Opening keynote

Speaker: Daniel T. Blumstein, Dept. of Ecology and Evolutionary Biology, University of California Los Angeles, USA

The sound of fear
What is it that makes certain sounds scary? Why are screams particularly evocative? I will discuss similarities among species in the structure of fear screams and other scary and arousing sounds and will review correlative and experimental studies of marmots, birds, and humans to evaluate the hypothesis that fearful and arousing sounds contain specific types of nonlinear acoustic phenomena. Recent experimental work using 'marmot-inspired music' has revealed that noise and other non-linear phenomena may be generally arousing. The sound of fear may be noisy.

Session 1: Ecology of Fear

Speaker: Johanna Mappes, Dept. of Biological and Environmental Science, University of Jyväskylä, Finland

To be red or dead? The evolution, function and maintenance of warning signals
Many animals are toxic or unpalatable and signal this to predators with warning colours. Indeed, vivid warning signals have evolved repeatedly throughout the animal kingdom: mammals, birds, amphibians, fish, marine invertebrates and many insects use them to deter predators. For warning colours to be effective they need to promote both initial avoidance and aversion learning in predators. But, what makes an effective signal, in particularly against different type of receiver? And how did warning signals initially evolve and how they are maintained under the opposing selection pressures? I will examine the recent progress in the study of warning colours. In particularly I will discuss how combined efforts by sensory ecologist, visual physiologists and evolutionary biologists have helped us to understand this complex animal communication.

Speaker: Emily Gray, School of Law, University of Sheffield, UK

Growing up with fear: Analysing Age, Period and Cohort Effects on Worry about Crime and Disorder through the framework of political generations.
Fear of crime is an area of substantial research in criminology. Still, to our knowledge it has not been considered within a long-term framework of political generations. Using insights from political science and generational modelling, we start the process of exploring cohort-influenced aspects of the fear of crime and perceptions of disorder. Individual ageing, socio-political contexts and generational membership are distinct temporal processes. These age, period and cohort (APC) effects are crucial to a robust understanding of the origins and shape of social change and its consequences (Mannheim, 1928). We employ repeated cross-sectional data from the British Crime Survey (1982-2012) in an APC analysis to explore how worry about crime and disorder were impacted by the political environment in which respondents experienced their 'formative years'. For example, we assess if those who grew up in the 1980s in England and Wales – an era of economic individualism and high-crime rates – were more likely to express anxiety about particular offences/activities than the political generations who came before and after them. Our results

underline the theoretical significance of political socialization and the methodological relevance of time when exploring public perceptions of crime.

Speaker: Armin W. Geertz, AIAS and Dept. of the Study of Religion, Aarhus University, Denmark

Fear in Religion

Fear has a variety of functions in the history of religion. These functions arose during the origin and evolution of religion. Religious behavior and religious thought are natural extensions of human thought and behavior, reaching back even to prior hominin species, at least in proto-form. Religion arose in response to natural and social environments, and thus its functions must have helped solve problems faced by hunter-gatherer groups. But religion also played a crucial role in the development of complex societies. The question is how fear fits in. Obviously, the functions of religion will differ depending on the complexity of the natural and social environments and this talk will address some of these functions. In terms of the natural environment, religion can alleviate the fears of biological creatures trying to survive and reproduce in the face of predators and natural disasters. The same can be said in relation to the social environment, but we also find the systematic use of fear in ritual and religious thought that seems to function as various forms of social control. This talk will present the results of various studies and cases in the psychological, sociological, anthropological, and comparative religion literature.

Session 2: Fear in Memory

Speaker: Marco Capogna, Department of Biomedicine & The Danish Research Institute of Translational Neuroscience – DANDRITE, Aarhus University, Denmark

Fear and sleep: key role of amygdala GABAergic neurons

The amygdala is a brain area that plays a key role on fear learning and memory. The talk will review recent data showing the diversity of neuron types present in the amygdala of rodents and their role on fear behaviour. Emphasis will be given to a comprehensive functional, neurochemical and anatomical definition of neuron types and their circuits.

