hydroxy-2-(diethylamino)tetralin (8-OH-DPAT) and selective serotonin reuptake inhibitor (SSRI) fluoxetine caused a substantial increase of cleaners' motivation to inspect clients without affecting their intraspecific interactions, which suggests a particular effect of 5-HT on interspecific behaviour but not of an overall effect on social behaviour. Additionally we've discovered that 5-HT antagonists WAY-100635 and p-chlorophenylalanine lead to a substantial decrease of cleaning inspections. To our knowledge, our study is the first to link the effects of neurotransmitter action (serotonin) to cooperative behaviour, beyond the usual focus of its influence on conspecific social behaviour. Our findings are consistent with those observed with arginine vasotocin' influence on cleaning behaviour, which might indicate that there is an important role of serotonin-related mechanisms in

**18.40 pm**

*Cortisol causes cleaner wrasse to switch from cooperation to cheating and prompts tactical deception*

Marta C. Soares, ISPA

A growing body of recent empirical research, mostly done on humans, recognizes that individuals' physiological/neurological state affects social behavior. An individual's decision to either cooperate or to defect may thus depend on how its current internal state affects the payoffs of behavioural alternatives. However, little is known about the physiology underlying state dependent cooperation. Here, we demonstrate that cortisol levels causally affect levels of cooperation in wild cleaner wrasse *Labroides dimidiatus*. These cleaners cooperate by removing ectoparasites from visiting 'client' reef fishes but prefer to eat client mucus, which constitutes cheating. We exogenously administered to small adults either cortisol, a glucocorticoid antagonist or a sham, and observed their cleaning interactions during the following 45 min. The effects of cortisol match an earlier observational study that first described the existence of "cheating" cleaners: such cleaners provide small clients with more tactile stimulation with their pectoral and pelvic fins, a behaviour that attracts larger clients that are then bitten. Blocking cortisol led to less cheating of small clients and more tactile stimulation to large clients. As cortisol links stress with perceived energy balances and affects cognitive functions, it potentially offers a general mechanism for condition dependent cooperation in vertebrates.

**19.00 pm**

*Steroid levels of male tilapia in a mirror challenge are independent of behaviors but dependent on chemical information*

João L. Saraiva, CCMAR

Animals facing a social challenge mount an endocrine response that usually results in an increase in androgens when they succeed, and a decrease when they do not. A reported exception appears to be when Mozambique tilapia *Oreochromis mossambicus* males mount escalating fights against their own mirror image, but fail to show androgen responses. The current study aimed at establishing the basis for the apparent lack of hormonal response. Males exposed to a mirror showed three consistent categories of behavioural response – freeze, fight or court – but no differences in circulating androgens between them after the test. Subsequently, either pulses of dominant male urine (containing a putative dominance pheromone) or control water were delivered to mirror fighting males. Males exposed to dominant male urine still displayed escalated fights, but at a significantly lower level compared to control males. However, urinary levels of 11-ketotestosterone (11KT) were higher in males that received urine pulses compared to control males. This increase is more evident when males are stimulated with dominant male urine in the absence of visual stimulus (own image). The putative urinary pheromone appears to have a releaser effect suppressing aggressive behaviour and a priming effect stimulating 11KT secretion. Our results suggest that while winner and loser effects are highly complex, subtle sensory signals may provide the key to explain the complex link between androgens and aggressive behaviour.



## Friday, October 25th . Talks

### 10.20 am

*Leaf-tool use for drinking water by wild chimpanzees (Pan troglodytes verus): ontogeny, social propagation and handedness*

Cláudia Sousa, FCSH-UNL

Among non-human primates, chimpanzees show the most diverse and flexible tool-using repertoire. They are proficient tool-users, making and using a variety of tools in subsistence and non-subsistence activities. One of the examples for a subsistence activity is the use of leaves for drinking water, which is a wide spread tool-use behaviour among chimpanzees. It can be found in three different forms: leaf-sponges, leaf-folding, leaf-spoons. Among the chimpanzee community of Bossou, we can observe all three forms, albeit in different frequencies. Here it is described the longitudinal record of manufacture and use of leaf-tools for drinking water. The learning process underlying the acquisition of tool-using skills, and the degree of laterality evident in both immature and mature performers were investigated. The use of leaves for drinking water emerges at the age of 1.5 years old, but the manufacture of leaf-tools only starts at 3.5 years of age. Infants and juveniles were observed to use drinking tools, which had been discarded by other individuals after use. Concerning handedness, the chimpanzees are ambidextrous, with some individuals biased to one side. We discuss possible explanations for the earlier emergence and increased ambidextrousness that accompanies leaf-tool use in comparison with other forms of tool-use by wild chimpanzees.

### 10.40 am

*When what I see is not what I hear. First data on cross modal perception of human emotions in domestic dogs (Canis familiaris)*

Fábio Rangel, FCUP

Recently, there has been a renewed interest in the study of the dog-human interaction with inter-species empathy emerging as an important topic of research. Within this topic, studies suggest that dogs may only react empathically to social situations involving multiple simultaneous and dynamic channels of information about human emotion. To date, however, nothing is known about cross-modal perception of human emotions in dogs.

This study tested twenty-seven domestic dogs for a possible match between visual and auditory components of human emotions. A modified version of the “preferential looking paradigm” was used, and for each dog we recorded the total time spent looking at each of two different facial expressions, presented simultaneously with a vocalization that was congruent with only one of the two shown expressions.

Results revealed an association between total time spent looking at the faces and proportion of time spent looking at the face matching the vocalization - the longer the total time spent looking at the faces, the longer the time spent looking at the incongruent face. This finding not only suggests that dogs may have the ability to integrate information about human emotions across the auditory and visual domains but also that they may generate an expectation of a stimulus from one particular domain in response to a stimulus from another different one.

### 11.20 am

#### *Habitat copying predicts highly aggregated colonies in birds*

Manuel Sapage, FCUL-CESAM

Colonial breeding is a widespread phenomenon in birds. The Habitat Copying Hypothesis (HCH) states that coloniality is a by-product of decision-making processes during habitat selection. Because it is physically impossible for each individual to evaluate all the fitness-affecting commodities of one habitat while prospecting for a breeding site, animals may use social cues that indicate the reproductive success of conspecifics, and choose to breed near the most successful ones. This would lead to the formation of breeding aggregations, which secondarily may generate costs and benefits of group living that lead colonies to grow or not. Using a comparative analysis, we tested the HCH that individuals are more prone to aggregate when they can detect the breeding success of conspecifics, in relation nest type and nest site. We analysed the Class Aves as a whole and the Order Charadriiformes in particular to capture the macro- and micro-evolutionary effects. We found that only nest site correlates with aggregation under certain conditions. The evolutionary transition from solitary or sometimes aggregated to always densely aggregated is more frequent when the breeding success of conspecifics is easier to detect, which is evidence of HCH. This is true for both Aves and Charadriiformes.

### 11.40 am

#### *Traditional behavioral assays and aggressiveness in a gregarious avian species (Estrilda astrild)*

Caterina Funghi, CIBIO

In many birds species a variety of behavioural assays have been shown to correlate with aggressiveness. In gregarious species, however, assays using isolated individuals may be poor predictors of behaviour within groups. We measured aggressiveness directly in groups of a very social species, the common waxbill (*Estrilda astrild*), and performed 5 traditional behavioural assays on the same individuals: tonic immobility, mirror test, novel object test, open-field test, and a variant of the latter in an enriched environment. We found that larger males were more aggressive, that differences in aggressiveness were repeatable, but that none of the traditional behavioural tests predicted aggressiveness, even controlling for body size. These results suggest that novel experimental designs more akin to the ecology of social species may be needed to assay avian aggressiveness in some species.

**12.00 pm**

*Social odors conveying dominance and reproductive information induce rapid brain transcriptome changes in a cichlid fish*

José Miguel Simões, ISPA

Animals adjust the expression of their social behavior to the daily changes in social life and such ability impacts on their Darwinian fitness. Neuroplasticity may be achieved by biochemically switching nodes of the neural network underlying the social behavior in response to perceived social information. At the molecular level, gene expression might be socially modulated by signaling pathways that interface the social environment and the genotype. The Mozambique Tilapia, *Oreochromis mossambicus* has a rich repertoire of social behaviors during which chemical information is conveyed. Territorial males increase their urination frequency during agonist encounters or courtship to convey chemical information reflecting their dominance status. We performed a genome-scale analysis of the brain molecular systems involved in processing olfactory stimuli. The recording of the electro-olfactogram showed that the olfactory epithelium discerns urinary olfactory information from territorial and non-territorial males as well as from pre- and post-spawning females. The different olfactory stimuli have a major impact in the brain transcriptome, with different chemical social cues eliciting specific brain patterns. These results reinforce the idea of an extensive transcriptional plasticity of cichlid genomes, in response to changes in their social environment and might shed some light on the rapid evolution of this teleost family.

**12.20 pm**

*Carotenoid-based color ornamentation predicts social dominance in serins, *Serinus serinus**

Ana V. Leitão, CIBIO

In gregarious animals, social interactions frequently take the form of dominance hierarchies that maintain stable relationships between individuals and settle disputes without extra-costs. Traits that function as signals of status can play important roles in mediating interactions among individuals. We used European Serins (*Serinus serinus*), whose plumage has carotenoid-based yellow ornamentation, to experimentally analyse feeding order and aggression in same-sex groups of unfamiliar individuals. We constructed a dominance hierarchy to each group and tested whether ornamentation (colour saturation), age, or morphology (size and condition) predict dominance.

Dominance hierarchies were stable/repeatable, and ornamental colouration, particularly the male yellow crown patch, rather than age or morphology, was related to dominance status. We argue that carotenoid-based colour differences in agonistic encounters can be a reliable predictor of social status in male serins.

