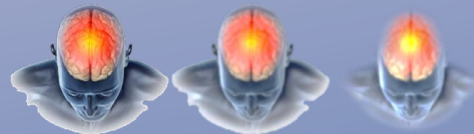




EXTINCTION LEARNING

Young Scientists Symposium



FOR 1581: Extinction Learning

November, 25th - 26th 2013



Local Organizers
(Young Scientists of FOR1581)



Extinction Learning
Nov 25th – 26th 2013
Bochum



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Key information

Optional Program for Saturday and Sunday

Saturday, 23.11.

6.30 pm: *Currywurst* at Dönninghaus and Christmas Market in Bochum

Sunday, 24.11.

12.30 pm: Meeting at the restaurant of the hotel for a snack

1.35 pm Departure for Zeche Zollverein in Essen, guided tour
(www.zollverein.de)

6.30 pm Yamas, Bochum (www.yam.as)

Schedule for the Symposium

Monday, 25.11.

9 am Arrival at Beckmanns Hof

Program see below

6.15 pm shuttle service back to the hotel (invited speakers only)

7.30 pm Dinner at Haus Rietkötter (altes-brauhaus-rietkoetter.de)

Tuesday, 26.11.

10 am Beckmanns Hof

Program see below

5.30 pm shuttle service back to the hotel

6.45 pm shuttle service to Haus Kemnade (hauskemnade.de)

afterwards optional visit to the Christmas market in Hattingen

Helpful Phonenumbers

Sandra: 0176-24899658

Onur's Office: 0234-32-28213



Umgebungskarte der RUB



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|--------------------|-------------------|-------------------------------|-----------------------------|--------------------------------|
| Universitätscampus | Autobahn A43 | U35 - Haltestelle | HZO Hörsaalzentrum Ost | UV Universitätsverwaltung |
| Siedlungsfläche | Hauptstraße | Ausfahrt | MZ Musikisches Zentrum | VC Vita Campus |
| Frei-/Grünfläche | Übrige Straßen | A43 - Ausfahrt (19) | TZR Technologiezentrum Ruhr | VZ Veranstaltungszentrum |
| Gewässerfläche | U35 - Campuslinie | BMZR Biomedizinisches Zentrum | UB Universitätsbibliothek | ZN Zentrum für Neuroinformatik |



Bochum Tourism



RuhrCongress Bochum

▶ more information



Lake Kemnade / Ruhr

▶ more information



German Mining Museum

▶ more information



Starlight Express Theatre

▶ more information

For more information see www.bochum.de (English version)

Körperwelten

Monday to Thursday 9 am-7 pm

Friday 9 am-9 pm

Saturday/Sunday 10 am-7 pm

Address:

Hermannshöhe 42

44789 Bochum (only 5 minutes away from the central station)

Advance booking:

Bochum Ticketshop Touristinfo

RUHR.INFOCENTER

Huestraße 9

44787 Bochum



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Program



Monday 25th

- 9.00 Arrival and Registration
- 9.30 Welcome by Onur Güntürkün
Introduction by the Young Scientists
- 10.15 **Juan M. Rosas**
Pavlov's dog is on Freud's couch
- 11.30 Coffee break
- 11.45 **Tom Beckers**
Cognitive processes in fear extinction and fear reduction
- 13.00 Lunch
- 14.15 Talk by **Gonzalo Urcelay**
- 15.30 Poster session (incl. coffee break)
- 17.00 **Stephen Maren**
Brain circuits for contextual control of fear

(Each talk will start with a short introduction of topic and speakers by the Young Scientists (10 min) – length of each talk 45 minutes followed by 15 minutes discussion)



Tuesday 26th

10.00 Arrival and coffee

10.30 Talk by **Andreas Olsson**
Aversive Learning and Extinction in Social Contexts

11.45 Coffee break

12.00 Talk by **Travis Todd**
Mechanisms of renewal after the extinction of free
and discriminated operant behavior

13.15 Lunch followed by an open discussion in subgroups

15.15 Talk by **Mohammed Milad**
Examining the influence of sex hormones and
hormonal contraceptives on the neurobiology of
fear extinction

16.30 Final discussions and farewell

17.30 Official end of the conference

(Each talk will start with a short introduction of topic and speakers by the Young Scientists (10 min) – length of each talk 45 minutes followed by 15 minutes discussion)



Extinction Learning
Nov 25th – 26th 2013
Bochum

Speaker Abstracts

(alphabetical order)



Tom Beckers

Cognitive processes in fear extinction and fear reduction

KU Leuven (Belgium) and University of Amsterdam (The Netherlands)

Contemporary, propositional theories of learning assume that fear learning relies on conscious, declarative memory processes. According to such theories, it is the acquisition of propositional knowledge about CS-US contingencies that drives conditioned responding. Psychological and neurobiological evidence would suggest that this is even more true for extinction learning and other forms of fear inhibition, as they appear to involve working memory resources and effortful prefrontal control. The strong dependence of extinction learning on effortful prefrontal inhibition may in fact help to explain why conditioned fear is so prone to recovery (reinstatement, renewal, spontaneous recovery).