Speaker: Tine Bennedsen Gehrt, Center on Autobiographical Memory Research - CON AMORE, Aarhus University, Denmark

Fear and autobiographical memory: In patients with severe health anxiety and obsessive-compulsive disorder

Abstract TBA.

Speaker: Kenneth D. Lukowiak, Hotchkiss Brain Institute, University of Calgary, Canada

Predator detection initiates a fear response that alters memory formation in *Lymnaea*

We study the short- and long-term effects of fear behaviours in our model organism, the pond snail *Lymnaea stagnalis.* Crayfish, a natural predator of the snail release kairomones in the water in which they are housed (i.e. crayfish effluent, CE). Snails detect the predator kairomones via a peripheral sensory structure, the osphradium, and alter neuronal activity via a serotonergic pathway. Sensing

the predator initiates epigenetic changes (e.g. DNA methylation) in a neuron necessary for long-term memory (LTM) formation. Thus, predator detection enhances the snails' ability to form long lasting memory. We hypothesizer that enhanced memory formation is a form of inducible anti-predator response and may convey an adaptive advantage to the snail. For example, training in CE in juveniles induces life-long changes in neural activity. In strains of snails with superior cognitive ability (i.e. smart snails) training in CE while further enhancing memory duration causes a qualitatively different memory. This memory is now susceptible to disruption by the beta blocker, propranolol, which has been used in humans to treat PTSD. In snails with 'average' cognitive ability, sensing a predator while enhancing memory does not cause a propranolol sensitive memory. Predator-augmented memory formation may help to prepare the animal to face future challenging situations. However, predator induced changes in smart snails may overwhelm their ability to cope compared to average snails. We have a unique opportunity to determine at the causal neuronal level why this occurs.

Session 3: Strategies of Fear

Speaker: Tom P. Flower, Centre for Wildlife Ecology, Simon Fraser University, Canada; Fitzpatrick Institute of African Ornithology, University of Cape Town, South Africa

Risky information: Animals use deceptive communication to manipulate FEAR responses

Animals communicate information about risk to one another, thus facilitating adaptive behavioural decisions. However, information-receivers are open to exploitation by risk-informers that peddle misinformation and benefit from the resulting fear responses. As a result, information-receivers should be highly discriminatory, while those spreading misinformation should seek to escape detection. Here I present research on an African bird, the fork-tailed drongo, which uses false alarm calls deceptively, to scare host animals and steal food abandoned as they flee to cover. In particular, drongos employ vocal mimicry of other species' alarm calls to both disguise their own identity and increase the perceived reliability of their false alarms, thereby evading host discrimination. In addition to deception, drongos also provide valuable risk information, by making true alarms at and even physically attacking approaching predators. I show how interactions with one host, the sociable weaver, are likely mutually beneficial, despite the costs of misinformation. This evolutionary perspective illustrates why individuals attend to risk communication, what tactics risk-informers use to deceive information-receivers and manipulate their fear responses, and when this risk information service can switch from costly to cooperative.

Speaker: Liana Zanette, Dept. of Biology, Western University, USA

The Dimensions of Fear: From Brains, to Ecosystems, to Human Health and Human Impacts

The fear that predators instill in prey induces anti-predator behaviours across every animal taxa beneficial in avoiding immediate death, but carry costs; one of the most well-established being that scared prey eat less. These findings, that animals stop eating to avoid being eaten, are not controversial. What is controversial is whether such fear effects can be long-term and powerful enough to affect wildlife prey populations and generate trophic cascades. Antipredator behaviors are often considered fleeting, evident only when a predator is present, and therefore insufficient to affect demography or ecosystems. We provide empirical evidence that, contrary to this traditional view of predator effects as fleeting, the learning and formation of fear memories leaves long-lasting effects on the brain that would continuously trigger antipredator behaviors when the threat of being killed is perceived as persistent, and so powerful enough to affect populations and ecosystems. Moreover, the long-term "memory of fear" can be passed on from parent to offspring, across

generations. Our work conducted on several species of wildlife across two different taxa corroborates recent suggestions that wildlife may be superior to traditional animal models in unraveling the etiology and treatment offered to human mental health conditions, including post-traumatic stress.