**14.50 pm**

*The role of signaling mistakes in communication: testing new hypothesis using dark-eyed junco (*Junco hyemalis*) song*

André M. Ferreira, FCT-UC

Animal communication signals should convey honest information to be evolutionary stable. Several explanations have been proposed to explain signal honesty, based on signal design or costs, or on social penalization of cheaters. In this work we explicitly test, for the first time, predictions of a recent suggestion: signalling exposes mistakes that may reveal information about individual quality or motivation, and this could be accessed by other individuals. We studied song in dark-eyed juncos (*Junco hyemalis*), and showed that signalling mistakes, defined as atypical songs, were negatively related to age and reproductive success. In addition, song types that appear physiologically more demanding increased the probability of mistakes occurring. These results suggest that signalling mistakes have the potential to encode important information and, therefore, to have a role in animal communication. We also studied song consistency, defined as similarity of frequency and length across syllables, and found that, similarly to what has been shown in other species, older males and males with higher reproductive success had more consistent songs. For the case of song consistency, information is conveyed by small deviations in syllable structure rather than large mistakes, since re-analysis focusing only on extreme deviations in frequency or length were less informative.

**15.10 pm**

*Patterns of male vocalization activity and acoustic interactions in the Lusitanian toadfish (*Halobatrachus didactylus*)*

Paulo J. Fonseca, FCUL

Biological rhythms rule many aspects of life, often allowing organisms to anticipate and cope with fluctuations of their internal and external environments. Environmental fluctuations in coastal and estuarine habitats include tidal level, currents, cyclic variations in turbidity, temperature, salinity and other physicochemical parameters, day/night related fluctuations, etc. Animals must cope with these fluctuations through physiological and behavioural adaptations. The Lusitanian toadfish breeds in coastal waters and form aggregations. Using acoustic signals (mostly boatwhistles) males advertise their presence, attract females to their nests and engage in interactions with other males. We used round-the-clock sound recordings to monitor vocal activity in three locations in a natural habitat in the Tagus estuary: intertidal nests only exposed in spring tides, subtidal nests (minimum 0.3 m water level) and infratidal areas (minimum 2.5 m water level). We investigated the relation of the vocal activity pattern with habitat parameters such as water level, temperature and light fluctuations. Vocal patterns differed in the intertidal and subtidal areas relative to infratidal ones. Vocal interactions among neighbours in a chorus followed two main patterns: males either alternated or synchronized boatwhistles. These results are discussed in relation to environmental and social constraints to sound communication.

**18.00 pm**

*Interplay between value and confidence in an olfactory guided decision*

Gil M. Costa, CNP

The life of an animal is punctuated by decisions. Which food source to choose, which sexual partner to pick, what should be done when facing a predator? Difficult decisions can occur because stimuli are hard to perceive or because the rules of what should be done given a certain stimulus are uncertain to the decision maker. We would like to understand how this second form of uncertainty is represented by the brain and may be assessed and used for adaptive behavior. In addition, we are interested in the relationship between uncertainty and value in such decisions.

To study these issues we trained rats to perform an olfactory guided decision and report their confidence by reward waiting time. By measuring the willingness to wait for a reward we observed that rats waiting time changed as a function of decision difficulty and expected outcome, as expected for a behavioral confidence report.

In order to further understand the interplay between confidence and value we also introduced a reward manipulation which, as expected, biased the choice function of the animals towards a more rewarded side. In contrast rats did not wait longer for higher amount of reward. This suggests the processes contributing to choice bias and confidence judgements in this task are not identical.

**18.20 pm**

*Elucidating the computational strategies behind nutritional decisions in Drosophila*

Verónica M. Corrales, CNP

Deciding what and how much to eat plays a fundamental role in regulating both lifespan and fecundity. These decisions are highly dependent on the animal's internal state, yet how this value-based decision-making process is implemented to achieve metabolic homeostasis has been poorly characterized at molecular, neuronal and behavioral levels in "*Drosophila melanogaster*". We developed an automated machine-vision system which records single fruit flies as they walk across 9 sucrose and 9 yeast spots distributed on a circular arena.

To dissect this decision-making mechanism, we looked at two key parameters that determine total food intake: 1) the probability of choosing a yeast vs. a sucrose spot and 2) the duration of the nutrient bout. Regarding the former, we found that flies standing on a given food spot were equally likely to have come from a yeast spot as from a sucrose spot. Nutrient bout durations followed a heavy-tailed distribution and were differentially regulated according to the internal state of the fly, as was the nutrient bout number. A detailed characterization of the nutrient homeostasis mechanism combined with neuronal and genetic manipulations, will be important to pinpoint which specific behavioral outcomes are controlled by these neuronal/molecular mechanisms in the fly.

### 18.40 pm


*Parasitic infection changes exploratory and risk behaviors on Toxoplasma hosts*  
Cristina Afonso, CNP

Felids are definitive hosts of the *Toxoplasma* parasite and, consequently, it is believed that a number of strategies have been used by this parasite to increase its transmission to this host (ex: modifying intermediate rodent host behavior by reducing the innate fear of predator odor). However, manipulation of intermediate host behaviors other than those that increase felid predation is also involved, given that wild *Toxoplasma*-infected rodents are more frequently caught in traps. We analyzed the behavior of chronically infected C57BL/6J mice in environments with exposed and non-exposed areas. By using principal component analysis, we identified behavioral differences in the microstructure of exploratory behavior and risk/unconditioned fear, which may result in enhanced capture probability. We were also able to demonstrate that *Toxoplasma* cyst distribution in the brain is not random, with observed behavioral changes being related both to cyst presence and localization. Additionally, we identified suites of related behavioral traits in the host (behavioral syndromes) that are affected by parasitic infection, namely we detected changes in behavioral correlations between infected and non-infected individuals. We are also interested in understanding the mechanisms through which infection results in modification of behaviors and we are currently developing genetic tools which will allow fast and reversible manipulation of the infected neuronal circuits.

### 19.00 pm

*Toxin and antitoxin proteins on the bacterial social behaviour*  
Rita Ponce, CBA-FCUL.

We generally associate communication to multicellular organisms, but unicellular organisms also communicate between them. Bacteria colonize almost all niches on earth where they engage into complex polymicrobial communities, involving many other different types of cells and organisms. They communicate and cooperate to perform a wide range of multicellular behaviours such as: dispersal, foraging (nutrient acquisition), biofilm formation, shelter, microbial and chemical warfare, quorum sensing, and mobility. Social bacteria secrete proteins that can thus be considered as bacterial public goods. Our results show that bacterial cooperation is controlled by mobile elements and that they evolve very fast. Important bacterial social behaviours, such as Quorum Sensing and fruiting body development, have been in some cases linked to the expression of toxin-antitoxin (TA) loci. TA loci are widespread and diverse in bacteria and their expression can lead to halt of cell cycle, or to cell death, as they encode a poison, the toxin, and an antidote, the antitoxin. Our work aims to clarify the role of the several families of TA loci in bacterial social relationships, as their ability to be secreted from the cell are important features of the molecules involved in bacterial sociality. Our findings could expand research interest in TA systems to studies of bacterial competition and potentially aid in developing new strategies for the treatment of bacterial infections.



10

CHAMPALIMAUD FOUNDATION  
Lisbon, Portugal

NATIONAL  
CONGRESS  
ETHOLOGY  
2013

Abstracts . Posters

## Thursday, October 24th . Poster Presentation

### 16.00pm . Poster session I

#### 1. *Mapping parental care and parenting in the Siluriformes: A phylogenetic approach*

Crespo, A.M., Levy, A., Robalo, J.I.,  
ISPA

Members of the order Siluriformes, mostly freshwater dwellers, display diversity regarding parental care and parenting traits. However, in several families, information on these features is poor or even absent.

In order to understand the evolutionary history of parental care and parenting in the Siluriformes, we mapped the above behavioral traits upon a Bayesian inferred mitophylogeny from 43 Siluriformes mitogenomes in Mesquite version 2.75, by using parsimony ancestral state reconstruction. The traced characters were treated as independent and categorical variables. The ancestral character history of both characters, mainly parental care, revealed ambiguities, hindering an accurate comprehension of the evolution of the study characters. However, both parental care and parenting traits showed independent evolutions and our results apparently contradicted any transitional directionality, as previously stated.

#### 2. *The role of ageing in behavioural and stress response*

Ana Faustino, Madalena Carneiro, Miguel Godinho Ferreira and Rui Oliveira  
CNP, ISPA, IGC

Zebrafish (*Danio rerio*) are becoming increasingly popular in behavioural neuroscience and behaviour genetics, being used frequently on trying to model physiologic, behaviour and neurological processes. Aging, is a multidimensional of physiological, physical and social change widely studied in rodents, that is known to influence memory processes in terms of behaviour and its neural correlates. Given the similarity of the HPI (hypothalamic-pituitary-interrenal) axis of zebrafish to the HPA (hypothalamic-pituitary-adrenal) axis of mammals and its wide behavioural repertoire, it seemed appropriate to use zebrafish to study the effects of aging on the behaviour (anxiety, boldness and depression like behaviour) and stress response. For that, we used wild-type AB line and, since telomere shortening is known to be related with aging, a line of tert <sup>-/-</sup> (a zebrafish mutant that lacks active telomerase leading to continuous shortening of telomeres). Several ages (4, 6, 9, 18, 24, 30 & 36 months) of these two lines are going through several behavioural paradigms (open field test – anxiety like behaviour; novel object test – boldness; confinement test – depressive like behaviour) and stress paradigms (ACTH challenge and chronic stress paradigm). In the future, we aim to understand if there is a differential expression of stress (CRH and GR) and neural plasticity (BDNF) related candidate genes and also if chronic stress leads to telomere shortening.