I will first review evidence that illustrates the important role of declarative knowledge in fear reduction and extinction in humans and shows how modifying people's conscious knowledge or expectations can be a very powerful way to affect conditioned fear responding. I will then go on to point out evidence that human conditioned fear responses do not always track conscious contingency knowledge quite so closely. In particular, I will argue that conditioned fear responses can be demonstrated even in the complete absence of US expectancy (and, perhaps, US expectancy can also go hand in hand with the absence of conditioned fear responses). This poses a challenge to propositional theories of learning and simple prefrontal theories of extinction learning.



Stephen Maren

Brain circuits for contextual control of fear

Department of Psychology and Institute for Neuroscience, Texas A&M University (USA)

While it is generally adaptive to rapidly learn about threats in the environment, this form of learning can lead to psychopathology including post-traumatic stress disorder (PTSD). In the clinic, exposure therapy is an effective method for suppressing pathological fear, but relief can be transient and prone to relapse. Recent work from my laboratory has explored the neural mechanisms underlying fear relapse after extinction, a form of learning that models exposure therapy in humans. Interestingly, extinction memories are labile and fear relapses upon the passage of time and changes in context. The return of fear after extinction is consistent with Konorski's proposal that extinction results in a new inhibitory memory that is formed along side the excitatory fear memory. We have now identified a network of brain structures in the rat including the amygdala, hippocampus, and prefrontal cortex that contribute to regulation of fear responses after extinction. In particular, we show using electrophysiological and cellular imaging approaches that reciprocal hippocampal-prefrontal circuits control fear output by regulating amygdala neurons involved in fear expression.



Mohammed Milad

Examining the influence of sex hormones and hormonal contraceptives on the neurobiology of fear extinction

Department of Psychiatry, Harvard Medical School, Massachusetts General Hospital, Boston, MA (USA)

Increasing evidence from rodents and human imaging studies shows that males and females may differ in how fear is acquired and extinguished in the brain across the sexes. Stress also differentially affects the neurobiology of the fear in males and females. In addition, we know that prevalence of mood and anxiety disorders is higher in women, relative to men. Lastly, we also know that sex hormones, such as estrogen, play critical role in synaptic plasticity and memory consolidation across different learning paradigms. Recently, we and others have begun to explore how sex hormones such as estrogen may contribute to differences in the way men and women acquire and extinguish fears. In my talk, I will focus on data relating to this domain. In addition, data related to the use of estrogen administration in both women and female rodents, along with data related to the influence of hormonal contraceptives on fear extinction circuitry will be presented and discussed.



Andreas Olsson

Aversive Learning and Extinction in Social Contexts

Emotion Lab, Department of Clinical Neuroscience, Karolinska Institute (Sweden)

The biological basis of emotional learning through direct aversive experiences (classical conditioning) is well studied. Yet, little is known about the mechanisms underlying indirect emotional learning through social means, which may be more representative of human every-day learning. Indeed, many of our learned fears and aversions are acquired by observing the emotional expressions of others ('learning models'). Moreover, we might acquire safety information from others by, for example, observing a safe learning model being repeatedly exposed to a feared stimulus without aversive consequences ('vicarious extinction'). My research aims to better describing the mechanisms underlying social aversive learning and regulation by bringing together two hitherto unconnected lines of research; the biology of emotional learning and social cognition. I will discuss behavioral, psychophysiological, and neuroimaging (fMRI) research showing that aversive learning through observation (1) shares important behavioral and neural qualities with traditional conditioning, but unlike non-social learning, it (2) is distinguished by its reliance on social information. For example, both stimulus bound (e.g. ethnic group belonging) and conceptual (e.g. attributed mental state) features of the learning model affect the learning outcome.