Speaker: Carsten Bagge Lausten, Dept. of Political Science, Aarhus University, Denmark

Afterschock. Reflections on the anatomy of the fear of terror

Terror is intimately connected to the feeling of fear. The presentation offers a number of tools to conceptually narrow down this fear historically, psychologically and sociologically. The starting point is the anatomy of fear. What is it about terror that makes us fear it so much more than other threats to life and health? How can we conceptually narrow down the shock that terror causes as fear or anxiety? What does it mean when we conceptualise the threat as risk or catastrophe? And last but not least, what are the consequences of the way we with our military and politics meet terror in connection with our anxiety? The title of the article – Aftershock – hints at the aftermath of terror – not for the immediate victims, but for all of those who witness or hear about it. That means all of us.

Speaker: Balász Kiss, Institute of Political Sciences, Hungarian Academy of Sciences, Hungary

Fear and Care. The political communication of PM Viktor Orbán during the migration crisis

Henri Tajfel once wrote that social identity has three components: cognitive, evaluative and emotional. Whenever a politician wants to create, reinforce or widen his/her community of supporters, whatever object he/she may offer for the crystallization of the drives of his/her supporters, all the three aspects should be taken care of. That is exactly what Hungarian Prime Minister Viktor Orbán has done ever since the beginning of the migration crisis in 2015. Beyond cognitive contents and evaluations, he has also offered emotions: e.g., fear of the cultural overwhelming by the Muslims on the one hand and self-confidence by national unity on the other. He has offered even more: various ways and channels of common action in order to care for and prevent the threats: the so called national consultations, online activities and a national referendum. Orbán's strategy of fear and care proved successful: it is shown by various indicators. The presentation will give a short summary of the means used and the successes reached by the government strategy of fear in getting popular support during the migration period.

Session 4: Dealing with Fear

Speaker: Belinda Thewes, Dept. of Medical Psychology, Radboud University Medical Centre, Netherlands

Can you conquer fear of cancer recurrence (FCR)? Current and future directions in the management of FCR.

Fear of cancer recurrence (FCR) is a common, persistent, and burdensome problem amongst cancer survivors. Based on literature review it is estimated that on average half of all cancer survivors experience moderate to high levels of FCR and 14-30% cancer survivors report an unmet need for help with FCR. FCR is a 'rational' and 'realistic' fear for many people living with a past diagnosis of cancer. However, the degree of FCR experienced by cancer survivors is not consistently associated

with objective estimates of risk of cancer recurrence. Medical doctors and other health professionals also report difficulty helping cancer survivors manage FCR, and recently evidence-based psychological interventions been developed to help those with troublesome and persistent FCR. This presentation provides an introduction to the topic of FCR. It will define FCR, describe its prevalence, impact and risk factors and provide an overview of theoretical models for understanding and treating FCR. Current evidence-based approaches to the management of FCR and priorities for future FCR research will also be described.

Speaker: Mikkel Arendt, Dept. of Clinical Medicine and the Dept. of General Psychiatry, Aarhus University, Denmark

Cognitive-behavioural therapy for anxiety disorders
Abstract: TBA

Speaker: Lasse Lindekilde, Dept. Of Political Science, Aarhus University. Denmark

Panic prone publics? Communicating with the public about terrorist attacks
How will European publics respond to advice on what to do in the event of a terrorist attack? Or to public campaigns encouraging reporting suspicious behaviour in crowded places? In two survey experiments, with more than 6000 respondents in the UK and Denmark we tested public reactions to two public-facing campaigns about risks of terrorism, the British *'Run, Hide, Tell'* and *'See it, Say it, Sorted'* messaging. Experiments were designed to test the impact of these communications on perceptions on terrorism, including the risk of falling victim to terrorism, feelings of reassurance, trust in security services and self-efficacy. Furthermore, the studies tested the effect on intended responses to a hypothetical terrorist firearms attack. Results find little evidence for the notion of fearful and panic prone publics when it comes to terrorism. Rather, results demonstrate important benefits of pre-event communication in relation to enhancing trust, feelings of security, self-efficacy, encouraging protective health behaviours and discouraging potentially dangerous actions. Cross-national similarities in response suggest these advices are suitable for adaptation in other countries.