**3. Behavioral responses of domestic dog (*Canis familiaris*) to human non-verbal emotional expressions - an experimental approach to the possibility of empathy in dogs**

Karine Silva<sup>1</sup>, Ana Leite<sup>2</sup>, Fabio Rangel<sup>2</sup>, Vera Ferreira<sup>2</sup> & Liliana de Sousa<sup>1</sup>  
ICBAS, FCUP

The special bond that dogs have developed with humans has been attracting increasing attention from researchers working in different fields of the behavioral and cognitive sciences, and particularly from those interested in the study of empathy related mechanisms underlying social interactions.

The experimental protocol designed and followed in this work aimed at analysing the behavioural responses of twenty seven domestic dogs to human non-verbal vocal expressions conveying emotional information. A detailed ethogram was followed as to allow for the identification of behavioural patterns potentially related to different levels of empathic responses in dogs, namely emotional contagion and sympathetic concern. Obtained results regarding the expressions of pain and fear were consistent with the possibility of some level of emotional contagion in the tested dogs. Also a tendency was observed related to gender differences with females appearing more responsive than males to the presented emotional vocalizations.

**4. Auditory cues in social transmission of fear**

Pereira A., Lima S. Q., Moita, M.  
CNP

It is well documented that social information is used to signal danger. We previously developed a behavioral paradigm to study transmission of fear between rats, and found that the cessation of movement-evoked sound is perceived as a signal of danger and its resumption as a signal of safety. We hypothesize that the sudden transition from movement sound to silence is the relevant auditory cue to trigger fear. Since Lateral Amygdala (LA) is a structure implicated in fear responses receiving auditory inputs from both cortical and thalamic pathways, we will use optogenetic tools to inactivate LA specifically during the transitions from movement evoked sound to silence, with the prediction that it will disrupt the expression of fear. In addition, we looked at the expression of immediate early genes in different sub-regions of the auditory thalamus, paying particular attention to regions shown to display offset responses to the presentation of white noise auditory stimuli. We found no differences in c-fos expression in the dorsal Medial Geniculate nucleus (dMGD) and Interpeduncular Nucleus (IPN) between rats exposed to the cessation of the movement-evoked sound and controls. This study will hopefully contribute to the understanding of the neural mechanisms of fear evoked by natural sounds.

**5. Zebrafish model on the upswing- a behavioural review**

Ana Valentim

IBMC

The increasing use of the animal model zebrafish (*Dario rerio*) in research urge to a better understanding of its behaviour. The results of a quick search on Pubmed showed that zebrafish behaviour has been studied in 144 articles in the last 20 years, from which 66% are from the last 5 years. Similarly to rodents, behavioural tasks have been developed for this model, in order to study anxiety, memory, aggression, social behaviour, among other issues. With different stages of development, zebrafish larvae and adult have different behavioural repertoire, and therefore appropriate behavioural tasks were developed for each situation. As zebrafish is a new model, this presentation intends to describe some behavioural tasks and their applications in research: avoidance behaviour in larva (by visual stimulus, startle stimulus or conspecific proximity), novel tank test, open field, dark-light paradigm, inhibitory avoidance, conditioned place preference, olfactory conditioning, T-maze, shoaling and agonistic behaviour in adults. These battery of tests are useful for phenotyping which is very important in a model where the quality of strains are still not always controlled.

**6. A blast from the past: how prior experience modulates transmission of fear**

Andreia Cruz & Marta Moita,

CNP/IGC

It has been shown that rats respond to the display of defensive responses by con-specifics. Also, rats with prior experience with shock show observational freezing but naïve ones do not. We hypothesized that, during exposure to shock, rats associate their own defense responses, such as freezing, with aversive stimuli. Thus freezing would become an alarm cue through its association with shock. Exposure to shock may also contribute to observational freezing through stress-induced sensitization. To test whether associative learning underlies freezing during a social interaction, we tested different exposures to shock. We found that experiencing shock alone is not sufficient, as animals that receive immediate shocks in an unfamiliar context do not display observational fear. This protocol entails no freezing nor fear learning. To test if fear learning in the absence of freezing is sufficient to sustain transmission of fear, we conditioned rats to fear a context without allowing them to express fear responses in that environment. We found that these rats show low levels of observational fear. These results support our hypothesis that the animal has to associate its own fear responses with shock. We will discuss a set of experiments to further disentangle the role of prior experience in observational freezing.

**7. Cognitive impact of repeated exposure to novel spatial arrangement of objects.**

Ângela Amaro-Leal; Isabel Rocha; Diana Cunha-Reis

IMM

Exposure to novel configurations of objects in familiar environments stabilizes long-term depression (LTD) in vivo (Kemp; Manahan-Vaughan, 2004, PNAS 101:8192). We recently tested the ability of a cognitive training program based on this paradigm to enhance cognitive function. Wistar rats exposed for two weeks to three objects always presented in a new spatial configuration (as control objects were presented in a fixed configuration or were not present) showed enhanced LTP and depotentiation in the CA1 area of hippocampal slices. We now tested the impact of this training program in hippocampal-dependent spatial learning using the radial-arm maze test.

During training all animals showed a progressive increase in exploratory activity and decrease in exploration of objects (nose-pokes). Trained rats (n=9) showed lower latency to find all baited arms when compared to controls (n=8) and this was still observed one week after (recall test), suggesting that they have better retention of memories. This suggests that training routines based on novelty exposure may have a significant impact on cognitive performance and may be useful in cognitive recovery in pathologies involving synaptic dysfunction such as temporal lobe epilepsy.

**8. How early life experience shapes mate preference**

António Dias, Léa Zinck & Susana Lima.

CNP

We are interested in understanding the neuronal basis of the assortative mate choice exhibited by *Mus musculus musculus* females when given a choice between a male of their own subspecies and a male from the closely related subspecies, *Mus musculus domesticus*. Previous results from our lab suggest that female mate preference is dependent on early life experience. Because olfaction is the major communication highway in mice, we hypothesize that the females are learning something from the odours present during early life development that allows them to choose which males to mate with later in life. To understand which olfactory cues are important during the learning period, we are manipulating different elements of the mice's social context within the first weeks of life, such as the presence of the father. We are also conditioning newborn females to neutral artificial odours, both pre and post-natally, and using these odours to manipulate male's value. We will also use immediate early gene expression to investigate which brain areas are involved in this early life learning.

**9. Longitudinal Stability and Growth of Child Social Competence During the Preschool Years**

António J Santos, Carla Fernandes, Marília Fernandes, Marta AntunJordana Cardoso, Nana Shin, Brian E. Vaughn  
ISPA

This study examines the stability and growth over a three-year period of individual differences in preschool children's social competence, which was assessed in three domains: social engagement/motivation, profiles of behavior and personality attributes characteristic of socially competent young children, and peer acceptance. 273 children participated in this study and were observed as 3 year-olds and again as 4 and 5-year-olds. Analysis tested the longitudinal stability of the SC construct across age levels. Consistent with our hypotheses, the path from SC3 to SC4 and from SC4 to SC5 were large and significant,  $\beta_s = .89$  and  $.74$ ,  $p < .001$ , respectively. Linear growth models were tested, the unconditional model fit the observed data adequately for the PB/PA domain with a mean for the slope term of  $.03$ ,  $p < .001$  (standardized value =  $.43$ ) indicating a small but significant incremental increase in the scores for this domain over time. Moreover, the negative correlation between the intercept and slope terms in the model indicates that children with lower initial scores tended to gain more in subsequent years. However, the unconditional growth model did not fit the data for the SE/M domain. These findings lend support to the social competence model proposed by Waters and Sroufe (1983).

**10. Semi-feral cats: the human influence on circadian activity**

Carla Fafiães<sup>1,2</sup> & Liliana de Sousa<sup>1</sup>  
ICBAS, FCUP

This study's main objective was to realize how *Felis catus* behaviors change at different times of the day. Generally, as nocturnal animals, cats are more active during early morning, afternoon and evening, but human influence makes this routine change. The sample that was chosen was of semi-feral cats living free but benefiting from the presence of humans to access food. Naturalistic observation technique was used with video recording to register cats' behaviors (individual and social) which allowed constructing an ethogram. The study was made during 5 days in a 10 minutes record for each of 4 periods of the day (early morning, late morning, afternoon and evening). Statistical data analysis regarding frequencies and duration differences of their behaviors according to those 4 day periods were accomplished with SPSS 17.0. Results lead to conclude that the circadian rhythms of the studied cats were affected by humans once there were no remarkable differences between the analyzed behaviors in the 4 different periods of the day. Results point out that this population was somehow influenced by human activity, which indicates that cats can change their nocturnal habits if factors that influence this change are present.

**11. Ex-situ reproduction for restocking endangered freshwater fish populations: the need to preserve the natural behavioral patterns of captive bred fish**

Carla Sousa-Santos, Joana Robalo & Vítor C. Almada

ISPA

A pioneer project of ex-situ conservation of endangered freshwater fish species started in 2007, aiming to preserve the genetic pool of populations in eminent risk of extinction until their habitats are restored and restocking with captive bred individuals may be accomplished. Stocks from populations of six endangered species were successfully bred under a "naturalistic approach" of reproduction, based in the following guidelines: 1) natural occurring spawnings; 2) availability of refuge areas for fry and juveniles; 3) natural conditions of light and temperature; and 4) minimal human intervention. With this approach our goal was to breed and rear fish in conditions that would preserve the natural behavioral patterns of the species (namely escape from predators, search for food, and attract sexual partners), so that they would preserve adaptations to the natural habitat conditions at the time of restocking.