Juan M. Rosas

Pavlov's dog is on Freud's couch

Department of Psychology, University of Jaén (Spain)

When an organism learns that a cue signals an outcome and such a relationship is then extinguished by presenting the cue by itself, subsequent performance will depend on the background (context) present at the time of testing. When testing takes place in the same context in which the relationship was extinguished, extinction performance is observed. Yet, when the test occurs in a context different from the extinction context, original learning is renewed, and extinction performance substantially decreases. And this is true for rats, as it is for humans, and regardless of whether the context is physical, temporal, conceptual or physiological. This is a well-known phenomenon, and its relevance for behavioral therapy should be obvious, especially when relapse has been found not only after extinction, but also after different interference treatments. If the original association is understood as the problem that needs to be solved, conditioned responding is viewed as the symptom, and interference is seen as the treatment, relapse suggests that whenever there is a contextual change, the symptom reappears. But what happens in the absence of a contextual change? Does extinction eliminates the problem, as a behavioral therapist would say, or just the symptom so that the problem will reappear with a different symptom, as a Psychoanalyst will say? The answer to this question is searched within the experimental work devoted to analyze the contents of extinction in both, human and nonhuman animals.



Travis P. Todd

Mechanisms of renewal after the extinction of free and discriminated operant behavior

Dartmouth College, Hanover, New Hampshire (USA)

Renewal indicates that extinction is context dependent, and the ABC and AAB forms of it suggest that extinction likely involves context-specific inhibitory learning. Using both free-operant and discriminated operant procedures with rats, several experiments examined renewal of extinguished instrumental behavior when the reinforcement histories of the contexts were equated by giving complementary training and extinction of a different response (lever press and chain pull) in each context. In Experiments 1 and 2 (free-operant), following extinction, renewal occurred when the response was tested in the acquisition context (ABA) or outside the extinction context (AAB and ABC). Renewal occurred during tests where only one response was available, and also affected choice during tests when both responses were simultaneously available. In Experiment 3 (free-operant), renewal was not reduced when testing occurred in a context that had been associated with extinction of the other instrumental response. Experiments 4 and 5 examined renewal using a discriminated operant procedure. In both experiments, ABA renewal was observed. However, in Experiment 5, renewal was reduced when the renewing context was previously associated with extinction of responding to a separate discriminative stimulus (S) that set the occasion for the same response. Finally, Experiment 6 tested for AAB renewal using a discriminated operant procedure. Although AAB renewal was observed, previous extinction of the response in the renewing context (occasioned by a different S) eliminated AAB renewal more than did extinction of a different response. Overall, the results indicate that differential context-reinforcer associations are not necessary for renewal, and they also raise questions about configural and occasion-setting accounts. The results are consistent with the idea that during extinction an inhibitory association is formed between the context and the response. Renewal is due to a release from context-specific response inhibition.



Gonzalo Urcelay

Boundaries and conditions for reconsolidation and extinction

Department of Psychology – University of Cambridge (UK)

Over the last 15 years, significant progress has been made in the field of extinction and this has been paralleled by research on reconsolidation, the impairment that results from the administration of amnesic agents soon after memory reactivation. In this talk, I will briefly summarize the historical background of the ideas behind amnesia, extinction learning, and reconsolidation. I will present three sets of data looking at the reconsolidation-extinction (RE) manipulation pioneered by Monfils et al (2009). The first will shed light on what is learned using the RE manipulation. Then I will present data shedding light on the conditions that allow to observe the RE benefit, and will end with experiments exploring the role of prediction error on reconsolidation and extinction.



Extinction Learning

Nov 25th – 26th 2013

Bochum

Young-Scientists Abstracts

for Poster Presentation

(alphabetical order)



Effect of mGlu5 receptor antagonism on the extinction of context-specific memory

Marion ANDRE^{1,2}, Valentina WIESCHOLLECK¹, Denise MANAHAN-VAUGHAN^{1,2}

¹*Department Neurophysiology, Faculty of Medicine, Ruhr-University Bochum, Germany*

²*International Graduate School of Neuroscience, Ruhr-University Bochum, Germany*

Metabotropic glutamate receptors mGlu5 are critically important for hippocampus-dependent learning, memory and plasticity processes. Extinction is a phenomenon which has never been studied on that kind of memory but has been intensively studied in the field of conditioning research, notably fear conditioning. In this context, after learning an association between a behaviour (e.g. freezing) and a signal (e.g. footshock), extinction is defined as the disappearance of this conditioned behaviour when the conditioning signal is no longer present. It has been shown that mGlu5 can be involved in this kind of extinction. We examined if antagonising mGlu5 can affect extinction of context-specific spatial memory.