Speaker: Robert Elliott, Dept. of Psychological Sciences & Health, University of Strathclyde, UK

Coping with Fear: A Practical, Phenomenological Approach from the Point of View of Emotion-Focused Therapy
Fear implies immediately present danger, motivating us to do something to reduce the danger in some way. Without fear, we wouldn't recognise danger and would be more likely to suffer damage or worse. In this presentation, I will attempt to address fear from a practical, phenomenological, and emotion-focused perspective. In doing so, I will approach this topic via a series of questions: First, What are our common shared cultural understandings (conceptual metaphors) of the nature of fear? What do these imply about coping? Second, what are some common and important dangers that our fears point to, and what do these say about us? Moving to more practical concerns, I take up a further set of questions: When is it best to attend to the dangers our fears point to? When, instead, does the fear become a danger in itself that needs to be coped with? Specifically, when fear itself is the problem, what ways of coping with the fear are more likely to be useful, and what ways are more

likely to create still more problems for us? How do we tell the difference, and how do we move toward coping more effectively with potentially damaging fears?

Speaker: Cornelius Gross, EMBL - European Molecular Biology Laboratory, Italy

Controlling your fears - cortical circuit plasticity and fear suppression

The expression of instinctive behaviors related to ingestion, reproduction, and defense depend on evolutionarily ancient behavioral circuits located in the hypothalamus. It has been proposed that neural activity in these hypothalamic circuits encodes an internal motivational state that is essential for the expression of instinctive behavior and may be related to the emotion that accompanies instinctive urges in humans. However, the precise brain nuclei and circuit logic that support instinctive physiological and behavioral responses remain poorly defined. Moreover, although instinctive behaviors are innate, animals are to some degree able of control them to adapt their behaviors to their environment. Little is known about the plasticity mechanisms involved in such instinct control and how maladaptation of these behaviors, a major hallmark of psychiatric disorders, might arise. Current work in the lab combines molecular genetic, electrophysiological, and genetically encoded neural manipulation tools with behavioral methods to understand how the medial hypothalamus controls defensive responses to social and predator threats and how these can be remodeled by experience.

Session 5: Innate VS. Learned Fear

Speaker: Michal Linial, Israel Institute of Advanced Studies & Department of Biological Chemistry, Life Science Institute, The Hebrew University of Jerusalem, Israel

From Mother to Son: Molecular Alterations in the Brain Following Prenatal Stress

In humans, traumatic and associative memories may lead to an extreme fear sensation that often has a devastating impact on the quality of life. Human behaviours that are associated with anxiety, stress, and fear are strongly dependent on an individual social, cultural and psychological states. Therefore, studying the mechanisms underlying fear in animal models remains challenging [1]. Many studies in animal models have shown that early experience can induce alterations in behaviour throughout life. In this study, we ask whether an activation prenatal stress (PS) has an impact throughout adulthood and if so, how PS programs the brain function [2,3].

We proposed a systems biology view to unveiling the molecular network underlying the behavioural changes following PS experience. Expression data were collected from the hippocampus of young rats (3 wks) whose mothers underwent repeated stress experience during pregnancy. Using statistical tools, we show that exposure of pregnant animals to stress during a critical period of fetal brain development increases the likelihood of anxiety and learning deficits. We further showed that the extent of the behavioural deficits is gender sensitive [3]. We found that the expression of 6.1% of the valid genes was significantly altered by PS experience ($p<0.05$). The gene functions of ~300 genes that were suppressed in PS-exposed offspring include axonal growth, regulation of ion channels and transporters, trafficking of synaptic vesicles and neurotransmitter release. A suppression in the expression of synaptic proteins (synaptophysin, synaptopodin) in PS of both sexes was compensated with an increase in expression of PSD-95 and a critical subunit of NMDA glutamate receptor in females. This research allows presenting testable hypotheses on how PS

programs the brain and a lead for removal of stress developmental alterations. Remarkably, about 30% of the genes that were down-regulated in PS rats were restored to control levels by a paradigm of handling. In addition to the global change in molecular signature in the young rat brain, handling also restores the deficit in behaviour. Our results provide a possible relationship between hippocampal gene expression and changes in behaviour resulting from prenatal stress. This study is performed in collaboration with laboratory of M. Weinstock (The Hebrew University).