**12. Development of hearing abilities in the highly vocal fish *Halobatrachus didactylus***

Daniel Alves<sup>1</sup>, Raquel O. Vasconcelos <sup>1,2</sup>, Andreia Ramos <sup>1,2</sup>, Joseph A. Sisneros <sup>3</sup>, M. Clara P. Amorim <sup>4</sup>, Paulo J. Fonseca <sup>1</sup>

1 - CBA, 2 - University of Saint Joseph, Macau, 3 - University of Washington, USA,

4 - ISPA

Hearing neural networks of vertebrates seem to have evolved from a shared brain area. Therefore understanding how auditory abilities differentiate in a less complex taxon, such as fish, may allow important insights into vertebrates' hearing ontogeny and evolution. Development of the auditory system might be important for communication and for the control of self-vocalizations. The Lusitanian toadfish *Halobatrachus didactylus* (Batrachoididae) produces at least five different calls. We aim to investigate possible changes with age in the peripheral auditory sensitivity and in the brain representation of conspecific signals. Evoked potentials were measured from populations of saccular hair cells in juveniles (g1: 2-5 cm; g2: 5-9 cm SL) and in adults (g3: >19 cm). Representation of conspecific signals was registered using the AEP technique. Saccular hair cells of the smallest juveniles were significantly less sensitive (circa 10 dB) than in the other two groups. Auditory responses to conspecific signals indicated a gradual improvement in the representation of various features throughout development, with adult fish presenting a more accurate encoding of the signal. Our data suggest that the development of the auditory system parallels the development of the vocal system in this highly vocal fish.

**13. One year with *Chioglossa lusitanica***

Daniela Torres<sup>1,2</sup>, Tiago Ribeiro<sup>1,2</sup>, Liliana de Sousa<sup>2</sup>, Nana Shin, Brian E. Vaughn,  
1 - FCUP, 2 - ICBAS

The behavior of *Chioglossa lusitanica* was recorded during 10 months. *Chioglossa lusitanica* is the only referred species of the genus *Chioglossa* and is endemic of the Iberian Peninsula. This species have particular characteristics like autotomy of tail and absence of functional lungs. This work was held in a gold mine at Valongo near Porto in complete darkness, the natural habitat of this endangered species. The salamander's behaviors were captured in 24 hours sessions, divided into two recordings of 12 hours during two consecutive days in order to construct an ethogram. They were registered with intervals of 3 weeks from February to November. Aggressive behaviors, sexual interference of males and other social behaviors were observed and analyzed. Some differences between the activity of the individuals during the day and seasonally were also noticed. This work brings new insights into parental care and into the distribution of the individuals along the tunnel, like the ones observed in other salamanders' species.

**14. Observations of the reproductive behaviour of *Lucanus cervus***

David Severino  
Parques de Sintra Montelua/ISPA

The *Lucanus cervus* is the biggest coleopteran in Europe, with a vast distribution across this continent, but being threaten of extinction almost everywhere, even if not globally. *L. cervus* has a larval development raging from one to seven years, but only about fifteen days as an adult, so it is very important that they reproduce during this period. This fact makes it difficult to register their reproductive behavior, and that is why there aren't many records of it. For this work; film and photographic records were taken of the behavior of three individuals: a female, a dominant male (major) and a satellite male (minor) - found on an oak tree in the Park of Monserrate, Sintra. It was verified that, throughout the mating period, the major male placed himself on top of the female and exhibited a very aggressive behavior, attacking everything that went near anything that passed nearby (being it the other male or not), the female stayed beneath the male, feeding herself from a wound on the tree while the eggs were being fecundated, and the minor male tried many times to copulate, either by sneaking to the female or by facing the major male.

**15. An intersectional approach to assess the requirement of subsets of apterous-neurons in receptivity**

Dennis Herrmann, Sophie Dias, Ricardo Silva, Maria Luísa Vasconcelos  
CNP/ IGC

Evolution equipped *Drosophila melanogaster* with reliable mechanisms to mediate mate choice ensuring successful propagation of the species. These mechanisms manifest in a stereotyped courtship behavior, during which the female is subjected to sensory modalities presented by the male which influence her decision whether to mate or not. These stimuli are processed and integrated by neural networks to yield an innate behavioral phenotype. We use a single-pair courtship assay to perform a behavioral screen of genetically modified nervous systems, allowing us to functionally and anatomically characterize the circuitry controlling female reproductive behavior. We prove the principle of our experimental design and show the involvement of apterous-positive neurons in female receptivity and egg laying. In order to reduce the number of neurons we used a collection of GAL80 lines in combination with our paradigm. We found four lines that rescue wild-type behavior when the neurons of the intersection are not silenced. Further investigation will lead to an understanding of how neural networks are assembled in order to transform sensory input into behavioral output.

**16. Rhythmic Activity in *Lipophrys trigloides* and *Lipophrys pholis***

Eunice Ricardo e Ana Pereira  
ISPA

The endogenous tidal rhythms of the littoral fishes *Lipophrys trigloides* and *L. pholis*, were studied in the laboratory. This study aimed to understand if activity patterns in both species are related to tidal and circadian rhythms. For this, 3 *L. trigloides* and 3 *L. pholis* were captured on São Pedro do Estoril beach and were placed in separate tanks without any contact and with constant light. Activity was monitored over a period of five days for each fish. Webcams filming individual aquaria were controlled by a movement detection software, which recorded fish's activity. As expected, in the first days, *L. pholis* increased activity during period corresponding to high tides, and decreased during low tides, and the same pattern was observed in *L. trigloides*. The patterns observed in both species were compared and discussed considering differences in habitat and behavior.

**17. Effects of social environment and cortisol in adult neurogenesis in Zebrafish**

Fábio Faustino<sup>1,2</sup>, Magda C. Teles<sup>1,2</sup> and Rui F. Oliveira<sup>1, 2</sup>  
1 - ISPA, 2 - CNP/IGC

Cortisol is known to have a detrimental effect on adult neurogenesis. However, recent studies suggest that contextual variables may modulate this effect. For example, in mice it has been shown that an increase in cortisol associated with a rewarding experience sexual interaction did not compromise adult neurogenesis. In the present work we test the effect of the interaction between increased cortisol and valence (positive vs. negative) of social context on neurogenesis in adult zebrafish. Fish were exposed to cortisol (10µg/ml) for either an acute (1h) or a chronic period (5d) under social environments of different valences: positive (shoal + conditioned water) and negative (predator + alarm cue). Cell proliferation was measured by PCNA immunohistochemistry in different brain regions known to be implicated in the processing of social information (DL, DM, Vv, Vs and POA). Our hypothesis is that positive social environment may stimulate neuronal proliferation and buffer against the suppressive effects of cortisol.

**18. Sensory bias in sexual selection of *Drosophila subobscura***

Gonçalo Faria da Silva, Margarida Matos, Susana Varela  
CBA, CESAM/FCUL

Sensory bias in female mating preferences occurs when certain male traits are favoured because they fit an already existing bias in the female sensory system. For instance, depending on the foraging ecology of the species, males may become more attractive if their ornaments are similar to the specific cues that the females are looking for in a potential food patch or local for oviposition. Working with *Drosophila subobscura*, we found that females tend to prefer males with spots of artificial Orange (O) colour, painted in their dorsal thorax. Our hypothesis is that this sensory bias for the O males was due to the females' pre-existing high sensitivity for ripen fruit colours. We are now further investigating if females prefer colourless (C) males or with O spots when compared to green (G) and blue (B) paints, as G is the colour of the unripen fruit and B an apparently "neutral" colour in this species. If *Drosophila* females can choose mates based on a colour sensory bias, it might have an important role in sexual selection. In fact, pigmentation is one of the most variable traits in *Drosophila* species. Could this variation be a by-product of sexual selection?



**19. Motor cortex is required for rapidly responding to unpredictable changes in the environment**

Gonçalo Lopes, Joana Nogueira, Joe Paton, Adam R. Kampff  
CNP

To investigate how the nervous system learns a predictive model to control behavior, we constructed an assay where we manipulate the predictability of an obstacle course. The assay is composed of eight equally spaced steps coupled to a motorized brake allowing independent control of their rotational stability. We tested fourteen rats (seven with bilateral motor cortex lesions and seven age-matched controls) that were trained to shuttle across the obstacle course for water rewards. During training, animals first learned to negotiate the assay with all of the steps stable, and performance was comparable between lesion and sham animals. Following one week in the stable environment, the center two steps were covertly released (i.e. free to rotate). When first encountering the new, unexpected state of the center obstacles, animals with motor cortex lesions were observed to suddenly stop their motor program and maintain a static posture for many seconds. In contrast, sham-surgery and normal control animals would either rapidly produce compensatory behaviors or immediately begin investigating (sniffing and manipulating) the altered obstacle and the cause of the environmental change. This finding reveals a novel role of motor cortex in preparation and control of rapid responses to unexpected changes in a learned environment.

**20. Hormonal response to an experimental emotion induction procedure**

Gonçalo A. Oliveira 1, Mariana Martins 1, Alexandre Fernandes (1), Rui F. Oliveira 1,2  
1 - ISPA, 2 - CNP

Recent reviews have shown that the testosterone (T) changes after a social challenge are not consistent with the predictions proposed by the current theoretical models (e.g. biosocial model, challenge hypothesis) and it has been suggested that this response variation may reflect the activation of cognitive variables. Among these variables, mood has been identified as a candidate mediator. However, the association between the hormonal response to winning/losing a competition and the participants' mood has not always been found in correlational studies. These findings could reflect a more intricate process that cannot be fully accounted by measures of positive/negative mood. With this experiment we aim to experimentally induce different emotional patterns (e.g. amusement, tenderness, anger, sadness) through film clips that have been specifically selected and validated for that purpose. No differences were found between the participants emotional state before the emotion induction procedure, but immediately after the end of the stimuli participants show a condition specific pattern of emotional experience. Baseline and post-stimuli measures of T and cortisol were also measured during this experiment.