To allow us to study this phenomenon with regard to context-specific spatial memory, we developed a new paradigm. We trained rats in a T-maze, within a specific sensory context (visual and olfactory) to find a small food reward in a certain proportion of trials. Once this behaviour was acquired with a food reward probability of 25%, we studied the extinction of this memory by comparing two animal cohorts: one cohort was exposed to a new unrewarded context (B) (one day after having achieved the learning performance criterion of 80% in context A) and the other cohort was exposed once more to context A in the absence of food reward. Renewal was assessed a day later by returning both groups to the original (now unrewarded) context. In the ABA cohort, significant extinction was followed by renewal whereas in the AAA cohort, only extinction occurred, showing that the extinguished memory was declarative-like.

In this paradigm, the antagonism of mGlu5 during the extinction trial prevented the formation of a long term memory of the extinction trial in both conditions, but the extinction was delayed only in the AAA context. These context-specific effects appear to relate to context-specific learning and possibly to impairments in working memory.

Our data support that context-specific extinction and extinction memory are mediated by the activation of mGlu5.



Effect of drug pre-exposure on learned immunosuppression in rats

Katharina BÖSCHE¹, Martin HADAMITZKY¹, Kathrin ORLOWSKI¹, Harald ENGLER¹, Manfred SCHEDLOWSKI¹

¹*Institute of Medical Psychology and Behavioral Immunobiology, University Hospital, University Duisburg-Essen*

Within an established model of behaviorally conditioned immunosuppression in the rat, we employ a conditioned taste aversion (CTA) paradigm in which the novel taste saccharin (conditioned stimulus, CS) is paired with the immunosuppressive drug cyclosporine A (unconditioned stimulus, US). Previous studies show that this association causes a reduced fluid intake (CTA), as well as a significant inhibition of the cytokine IL-2 in splenic T cells during acquisition and evocation. In the present study we exposed male dark agouti rats to either the unconditioned or the conditioned stimulus, respectively, three days prior to conditioning. Pretreatment with cyclosporine A (US) accelerated the extinction process of the CTA, however did not affect the learned suppression of anti-CD3 stimulated IL-2 production. In contrast, the presentation of saccharine (CS) before the conditioning trial did not accelerate the extinction of the CTA, but erased the suppression of IL-2 production.



Effects of stress on retrieval and consolidation of extinction memory in humans

Tanja C. HAMACHER-DANG^{1,2}, Metin UENGOER³, Harald ENGLER⁴, Manfred SCHEDLOWSKI⁴, Oliver T. WOLF^{1,2}

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Stress has been shown to modulate learning and memory in a phase-dependent fashion, with retrieval of episodic memory usually being impaired and consolidation being enhanced. First evidence from rodent studies suggests that this might also be the case for extinction memory.

Retrieval of extinction memory is also modulated by contextual cues, as a recovery of conditioned responding is often more pronounced when retrieval is tested outside the extinction context (renewal effect). In two studies, we investigated the potential modulatory effects of stress and contextual cues in a predictive learning task designed as a renewal paradigm.

In the mornings of three consecutive days, participants learned an association between stimuli and outcome in one context (on day 1), underwent extinction in a second context (on day 2) and were then tested for retrieval in both contexts (on day 3). We applied an acute stressor (socially evaluated cold pressor test, SECPT) either prior to retrieval testing on day 3 (study 1), or directly after extinction learning on day 2 (study 2), presumably affecting the consolidation of extinction memory. As assessed by salivary cortisol concentrations, blood pressure measures, and subjective stressfulness ratings, stress induction proved to be successful in both studies. A general renewal effect was present, as reflected by a stronger recovery of responding when retrieval was tested in the presence of acquisition context cues compared to extinction context cues. Compared to controls, participants who were stressed prior to retrieval testing showed an overall impaired retrieval of extinction memory, which was more pronounced in acquisition context test trials. In contrast, stress directly after extinction learning enhanced the consolidation of extinction memory, as indicated by a strongly reduced spontaneous recovery on day 3.

Thus, the effects of stress on extinction memory retrieval in humans seemingly parallel those on declarative memory retrieval - whereas stress impairs retrieval of extinction memory, it enhances its consolidation. These results have important implications for psychotherapeutic treatment of anxiety disorders, especially for extinction-based methods such as exposure therapy: stress, especially outside the therapeutic context, might increase the probability for experiencing relapse or symptom reoccurrence, whereas stress induction included in the end of an (extinction-based) psychotherapy session may aid in enhancing the consolidation of the corrective memories formed during therapy.