Speaker: Mathias Clasen, School of Communication and Culture, Aarhus University, Denmark

Recreational Fear: On the Psychology of Horror Media

Frightening media presentations are paradoxically popular. Why do people seek out horror in films, literature, video games, and live attractions? Drawing on a range of scientific disciplines, I argue that the appetite for horror runs deep in our nature and is explicable as an adaptation to give vicarious experience with evolutionarily relevant threat scenarios via exploitation of an evolved fear system. Through exposure to frightening media, consumers get crucial experience with negative emotion and with strategies for coping. Horror media may thus offer a context for psychological and moral calibration, but horror media can also have short- and long-term traumatic effects. The negative consequences of horror exposure are much better documented and understood than are the potential positive consequences. Yet even though horror media offer unique contexts for the empirical study of fear responses, there is still very little psychological research on the genre and its effects and functions.

Speaker: Andrea Moreno, Dept. of Molecular Biology and Genetics, Aarhus University, Denmark

Erasing fear memories by pharmacological manipulation

A central dogma in neuroscience is that memories are formed by changes in the connections between nerve cells, a process known as synaptic plasticity. The two best established mechanisms for synaptic plasticity are the long-term increase and decrease in synaptic strength, known as long-term potentiation (LTP) and longterm depression (LTD). The neuroscience of learning has traditionally relied on the study of LTP as the cellular and molecular substrate of new memory acquisition. However, the mechanisms of forgetting have been largely neglected; Whether LTD is the substrate of forgetting is still a highly controversial statement. In this study, we aim to address the question of whether artificial induction of LTD could be employed to erase previously acquired fear memories. Recent work from the laboratory demonstrated that blocking NMDA receptor- the quintessential receptor for learning- through uncompetitive antagonist, MK-801, can trigger LTD when concomitant to the application of an LTP-induction protocol, in an in vitro model. To test the previous findings in vivo, we study the well-known amygdaloid circuit for pavlovian fear conditioning in the mouse. Using a combination of optogenetic, behavioural, and electrophysiological tools, we target inputs to the Lateral Amygdala and selectively trigger them by optical stimulation. In this preparation, animals are trained in the lever-press task and conditioned. We describe how the injection of MK-801, when administered during memory recall, affects the behavioural performance of the animals. This data provides valuable insights into the mechanisms of forgetting, and the possibility of erasing existing memories by targeting them with synapse specificity, without damaging the network's resting state activity.

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Closing keynote:

Speaker: Andreas Olsson, Emotion lab, Karolinska Institutet, Sweden

The social transmission of fear: From social to neural networks

In rapidly changing environments, humans and other animals often glean information about the value of objects and behaviors through social learning. In humans, for example, observing others' behaviors and their consequences, enables the transmission of a wide range of value-based information, from what stimuli should be avoided or approached to the appropriateness of specific social behaviors. In contrast to learning from direct, personal, experiences, little is known about the mechanisms underlying these forms of social learning. Here, I will discuss studies using behavioral, imaging, and pharmacological techniques examining both the sender and receiver during various forms of social learning. I will focus on the learning of threat responses, fear, and safety from threat. Consistent with research across species, our results show that these forms of social learning draw on processes partially shared with direct conditioning and extinction learning. Importantly, however, the outcome of social learning is distinguished by its dependence on social information and interaction. The study of the mechanisms underlying social learning is fundamental to our understanding of the spread of both adaptive and non-adaptive emotional information between individuals, as well as in networks and societies.