**21. *The numbers of attraction: the effects of density on the attractiveness of a male face***

Inês Balula; Paulo Gama Mota

CIBIO

Mate choice has evolved to maximize female benefits and is, therefore, a decision process based on signals associated with the quality of the potential mate. Some of these clues are related with the attractiveness of the male face. In a society in which more and more males are available it is hard for females to perceive all these signs and, because studies have shown that the number of potential mates influences female choice, it is pertinent to question whether density could influence the attractiveness of a face. To test this hypothesis, 40 male faces were photographed and their attractiveness was classified by female evaluators. The density effect was achieved by creating groups of different sizes (20 and 40). Groups of 20 individuals are easier to compare than groups of 40 faces, which represent an exaggerated number of choices. The attractiveness of each face was established in smaller and larger groups and significant differences were found between evaluations. This study demonstrated that male faces presented in smaller groups achieved higher rating scores than when evaluated amongst a larger number of individuals. This outcome demonstrates that the number of potential mates influences female decisions in relation to the attractiveness of faces.

**22. *Male sexual behaviour adjustment in the presence of a rival***

Órfão I. (1), Ojanguren A.F. (2), Barbosa M. (2,3), Vicente L. (1), Varela S. (1), Magurran A.E. (2)

1 - CESAM/UL, 2 - SOI, University of St Andrews, UK, 3 - CESAM/UA

Behaviour allows individuals to rapidly adjust to present conditions. In the context of sexual selection in guppies, research indicates that male sexual activity increases in the presence of other males. However, how mating behaviour is adjusted in the presence of a rival and in relation to the condition of the competing male is incompletely understood. In order to address this question, 36 males were observed in a non-competitive and in a competitive context. In the first, the focal male was placed in a tank with two females, and, in the second, a competitor male was added to the group. The order of trials was randomised and sexual displays and sneaking attempts were recorded for 15 minutes. After the observations, males body' area and number of colour spots, condition and length (standard and total length) were measured.

In accordance with previous studies, sneaking attempts increased in the presence of a rival. However, a new result is that overall sexual activity was maintained, as the balance between courtship displays and sneaking attempts changed. The role that attractive features and physical condition plays in the mating decisions of individual males is now being analysed. Do less attractive males adjust their behaviour more often?

**23. Acoustic adaptation to noise in the Serin**

Joana Magalhães, Paulo Gama Mota  
CIBIO/FCUC

Song is a very common form of communication in birds. Males sing to repel other males or to attract females. However, acoustic signals suffer attenuation and degradation by the environment and the continuous growing of anthropogenic noise particularly in urban areas, has a potential great impact on birdsong, affecting the receiver's perception and interpretation of the message. The objective of this experimental study was to assess the short-term strategies performed by male serins, *Serinus serinus*, when exposed to two types of digitally created noise: low and high-frequency stimulus. Subjects showed temporal and structural changes. Males that were exposed to low-frequency noise significantly decreased the duration and peak frequency of selected sections of their songs. No other analysed parameter has suffered any temporal or structural change with noise masking, for both experimental groups. Although we just recorded slight adjustments, those performed show some capacity of this species to adapt and possibly overcome noise. This work provides another evidence of adjustment to noise that might seriously affect birds' communication and consequently their population ecology.

**24. The role of acoustic communication in mate choice of the sand goby *Pomatoschistus pictus***

Joana Vicente<sup>1</sup>, Paulo J. Fonseca<sup>1</sup>, M. Clara P. Amorim<sup>2</sup>  
1 - CBA, 2 - ISPA

*Pomatoschistus pictus* is a small vocal marine goby with exclusive paternal care. Breeding males are territorial and actively court females with vocalizations (drums) and visual displays to attract them to lay eggs in their nests. Previous studies have shown that males in better condition (e.g. with larger lipid reserves) exhibit higher mating sound production rate and seem to be chosen by females. We tested mate choice based on acoustic and visual signals in two separate playback experiments. Females were presented with a choice of a high and a low drum rate broadcast from the lateral compartments of the aquarium. Acoustic playbacks were combined with the visual stimuli of two size-matched males confined in small glass aquaria. In the first experiment females did not have access to the lateral compartments whereas in the second experiment they could approach the confined males. In contrast with previous work, females did not show an active choice for different sound rates in both experiments. We suggest that acoustic signals are part of a more complex multimodal communication and that females will only show active choice when they have access to males that can interact freely and exhibit their full repertoire possibly including chemical communication.

**25. *The role of dopaminergic system in the modulation of the Indo-Pacific bluestreak cleaner wrasse *Labroides dimidiatus* cooperative behaviour***

João P. Messias 1, José R. Paula 1, Alexandra Grutter 3, Rui Oliveira 1,4, Redouan Bshary 2, Marta C. Soares 1,2

1 - ISPA, 2 - Université de Neuchâtel, IZ, Switzerland, 3 - The University of Queensland, Australia, 4 - CNP/IGC

The cleaner wrasse *Labroides dimidiatus* system is considered to be a classic example of mutualism, in which interspecific interactions often yield positive payoffs for all involving parties. Although much is known on the behaviour of this species, its physiological counterpart is less comprehended. The cleaner wrasse *Labroides dimidiatus* is a highly specialized fish species that interacts with all sorts of other reef fish, which requires a great deal of behavioural flexibility. Here we asked if dopamine, a neurotransmitter involved in a variety of behavioural modulating actions, that is tied with reward-related learning and decision-making systems may be a good modulator candidate of these cleaners behaviour. We tested if the administration of exogenous agonists (SKF38393, Quinpirole) and antagonists (SCH23390, Metoclopramide) would produce any changes in their motivation to interact with other fish. To our knowledge, our study is the first to link the effects of dopamine actions and mechanisms to cooperative behaviour, to which we expect have tremendous effects on the output behaviour of these highly social fish.

**26. *Classic and Social Fear Conditioning in Zebrafish***

Júlia S. Pinho<sup>1,2</sup>, Marisa Fernandes-de-Castilho<sup>3</sup> and Rui F. Oliveira<sup>1, 2</sup>

1 - IGC, 2 - ISPA, 3 - Universidade Federal do Paraná , Brazil

Alarm response to conspecific skin extract has been broadly used in associative learning in fish, since this stimulus is inherent to the species and fear responses are consistently elicited. In our lab we are starting to use the alarm response to study associative and social learning in zebrafish (*Danio rerio*). Here we report the two studies that aim to establish a behavioral paradigm for zebrafish in this area. In Exp. 1 the occurrence of inter-strain variation (i.e. AB, Commercial and Tubingen) in the potency of the skin extract and in the fear response was tested. It was found that the AB skin extract induced a more intense behavior response irrespective of the receiver strain, and that this difference was associated with larger epidermal alarm-substance-producing club cells in the AB strain. In Exp. 2 classic conditioning and a social conditioning protocols were established and the fear response compared to the innate fear response to the skin extract. For the classic conditioning the alarm cue (US) was paired with red light (CS). For the social conditioning observer fish were allowed to watch a conspecific responding to the CS alone. Both conditioned groups exhibited a similar pattern of fear response to the innate group.

## Friday, October 25th

### 16.00 pm · Poster session II

#### 1. *Pup mortality in laboratory mice – infanticide or not?*

Elin M. Weber, Bo Algers, Jan Hultgren, I. Anna S. Olsson  
Swedish University of Agricultural Sciences, IBMC

Perinatal mortality is a relatively common problem when breeding mice, reported mortality rates vary from nearly 0 to 50% in experimental studies. However, knowledge of what causes perinatal mortality is scarce. Pup mortality constitutes a welfare problem and leads to an increase in the number of breeding animals needed to supply experimental animals, contradicting the goal of reducing the number of animals used for experimental purposes. Dead pups are generally eaten and it is commonly assumed that mothers kill their pups. The aim of this study was to increase the understanding of litter mortality and investigate if females actively kill their pups. We used video recordings of 10 females (C57BL/6 and knockouts *Hfe*<sup>-/-</sup> and *\_2m*<sup>-/-</sup>) that lost their litters to observe interactions between mother and pups from parturition until the pups died. A flowchart was used to systematically focus on critical events. Females interacted with both moving and still pups, but were never observed manipulating a moving pup that stopped moving after the interaction. Nor were any wounds visually detected during the video observations. Hence, even with detailed observations, we found no evidence that females kill their pups. These findings highlight the importance of being cautious when concluding how laboratory mouse pups die, and stress the need for more systematic investigations. By assuming that pups are killed by the mother, based on findings of pups half-eaten or not found at all, the true causes of pup loss are probably overlooked, and a welfare problem in laboratory mice is left unresolved.

#### 2. *Exponential random graph models of social attention in preschool peer groups*

João R. Daniel, António J. Santos, Joana Pipa, Marília Fernandes, Tânia Sousa, ISPA

Exponential random graph models (ERGM) are probabilistic models that regard observed networks as one realization from a set of possible networks, where the probability of observing a specific graph is dependent on the presence of different local configurations (e.g. reciprocated ties, transitive triads). These local configurations can be seen as outcomes of different social processes occurring in the network. ERGM were used to assess the relevance of reciprocity, popularity, activity dispersion, triadic closure and gender homophily effects on the distribution of social attention in 19 Portuguese preschool peer groups aged 3 to 5. Data collection involved 200 rounds per class of social attention focal samples. The ERGM yielded a set of parameter estimates and standard errors for each of the 19 preschool classrooms. These independent estimates were summarized following a multi-level approach to meta-analysis. Results showed that social attention in preschoolers was gender segregated, highly reciprocal, more likely to be directed at a restrict number of children and with a tendency for triadic closure. These results are similar to those found in other preschool peer networks (social proximity and sociometric choices) suggesting the existence of similar processes for different types of “positive” peer relations.