Context-dependent effects on extinction and renewal of classically-conditioned fear memories in a visceral pain model

Adriane ICENHOUR¹, Joswin KATTOOR¹, Sven BENSON¹ and Sigrid ELSENBRUCH¹

¹*Institute of Medical Psychology and Behavioral Immunobiology, University Hospital, University Duisburg-Essen*

The role of associative learning and memory processes is widely acknowledged in the pathophysiology and treatment of anxiety disorders, drug abuse and relapse, but far less is known about their contribution in the context of chronic visceral pain like in irritable bowel syndrome (IBS). Fear conditioning is a well-established model for investigating the pathophysiology of anxiety, but it also serves as a translational model in neuroscience and provides useful insights into mechanisms contributing to a large number of disorders, including fibromyalgia and chronic back pain. Given the well-documented overlap between IBS and other somatization disorders with pre-clinical and clinical anxiety, it also appears well-suited for exploring the central mechanisms underlying the generation and persistence of IBS, particularly visceral hyperalgesia, which may be mediated by conditioned fear of pain.

In “real life” situations, pain is never an isolated experience, but is always embedded in specific contexts, so not only aversive learning and memory processes themselves, but also the context in which they take place, could play a crucial role in the pathophysiology of IBS, particularly in the chronification and relapse of symptoms. In a series of conditioning studies, we aim to address context effects on extinction and renewal in a clinically-relevant visceral pain model in healthy volunteers, as well as in patients with IBS. More translational knowledge about the influence of learning processes on visceral pain, particularly the potential role of the context in extinction and reactivation of extinguished fear memories, could contribute to refining recently emerging new treatment options in the field of IBS such as pain-focussed exposure therapy.



Effects of CS-US learning trials on fear acquisition and extinction: A pilot study

Joswin KATTOOR¹, Carolin GRAMSCH², Adriane ICENHOUR¹, Sigrid ELSENBRUCH¹

¹Inst. of Medical Psychology & Behavioral Immunobiology, University Hospital of Essen, University of Duisburg-Essen, Essen, Germany

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Disturbed associative learning may play a role in chronic abdominal pain syndromes. We have recently implemented a visceral aversive fear conditioning paradigm (Kattoor et al., 2013a). Given the putative evolutionary significance of visceral stimuli, aversive visceral conditioning may require only very few learning trials. Therefore, we modified the established conditioning paradigm (which contained 12 conditioned stimuli (CS) – unconditioned stimuli (US) pairings) by reducing the number of CS – US pairings to 4 pairings in order to examine if differential aversive learning is still evocable.

In N = 24 healthy humans, fear acquisition was accomplished by pairing visual conditioned stimuli (CS⁺) with painful rectal distensions as US, while different visual stimuli (CS⁻) were presented without US. During extinction, all CSs were presented without US. In this pilot study we investigated the effect of a reduced number of CS – US pairings on extinction. Using event related fMRI, conditioned anticipatory activation was assessed along with perceived CS-US contingency and CS unpleasantness.

A significant valence change was found, indicating successful differential aversive learning. CS-US contingency awareness was not fully established, suggesting that differential visceral conditioning does not require full contingency awareness. This was paralleled by activation of the putamen, insula and the secondary somatosensory cortex in response to the CS⁺. Extinction involved activation of the cingulate gyrus and the primary motor cortex to the CS⁻.

Visceral stimuli are effective US that elicit conditioned fear even after very few learning trials even in the absence of full contingency awareness. These findings contribute to understanding the role of associative learning processes in the pathophysiology of chronic abdominal pain syndromes.



A within-subject appetitive conditioning paradigm to assess the role of the hippocampus and the 'prefrontal cortex' for extinction learning and renewal in pigeons.

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¹ Ruhr University Bochum, Universitätsstr. 150, D-44780 Bochum, Germany

² International Graduate School of Neuroscience

The prefrontal cortex (PFC) and the hippocampus are crucially involved in the neural circuit of context-specific extinction learning. Most extinction research is based on Pavlovian fear conditioning in rodents. However to elucidate fundamental mechanisms of learning and refine extinction-based behavior therapy for phobias and drug addiction, learning under appetitive requirements should be investigated.