**3. *Effects of temperature in the courtship sounds of male Pomatoschistus pictus***

Joana Vicente<sup>1</sup>, M. Clara P. Amorim<sup>2</sup>, Paulo J. Fonseca<sup>1</sup>

1- CBA, 2 - ISPA

*Pomatoschistus pictus* is a small marine goby that inhabits sandy or gravel substrates in Atlantic waters. Territorial males actively court females during the mating season (January to May) using acoustic signals (drums, i.e a sequence of sound pulses) and visual displays to attract them to lay eggs in their nests. Since a few years now, climate change has become a trending topic and a great concern. Temperature is known to influence not only species distribution but also reproduction. Fish are ectotherms and therefore muscle contraction kinetics, and thus sound production, must be dependent on water temperature. We recorded *P. pictus* courtship drums at different temperatures ranging 14 – 22 °C. Our results show that drum duration and sound pulse period decreased with increasing temperature and that spectral peak frequency was negatively correlated with male size. Drum emission rate, sound amplitude, number of pulses in a drum were not affected by temperature. We discuss the implications of changes in acoustic parameters in fish acoustic communication.

**4. *Social signals in the ventromedial hypothalamus of female mice: influence of the reproductive cycle***

Kensaku Nomoto, Susana Q. Lima

CNP

Animals should choose appropriate actions at the right time in order to survive or reproduce successfully. During social interactions, animals must choose either being affiliative or antagonistic. It is well established that the reproductive cycle modulates this choice, and that female rodents show increased sexual receptivity when they are fertile. The ventrolateral part of the ventromedial hypothalamus (VMHvl) is thought to be involved in the neural control of such behavioral change. However, it remains unclear how the orchestrated activity of the VMHvl neurons produces different behaviors depending on the reproductive phase. To address this issue, we performed multiple single-unit recording experiments across the reproductive cycle in female mice during social interactions. We found that the proportion of male-responsive neurons in the VMHvl increases during the sexually receptive phase. This was not the case with the female-evoked responses. These results suggest that a change in the proportion of male-responsive neurons facilitates transmission of male information to the downstream brain regions, which may lead to increased sexual receptivity.

**5. Why do male spider mites mate with mated females if only the first mating is effective?**

Leonor Rodrigues 1,2, Susana A M Varela<sup>3</sup>, Joana Carvalho<sup>1</sup>, Fernando Duarte<sup>1</sup>, Isabelle Olivieri<sup>2</sup> and Sara Magalhães<sup>1</sup>

1 - CBA, 2 - Université Montpellier, France, 3 - CESAM/UL

In *Tetranychus urticae*, only the first mating is thought to be effective, except if the interval between first and second copulations is shorter than 24 hours or if the first mating is interrupted. However, males often attempt to copulate with mated females, suffering unnecessary energetic costs. Possibly, such behavior is linked to the inability of males to recognize which females they can effectively mate with. Alternatively, the second mating event may be beneficial to males and/or females. To test this, we first performed paternity tests using two strains, susceptible and resistant to pesticide. Overall, we confirmed the existence of first male precedence. Next, we performed male choice experiments. Males preferred virgins over mated females but did not prefer any type of mated female, which confirms male's discrimination ability. Finally, we measured the fecundity and offspring sex-ratio of each of those females. In general, no differences were found between once and multiply mated females. However, mated females showed longer latency to copulation and shorter duration of copulation compared to virgins. Our results suggest a cost and avoidance of remating by females and that the second mating occurs, from the males' perspective, for a different reason than siring offspring.

**6. Behavioral study of cats in shelter in enrichment and non-enrichment environment**

Sule Domnez, Alexandra Ribeiro, Ana Magalhães, & Liliana de Sousa  
ICBAS, Faculty of Veterinary Medicine, Ankara University

Cats in shelters can't find enough opportunity to interact with other animals or humans. This normally conducts to a less degree of activity that can be related with lack of well-being conditions. Based on ethogram of shelter cats, this study aims to know if the same cats living in two different shelter environments present different levels of global activity and of behavioral variability which is a sign of their well-being. Behavior was video recorded and observed during 10 minutes, 2 times a day (early in the morning and at evening), during 10 days. The 7 studied cats stayed, in a random order, 5 days in a shelter enriched environment and 5 days in a normal one. In the enriched environment cats have the presence of some toys namely a ball, a rope, and a bell. The studied behaviors like, for instance scratching, yawning, snoozing, playing were registered with Observer 7.0 software and compared by frequency and duration with SPSS 17.0. Results show that the positive effect of enriched environment is greater at evening. Shelters conditions are discussed in terms of cats' well-being.

**7. Socially driven changes in neural plasticity mediate behavioral flexibility.**

Magda C. Teles ab, Rui F. Oliveira ab

a - ISPA, b - CNP/IGC

In social species animals tend to adjust their social behaviour according to the available social information in the group. This changing environment requires for neuronal plasticity of the neural network underlying social behaviour. Two major neural mechanisms have been proposed to mediate these changes, biochemical switching and structural reorganization of the neural circuits underlying social behaviour that ultimately, depend on social regulation of gene expression. In the current work we examine both mechanisms with particular focus on monoamines and neuropeptides as major candidates to mediate biochemical changes, adult neurogenesis as a proxy for rewiring of the networks, and candidate genes (*bdnf* and *npas4*, *wnt3* and *neuroD* and *ngln1*, *ngln2* ) to identify different neurogenomic states. For this purpose we used zebrafish (*Danio rerio*) males to study the effects of acute social interactions in rapid changes in the brain. A behavioral paradigm under which male zebrafish consistently express fighting behavior was used to investigate the effects of different social experiences: winning the interaction, losing the interaction, or fighting an unsolved interaction (mirror image). Our results indicate that different social experiences operate at different levels to promote distinct internal states leading to different behavioural responses. This study will establish the quantitative response of neuronal plasticity in the brain of zebrafish to social changes.

**8. Beyond describing complex repertoires: the immediate functions of underwater acoustic emissions of bottlenose dolphins**

Manuel E. dos Santos, Ana Rita Luís & Miguel N. Couchinho  
ISPA, CPEMM

Identifying the immediate function of behaviours is a fundamental mission of ethological research. Behaviours often contribute to more than one function, and clarification of which features of a display produce each observed effect is important, as well as documenting the conditions under which a certain ecological function of a behaviour is predominant.

In the case of some cetacean acoustic emissions, the challenge has been to pinpoint their functional components as possible orientation, communication or prey debilitation behaviours. Studies of the acoustic production of bottlenose dolphins (*Tursiops truncatus*) resident in the Sado estuary and adjacent coastal waters have revealed a range of signals generally in concordance with the repertoire known for this cosmopolitan species: click trains, creaks, squeaks, squawks (mostly pulsed sounds), as well as whistles and bray sequences, the latter rather rare globally.

If slow click trains and whistles seem to have clear biological functions (echolocation and communication, respectively), the role of some other emissions remains ambiguous. Using a wealth of recordings obtained while observing these animals for more than 20 years, some facts and questions regarding their underwater acoustic emissions will be discussed in a functional, ethological perspective.



**9. Automatic Individual Identification and Call Type Recognition of Lusitanian Toadfish Acoustic Signals**

Manuel Vieira 1, M. Clara P. Amorim 2, Carlos Teixeira 3, Paulo J. Fonseca 1  
1 - CBA, 2 - ISPA, 3 - Departamento de Informática, FCUL

Numerous species communicate through acoustic signals that can fulfill several functions from mediating agonistic interactions to mate finding, and may provide cues for sexual selection. The study of acoustic communication often requires not only the recognition of species specific acoustic signals but also the identification of individual subjects in a complex acoustic background. When acoustic activity is to be studied based on very long recordings, automatic methods can be invaluable tools to extract the relevant biological information. Here we present an automatic pattern recognition methodology based on the Hidden Markov Model allowing accurate detection and recognition of fish vocalizations. Preliminary results show that the system is capable not only to detect the mating vocalizations (boatwhistles) but also allows individual identification of male Lusitanian toadfish (*Halobatrachus didactylus*) reaching an identification rate of 96 %. The system was applied to a stream of round-the-clock recordings of toadfish vocalizations in their natural estuarine habitat. Precise detection of mate advertisement sounds (boatwhistles) revealed several features of the toadfish vocalizations such as consistent activity up to several hours, the existence of tidal activity rhythms, and chorusing dynamics involving synchrony and alternation.

**10. Identification of neurons controlling female sexual behavior**

Márcia M. Aranha, Anita Souza, Sophie Dias, Maria Luisa Vasconcelos  
CNP

During courtship behavior, *Drosophila* female must decide whether or not to mate with the courting male. Virgin *Drosophila* females are receptive, while mated females become temporarily unreceptive after a successful copulation. We aim to identify and characterize the set of neurons that contribute to female receptivity behavior in *Drosophila melanogaster*. We used 1050 lines from the Janelia GAL4-Driver line collection to silence subsets of neurons by expressing Kir2.1. The lines were initially screened for fertility. 75 lines exhibited reduced fertility and they were subsequently evaluated for receptivity by video-recording the behavior of mating pairs in a small chamber. Our results show that 17 out of 46 lines tested so far exhibit a significant decrease in female receptivity that ranges from 21 to 100% after neuronal silencing ( $p < 0.05$ ,  $p < 0.01$  and  $p < 0.0001$ ). Furthermore, out of the 29 lines that show no alteration of the mating success, 11 lines exhibit decreased latency to copulate after neuronal silencing. This work suggests a causal relationship between activity of the mapped neurons and receptivity behavior that we will investigate further.

**11. Feed intake recovery after stressful events in Gilthead Sea bream (*Sparus aurata*): what is the influence of coping style?**

Cerqueira, Marco1; Millot, Sandie1; Martins, Catarina I.M.1

1 - CCMAR-CIMAR L.A.

It has been shown that stress in rearing environment can affect the fish feeding behaviour and lead to feed wastage, diseases and consequently loss of production. Moreover, the way that stress induces changes in feeding behaviour seems to be dependent of coping styles. The goals of this study were to: 1) determine in a group context whether divergent coping styles (proactive and reactive) in sea bream differ in feed intake recovery after stressful events, 2) characterize individual differences in feeding behaviour in a group context and 3) determine whether such individual differences are consistent over time. One hundred and eight individuals ( $BW_0 = 39.5 \pm 10.5g$ ) were initially screened for coping styles using previously validated methods. Afterwards homogenous groups of either proactive or reactive individuals ( $n=4$  individuals per tank) were subjected to acute stressors (exposition to a new environment and handling stressor) and the individual feed intake recovery determined. The results showed that coping styles did not influence the feed intake recovery whatever the stressful events. However, this study highlighted a consistency of individual feeding behaviour in a group context. Indeed, fish which showed the faster feeding recovery after exposure to a new environment were also the faster after the handling stressor.

**12. Distribuição vertical e ocupação de abrigos em *Lipophrys pholis* (Linnaeus, 1758) e *L. trigloides* (Valenciennes, 1836)**

Maria Gouveia, Ana Pereira

ISPA

The preferences for shelters in different levels of the water column (along the substrate, mid-height and adjacent to the surface) was studied in captivity in *Lipophrys pholis* (Linnaeus, 1758) and *Lipophrys trigloides* (Valenciennes, 1836). In addition, the number of shelter used in these species and the presence on platforms out of the water was studied. 12 *L. trigloides* and 8 *L. pholis* were captured on the intertidal platform of Bafureira beach. Three observation periods with five minutes scans for 100 hours were made.

Results showed that *L. pholis* and *L. trigloides* preferentially occupy the floors within the substrate and along the surface. There are no differences in time of occupation in shelters as well as number of shelters visited between species. Additionally, it was found that the number of shelters chosen and the intensity of the choice does not vary among species, and that 50% of individuals chose between one and three, of which 80% choose two, as supported in literature. A relationship between the maximum time of occupation and the number of visited shelters was found. There were no occurrences of individual on platforms off water.

**13. Coping styles and welfare in farmed fish: current understanding and future directions**  
Castanheira, Maria Filipa<sup>1\*</sup>; Herrera, Marcelino<sup>1,2</sup>; Millot, Sandie<sup>1</sup>; Cerqueira, Marco<sup>1</sup>; Conceição, Luís E.C.<sup>1</sup>; Martins, Catarina I.M.<sup>1</sup>  
1 - CCMAR-CIMAR L.A., 2 - IFAPA, Spain

Individual variation in behavioural and neuro-endocrine responses to aversive stimuli is no longer recognized as noise around a mean. Instead such variation seems to represent adaptive responses that are crucial for survival in a continuously changing environment. Nevertheless, individuals of the same species show consistent responses in stressful situations, i.e. they exhibit coping styles. Over the past 10 years the interest on understanding coping styles in farmed fish has increased because many studies have established links between coping styles and welfare problems. This study will review 1) the methodological approaches used to identify coping styles in the most relevant farmed fish, 2) the main behavioural, neuro-endocrine, cognitive and emotional differences between reactive and proactive coping styles and 3) how the knowledge on coping styles may contribute to improve the welfare of farmed fish. This review will show that 1) methods are already available for fast screening of coping styles at the farm level, 2) behavioural, neuro-endocrine and cognitive characteristics of coping styles in fish share many similarities with other vertebrates and 3) coping styles influence a number of welfare relevant issues such as performance traits, disease resistance, aggression, cognitive ability and affective states.

**14. Serotonergic modulation of sexual behavior**

Patrícia A. Correia, Susana S. Valente, Susana Q. Lima and Zachary F. Mainen  
CNP

Serotonin (5-HT) is a major neuromodulator in the brain, involved in diverse functions and behaviors. One main theory suggests that 5-HT is involved in modulating behavioral inhibition and satiety. In particular, pharmacological studies propose that 5-HT is involved in sexual behavior termination, although the details of this process remain enigmatic. Sexual behavior is a natural, robust and well-conserved behavior amongst species. In order to understand the role of the serotonergic system in sexual behavior we will use a set of optogenetic tools to monitor and manipulate 5-HT activity during mating, in mice. This strategy will allow to specifically activate 5-HT neurons, with high temporal precision.

Our current goal is to test the effect of serotonergic activation within the dorsal raphe in a variety of sexual behaviors as frequency and latency of mounts, intromissions and ejaculations. Furthermore, we plan to manipulate the specific circuit involved in the behavior, focusing on the dorsal raphe projections to the hypothalamus.

### **15. *Analysis of a Bottlenose Dolphin's Behavior Using an Inertial Sensor and a Tracking System***

Patrícia Rachinas-Lopes 1,2; Vítor B. Paixão 1; Alex Gomez-Marin 1; Manuel E. dos Santos 2 & Rui M. Costa 1

1 - CNP, 2 - ISPA

Dolphins are marine mammals with highly specialized adaptations that required behavioral adjustments throughout evolution. To better understand the behavioral repertoire of captive but unrestrained bottlenose dolphins (*Tursiops truncatus*), housed in a pool with 21 m diameter, a non-subjective quantitative classification, using a pattern recognition algorithm with triaxial accelerometer data, has been performed. Every session requires three video cameras and one hydrophone, and is recorded with or without accelerometer. Each accelerometer's session has in average 40 minutes with a total of 14 sessions with the animal alone and 19 sessions accompanied with another dolphin in the pool. Sessions without accelerometer were an hour long with a total of 11 sessions each, alone and accompanied. As a complement, a tracking system has been developed to use in the focal dolphin, to study both its routine and preferred locations. An underwater sound recording system extends the behavior measurements to determine periods of activity/inactivity, and permit the vocalizations analysis. To study the dolphin's routines, each method alone does not provide complete information. Therefore, their combination will fill the individual gaps and gives the opportunity to increase our understanding of how behavior transitions occur and how these transitions are associated with movements and sound production.

### **16. *'Woof' talk - Context and emotion categorization of dog barks by human listeners: a replication study with new findings***

Karine Silva, Patrícia Romeiro & Liliana de Sousa

ICBAS/FCUP

Although recognized as a means of communication between dogs and humans, barking has received little attention from Ethologists. This study aimed at replicate previous work on a sample of Hungarian people (including dog owners and people that never had a dog at home) showing that humans can recognize meaning in barks. Using the same methodology, we tested whether Portuguese people could also correctly categorize played-back barks and associate emotional ratings. Listeners were asked to categorize different bark samples into one of six situations, and also to rate each vocalization on a scale for different content of emotionality. Results showed a significant effect of owning a dog, with dog owners being more successful in accurately contextualizing the barks than non-owners. This contrasts with results obtained from the Hungarian sample showing that all listeners, both owners and non-owners, were able to categorize bark situations high above chance level. In respect to emotionality ratings, a significant interaction between sex of the listener and emotion was observed that was not previously reported. Overall this study contributes to the debate on whether or not humans might share knowledge about dog vocalization and behaviour. Also, it raises questions on the influence of psychological traits to our understanding and involvement with these animals.

**17. Mutualistic interactions between facultative cleaner fish *Thalassoma pavo* and *Coris julis* and their clients in São Miguel Island, Azores**

Pauline Narvaez, Miguel Furtado, Marta Soares

FCUL, ISPA

The cleaning mutualism involving species of small fish has always been studied in the tropical waters. However, the behaviors of facultative fish cleaner species in temperate waters are not well known and many studies are still needed to fill this gap. In this study, carried out on the island of São Miguel, Azores, 17 cleaning stations were found, where the behaviors of two facultative cleaners wrasses species, *Coris julis* (Linnaeus, 1758) and *Thalassoma pavo* (Linnaeus, 1758) were assessed and defined which species of clients are presents in these cleaning interactions. Behavioral observations will be performed through snorkeling, at different sites in the coastal zone during the month of July 2013. As a result, it is expected first obtain differences in the cleaning behavior of the two cleaner species, as well as differences in behavior of these cleaners in the arrival of different species of clients in the cleaning stations. Second, it is expected obtain a correlation between the size of client's body with the inspection's time of the cleaner. For complete these study, 6 cleaners fish were caught to analyze their stomach content. Thereby, it is expected found ectoparasites in the stomach of the two species of these cleaners.

**18. Variation in song syntax elicits aggressive responses in male serins (*Serinus serinus*)**

Ana Teresa Neves, Paulo Gama Mota

CIBIO, Universidade de Coimbra

Birdsong is one of the most effective ways of communication between individuals. It can work to attract mates or to keep other males away. Mechanisms such as song overlapping, songtype matching or soft song have been implicated in communication of aggressive intent by the sender. But very little is known on the role of specific syntax in a song as a way of causing aggressive responses. Trills are short elements that tend to be repeated at fast rates. And in banded wren it was shown that their presence elicited aggressiveness on males. Serin males (*Serinus serinus*) present trills in the beginning of most songs. We decided to test whether these rapidly repeated elements convey any aggressive intent, through a field interactive playback experiment where we presented songs with and without trills. Males subjected to songs with trills approached the speaker faster and more frequently. They also displayed threat behaviours in 63.5% of the situations, while none were exhibited against songs without trills. Also, males increased the duration of their songs in response to the stimulus with trills. We conclude that the trills present in the male *Serinus serinus* songs are an aggressive signal used in interactions between males.

**19. *Dog/owner relationship: anxiety in the waiting room of a veterinary clinic***

Renata Alves<sup>1,2</sup> & Liliana de Sousa<sup>1</sup>

1 - ICBAS, 2 - FCUP

This study aims to understand the relation between the owners' anxiety behavioral responses and their dogs' behavior at the waiting room in a veterinary clinic and also to analyze if they influence each other's behavior. It is also intended to study if the gender or the presence of one or two owners affects the interaction with the dog. A hidden video-recorder was placed in the waiting room to record dogs' and owners' behaviors and interactions in order to construct both ethograms. Owners' anxiety levels were assessed with the Zung Self-Rating Anxiety Scale. Data analysis showed significant correlations for some anxiety behaviors both of the dog and owner and between the owner's level of anxiety and the time dogs spent moving in the waiting room. The presence of one or two owners does not influence the anxiety behavior of the dog. The owners' gender proved to be important for differences found in physical interactions with dogs but not for verbal communication. This study contributes to understand the importance of lowering the anxiety state of both dogs and owners before treatment which will contribute to an increase in the welfare of the animal during the consultation process.