Therefore, we established an appetitive conditioning paradigm to investigate context-specific extinction learning with pigeons in a within-subject design. Subjects acquired responses to a rewarded conditioned stimulus (CS) in a defined acquisition context. Once a defined performance criterion was reached, responding to the CS was extinguished in a different context. Subsequently the CS was tested in the acquisition (ABA-condition) as well in the extinction context (ABB-condition). The within-subject version of ABA renewal allows for testing a single individual in an ABA as well as an ABB design for direct comparison. In order to characterize the neural substrate for the renewal effect (ABA) and spontaneous recovery (ABB) we a) inactivated the hippocampus via local administration of tetrodotoxin (TTX) or b) blocked NMDA-receptors locally in the nidopallium caudolaterale (functional analog to the mammalian PFC) via 2-amino-5-phosphonopentanoic acid (AP-5) before extinction. The TTX-injection did not affect the extinction dynamic *per se* but increased spontaneous recovery whereby the renewal effect remained unimpaired. Previous work has shown that the NMDA-receptor antagonist treatment prolongs successful extinction, presumably influencing the magnitude of renewal via impairing memory consolidation. Hence, NMDA-receptors are involved in encoding contextual information.

Keywords: bird, instrumental conditioning, context-specific learning, hippocampus, PFC, sign-tracking, TTX, AP-5



Manipulating the informational value of contexts during extinction learning

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²*Ruhr-Universität Bochum, Germany*

In one predictive-learning experiment, we investigated the role of the informational value of contexts for the formation of context-specific extinction learning. The contexts were each composed of two elements, a color spot (dimension A) and a picture of an animal (dimension B). In Phase 1, participants received acquisition training with a target cue Z in a context A1B1 (numbers assign particular values on the context dimensions). In Phase 2, participants were trained with conditional discriminations between two other cues, X and Y, for which only one of the two context dimensions was relevant. In a third phase, participants received extinction trials with cue Z in context A2B2. During a final test phase, we observed that a partial change of the extinction context disrupted extinction performance when the context manipulation involved a shift of the value on the context dimension that was trained as relevant for the conditional discrimination. However, when the extinction context was partially changed by a shift of the value on the irrelevant context dimension, extinction performance was not affected. Our results are consistent with the idea that contexts with a higher informational value receive more attention, leading to stronger context-specific processing of information learned in these contexts.



Acute stress reduces fear retrieval in healthy men

Christian J. MERZ¹, Tanja C. HAMACHER-DANG¹, Oliver T. WOLF¹

¹*Institute of Cognitive Neuroscience, Department of Cognitive Psychology, Ruhr-University Bochum*

The stress hormone cortisol reduces retrieval of emotional memories, which has been suggested to support the treatment of psychiatric disorders characterized by exaggerated fear-related memories. Indeed, studies in patients with anxiety disorders have indicated that the success of exposure therapy can be enhanced with accompanying cortisol administration. Fear renewal refers to the clinically relevant phenomenon that successfully extinguished fear can return after a context change. It remains to be investigated whether the effects of stress hormones on fear retrieval also generalize across different contexts. Healthy men were exposed to a fear renewal design with fear acquisition in context A and extinction in context B. Pictures of rooms served as contexts, colored lights were introduced as conditioned stimuli (CS), and an electrical stimulation served as the unconditioned stimulus (UCS). On the next day, participants were randomly assigned to a stress or a control condition. We tested for fear retrieval in contexts A and B during peak cortisol concentrations after stress induction. Overall, a context x stress interaction occurred, revealing that stress attenuated skin conductance responses in the extinction context B. Additionally, stress abolished the renewal effect (differentiation between CS in context A) at the electrodermal level. These results demonstrate a decreased return of fear after acute exposure to stress. Stress interferes with the retrieval of the original fear memory. Thus, acute stress reduces rather than promotes the return of fear.



The extinction of conditioned taste aversion is modulated by intra-insular infusions of anisomycin or propranolol

Kathrin ORLOWSKI¹, Katharina BÖSCHE¹, Martin HADAMITZKY¹, Harald ENGLER¹, and Manfred SCHEDLOWSKI¹

¹Institute of Medical Psychology and Behavioral Immunobiology, University Hospital Essen, University of Duisburg-Essen, Germany