**20. *Social Eavesdropping in Zebrafish***

Rodrigo Abril de Abreu, Rui F. Oliveira

CNP/IGC, ISPA

Social information can be collected first-hand by directly interacting with other individuals or by observing interactions among third parties. Previous work in our lab has shown that the perceived outcome of agonistic social interactions (fights) in zebrafish has a major impact in the regulation of gene expression in the brain and affects future interactions (i.e. winner and loser effects). Currently we are investigating how social information is perceived by bystanders who observe social interactions (social eavesdropping) and how this information might be used to direct subsequent behaviour. For this purpose, we established a behavioural paradigm where isolated zebrafish either observe a fight between conspecifics, a non-interacting conspecific dyad or an empty tank. Behavioral analysis, hormonal measures (cortisol, 11-KT) and microarray brain gene expression levels are used to characterize the impact of this information. Gene expression of immediate early genes (*c-fos*, *egr-1*) is used to map the brain areas involved. Additionally, in order to identify which features of the social information are relevant to the observer, we are conducting video playback experiments where movement is decoupled from other features. Finally, we are assessing how bystander fish use the perceived information by using a choice discrimination task between winners and losers of observed fights.

**21. *Asymmetric reproductive interference among two spider mite species***  
Salomé Clemente, Leonor Rodrigues, Ana Rita Ponce, Cristina Cruz, Sara Magalhães  
CBA/ FCUL

Incomplete specific recognition can lead to the occurrence of reproductive interference (RI) - reproductive interactions between two species resulting in (a)symmetric fitness losses, potentially affecting the outcome of competitive interactions.

We tested the occurrence and magnitude of RI between *Tetranychus urticae* and *T. evansi*, closely related haplodiploid spider mite species competing for resources on the same host plant. We found that *T. urticae* females and *T. evansi* males prefer mating with conspecifics, but no preference was detected in the other crosses, which enlarges the scope for RI. No-choice assays showed that virgin and heterospecifically mated females had similar latency to copulation in subsequent matings. Moreover, *T. urticae* females copulated for a shorter period with heterospecifics than with conspecifics. Specific recognition may thus also occur at post-copulatory level: individuals perceive heterospecific matings as non effective

In both species, heterospecific crosses did not affect egg viability. *T. evansi* females had higher (haploid) fecundity when mating with a heterospecific. *T. urticae* females that mated with a heterospecific male after a conspecific mating had lower fecundity and female sex ratio. These results suggest asymmetric RI, as *T. evansi* females benefit from heterospecific matings, whereas *T. urticae* pay a cost.

**22. *"The price is right": How do females value males?***

Silvana da Costa Araújo, Luís Moreira, Susana Q. Lima  
CNP

Inspired on a naturally occurring situation, we are studying the assortative mate choice of *Mus musculus musculus*, which is observed across the contact zone with its sibling species of house mouse, *Mus musculus domesticus*. Previous work in our lab show that females of the *musculus* subspecies (PWD) have a strong and reliable homospecific preference if given the choice between males from the same subspecies (PWK) or a *domesticus* male (B6), mimicking what is observed in the wild. Importantly, when only one male is available, females equally interact with males, suggesting that they are both suitable mates when no other option is available, reinforcing the idea that during the choice condition a real decision making process is occurring. Therefore, our aim is to understand if PWD females differentially value the opportunity to interact with a particular male.

To understand this phenomenon we developed a new behavioural paradigm. By providing PWD females with the choice between variable amounts of water reward only or paired with access to a specific male, we will be able to estimate the value of each male in fluid units. The results will allow us to unravel if this assortative mate choice is a value based decision making process.

**23. Can we use personality judgments to assess wolf behavioural differences?**

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1 - ICBAS, 2 - FCUL

In many animal species studied individuals differ in numerous aspects of their behaviour. These differences, consistent over time and across situations, may be referred to as personality. Personality constructs are spreading beyond the realm of human psychology and being applied to other animals. Personality assessments in species ranging from arthropods to nonhuman primates meet the standard psychometric criteria held for humans. Moreover, personality judgments, have been extended to research on dogs with impressive levels of accuracy. Despite the interest in dog behaviour and personality, studies focusing its wild ancestor, the wolf, are scanty. One experiment in 1983 provided support to the existence of a high degree of stability in individual differences in behaviour in a litter of wolf cubs, despite variations in the social environment. In this study we assess the validity of the judgment approach to the study of wolf behaviour. Different observers, familiar with the Iberian Wolf Recovery Centre wolves, rated the subjects in a number of traits. Several instruments adapted from personality studies in human and non-human animals were used. Personality seems to be important in the establishment of social structure and pack dynamics and can deepen our understanding of such a social species as the wolf.

**24. Studying Social Interactions in a captive Pack of Iberian Wolves (*Canis lupus signatus*)**

Sofia Lino

FCUP/GaiaZOO, the Netherlands

This is a study on social interactions of a captive pack of Iberian Wolves, from GaiaZOO (Kerkrade, the Netherlands). The purpose of this study was to inquire the dominance hierarchy of the adult wolves of the pack, being a breeding couple and their offspring from different litters. Agonistic interactions within adult dyads were used to construct the dominance hierarchy, and affiliative interactions were used to quantify the existence and strength of social bonds between the whole pack. The chosen features to be analysed for the dominance hierarchy were Humbleness and Flight/Fight displays. The behavioural elements in these categories were assumed to be neutral or to signal dominance or submission. Using SOCPROG 2.4 software for MatLAB, both agonistic and affiliative interactions were analysed. Results showed a hierarchy in which the offspring was always submissive to the breeding pair, and whose dominance relationships appeared as a sub sex hierarchy. The breeding pair interacted mostly in an agonistic way and presented low values of affiliative interactions. They also had punctual affiliative interactions with some of their offspring. With further research these results could be applied while choosing adequate pack structure, being decisive in improving the welfare of the animals in captivity.



**25. Ecological relevance determines Arginine-vasotocin influence on cleanerfish learning abilities**

Sónia C. Cardoso<sup>1</sup>, Redouan Bshary<sup>2</sup>, José R. Paitio<sup>1</sup>, Renata Mazzei<sup>3</sup>, Rui F. Oliveira<sup>1,4</sup> and Marta C. Soares<sup>1,2</sup>

1 - ISPA, 2 - Université de Neuchâtel, IZ, Switzerland, 3 - Universidade Federal Fluminense, Brasil, 4 - CNP/IGC

According to an ecological approach to cognition, a species ability to solve any task depends on its evolutionary history and on its specific ecological selective pressures. Proximate mechanisms are required to establish individual social competence, which optimizes social behaviour in relation to ecological significance. Here we show that arginine-vasotocin (AVT), a neuropeptide implicated in the regulation of social behaviour, is directly linked to the learning performance of the cleaner wrasse (*Labroides dimidiatus*). We tested the influence of this neuro-hormone upon these cleaners ability to solve two problems that varied in neural mechanisms involved (cue and spatial learning). The influence of our tested neuropeptides differed considerably between problems. While blocking the effects of AVT increase these cleaners learning abilities, these effects would only stand for a task that reflects their specific learning rules under natural conditions. In the absence of ecological relevance, AVT was only responsible for a significant decrease of their learning aptitude. Our results show that AVT pathways should be directly implicated on the building of these animals' social cognitive competence and complex behavioural output and should also have a prominent role in the learning of key behavioural decision rules associated to their ecological context.

**26. Neuronal pathways for arousal termination**

Susana S. Valente and Susana Q.Lima  
CNP

Sexual arousal has a beginning and an end during the flow of sexual behavior, which is critically influenced by the CNS. Although in males the ending process is much better understood and is linked to ejaculation, in females this process is much less clear. During copulation, neurochemical changes drive the animal from an aroused to a sated state. Amongst others, prolactin, which has been shown to be released after orgasm in humans and rats, is thought to mediate/trigger satiation. To test this hypothesis, we are taking a two-pronged approach: 1) Characterize female sexual behavior to later on be able to manipulate arousal termination; 2) Investigate the role prolactin in female arousal termination. To characterize female sexual behavior, we have developed a paced-mating paradigm where females can control their interaction with the male. Behavior analysis indicates an increased arousal after a first ejaculation and different patterns of behaviors between appetitive and consummatory phases. To investigate which brain circuits are activated during sexual behavior, we aim to identify/quantify IEG/prolactin brain activation in females that receive different amount of sexual input. With these experiments we intend to establish a causal link between activity within specific brain regions and the termination of sexual arousal.

**27. *Time perception reflects body dynamics***

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CNP

Any organism capable of adaptive behavior in complex environments routinely estimates the passage of time. Hypotheses about the biological implementation of this cognitive ability disagree critically on whether it results from dedicated, high-level, or distributed, low-level processes. To what extent are internal time-keeping processes tied to lower level sensor and effector systems?

We trained both rats and mice to categorize time intervals as either short or long. Animals made virtually no errors when categorizing the shortest and longest intervals, but response variability increased as intervals approached the categorical boundary. Subjects invariably produced a stereotyped sequence of behaviors during the interval being judged. The dynamics of the sequence were predictive of perceptual decisions being formed in advance of their behavioral report. This suggests that inspecting motor behavior continuously during choice tasks provides a window into the unfolding of decision processes, and hints at the hypothesis that the brain exploits temporal regularities of and motor and sensory streams to derive perceptual decisions.



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Lisbon, Portugal

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ETHOLOGY  
2013

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