Based on Pavlovian conditioning we established a conditioned taste aversion paradigm (CTA) in rats. Injection of cyclosporine A (CsA) (i.p., 20 mg/kg) as an unconditioned stimulus (US) is paired together with a saccharin drinking solution (0.2 %) as a conditioned stimulus (CS) during acquisition. CsA is an immunosuppressant known for its ability to suppress cytokine production (IL-2 and IFN- γ) in T cells. Re-exposure to the CS during evocation induces a CTA and concomitantly a conditioned suppression of cytokine production and T cell activation. However, extinction of the CTA as well as of the learned immunosuppression occurs after repeated re-exposures to the CS alone. Therefore, the present study aimed to elucidate neurobiological mechanisms responsible for the extinction process in CTA. As the evocation of this conditioned immunosuppression is mediated centrally via the insular cortex (IC), we analyzed whether bilateral infusions of either the protein synthesis inhibitor anisomycin (120 $\mu\text{g}/\mu\text{l}$) or the β -adrenergic antagonist propranolol (20 $\mu\text{g}/\mu\text{l}$) into the IC affect the extinction of CTA. Daily administration of anisomycin or propranolol for six consecutive days during evocation significantly delayed (anisomycin) or accelerated (propranolol) the extinction of CTA compared to the vehicle injected conditioned controls. Though, the mRNA expression of IL-2 and IFN- γ was unaffected after six re-exposures. These data indicate that in this paradigm repeated inhibition of protein synthesis or β -adrenergic blockade in the IC modulate the extinction process of CTA.



Observing single-unit activity across three stages of learning

Sarah STAROSTA¹, Onur GÜNTÜRKÜN¹, Maik C. STÜTTGEN¹

¹ Ruhr University Bochum, Universitätsstr. 150, D-44780 Bochum, Germany

Neuronal mechanisms underlying extinction learning are primarily studied employing fear conditioning in rodents. Neural processes underlying the extinction of appetitive, operantly conditioned responses are way less understood. This is quite remarkable, considering that most animal behavior is operant in nature. Additionally, it offers the opportunity to disentangle the time courses of plasticity which has been notoriously difficult with fear conditioning because of the low number of trials required for both acquisition and extinction. We therefore seek to investigate the differences and similarities of acquisition, extinction and also reacquisition on the behavioral as well as on the neuronal level in an appetitive conditioning paradigm. For investigating the neuronal correlates at the level of single cells, it is critical to record one and the same neuron during all three stages of learning. Since it is difficult to record from the same cells over days, we established a behavioral paradigm in which the animals run through all three stages of learning within one experimental session. A prerequisite for this is that experimental animals are willing to perform several hundred of trials over an extended period of time for a relatively low number of reinforcers. Additionally, they should acquire a new association in a reasonable time span and show stable performance across sessions. Here we present a behavioral paradigm which allows for the within-assessment of acquisition, extinction, and reacquisition in one experimental session in pigeons. In addition, highly dynamic, single unit response patterns across the three learning stages are shown.



Contribution of the cerebellum to acquisition and extinction of conditioned eyeblinks: A 7T fMRI study

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¹ *Department of Neurology, University of Duisburg-Essen,* ² *Department of Neuroscience, Erasmus MC Rotterdam*

² *Institute of Cognitive Neuroscience, UCL,* ⁴ *Erwin L. Hahn Institute for Magnetic Resonance Imaging, University of Duisburg-Essen*

Contribution of the cerebellum to acquisition of conditioned eyeblink responses is well known both in animals and humans. Although animal studies suggest that the cerebellum is equally involved in extinction, cerebellar contribution has rarely been assessed in humans. Furthermore, human studies of both acquisition and extinction focus on the cerebellar cortex. Due to a number of methodological constraints studies of the cerebellar nuclei are sparse. Based on animal data, intermediate parts of cerebellar lobule VI and interposed nuclei appear to be of particular importance. To test the hypothesis that overlapping areas of the intermediate cerebellum, more specifically intermediate lobule VI and interposed nuclei, contribute to acquisition and extinction of the classically conditioned eyeblink in humans.



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Curriculum Vitae

- Since 2008 PhD Student in the Neurophysiology department of Neurophysiology under the supervision of Prof. Dr. Manahan-Vaughan
- 2008 MSc (+5) in Integrative and Cognitive Neurosciences, University of Provence, Aix-Marseille I, France
- Thesis : Single unit recording in wild and L7-PKCI mice hippocampus during spatial navigation under supervision of Dr. Etienne Save.
- 2007 Maitrise (+4) in Integrative and Cognitive Neurosciences, University of Provence, Aix-Marseille I, France
- Effects of post-natal iron overload on spatial behaviour in the rats under supervision of Dr. Etienne Save
- 2006 License (eq. BS) in Integrative and Cognitive Neurosciences, University of Provence, Aix-Marseille I, France
- 2005 DEUG (+2) in Integrative and Cognitive Neurosciences, University of Provence, Aix-Marseille I, France
- 2002 High School Graduation, Lycée d'Apt, Apt, France



Methods and Research interests

- Place cell recordings and EEG recordings in freely moving rodents
- Animal behaviour
- Spatial and declarative memory
- Hippocampal plasticity

Publications

Cerebellum shapes hippocampal spatial code. Rochefort C, Arabo A, **André M**, Poucet B, Save E, Rondi-Reig L. Science. 2011

Spatial olfactory learning facilitates long-term depression in the hippocampus. **André MAE**, Manahan-Vaughan D. Hippocampus. 2013

The metabotropic glutamate receptor, mGlu5 is required for extinction learning that occurs in the absence of a context change. **André MAE**, Güntürkün O, Manahan-Vaughan D. Hippocampus. Submitted.



M.Sc. Biol. Katharina Bösche



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Curriculum Vitae

Since 11/2011	Member of the DFG Research Unit 1581: Extinction learning: Neural Mechanisms, Behavioral Manifestations and Clinical Implications
Since 11/2011	PhD student in the Institute of Medical Psychology and Behavioral Immunobiology of Prof. Dr. rer. biol. hum. Manfred Schedlowski
2011	M.Sc. Thesis: "Functional expression and electrophysiological characterization of vertebrate chemoreceptors in a recombinant system" (Prof. Dr. Dr. Dr. med. habil. H. Hatt)
2009-2011	M.Sc. Biology, Ruhr-University Bochum
2009	B.Sc. Thesis: "The influence of the murine receptor type protein tyrosine phosphatase plogrin and the effects of mutated plogrin on the neurite outgrowth of PC12 cells" (Prof. Dr. S. Wiese)
07-08/2008	Internship at the Institute of Forensic Medicine (University Hospital Essen)
2006-2009	B.Sc. Biology, Ruhr-University Bochum
2006	Abitur/ A-level Exam Theodor-Heuss-Gymnasium Waltrop

Methods and Research Interests

Associative Learning Paradigms

Clinical Implications of Conditioned Immunosuppression

Real Time quantitative PCR



Main Research Projects

Reconsolidation of the conditioned immune response after heterotopic heart transplantation

Extinction, Reconsolidation and Renewal in behaviorally conditioned immunosuppression

Influences of small molecule-drug immunosuppression on amygdala-dependent behavior

Neurobehavioral consequences of acute mTOR blockade using rapamycin

Publications

Martin Hadamitzky, Arne Herring, Kathy Keyvani, Raphael Doenlen, Ute Krügel, Katharina Bösche, Kathrin Orlowski, Harald Engler, Manfred Schedlowski (2013) Neurobehavioral consequences of acute mTOR blockade. *Neuropharmacology* (*submitted*)

Abstracts

Katharina Bösche, Martin Hadamitzky, Kathrin Orlowski, Raphael Doenlen, Harald Engler, Manfred Schedlowski (2013) Impact of the immunosuppressant rapamycin on amygdala activity and behavior (2013) 10th Congress of the German Endocrine Brain Immune Network (GEBIN), Regensburg

Grants

Grant of the “exploratory treasure” for young scientists within the DFG Research Unit FOR 1581 entitled *Reconsolidation of the conditioned immune response following subtherapeutic CsA treatment: Acute allograft rejection*.

Recent teaching activity

Supervision of medical students and interns



M.Sc. Psych. Tanja C. Hamacher-Dang



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Curriculum Vitae

Since 10/2011	PhD Student at the Department of Cognitive Psychology, Prof. Dr. Oliver T. Wolf Associate PhD student at the International Graduate School of Neuroscience (IGSN)
2011	M.Sc. Thesis: "Erinnerungsvermögen an die Einzelheiten in einer Stresssituation" (Memories of a stressful episode) (Prof. Dr. Oliver Wolf, Dr. Uta Wiemers)
2009 - 2011	M.Sc. Psychology, Ruhr-University Bochum
2009	B.Sc. Thesis: "Die Verwendung von Emotionsworten bei autobiografischen und fiktiven Erzählungen" (Usage of emotional words in autobiographic and fictitious stories) (Prof. Dr. Axel Schölmerich, Dipl.-Psych. Jens-Ulrich Heete)
2006 - 2009	B.Sc. Psychology, Ruhr-University Bochum
2004	Abitur/ A-level Exam Schiller-Gymnasium Bochum

Methods and Research Interests

- Stress induction
- Physiological measures: neuroendocrine marker of Hypothalamus-Pituitary Adrenal (HPA) axis activity (salivary cortisol), blood pressure, electrodermal activity (EDA) as marker of the fear response
- Stress effects on extinction and renewal in neutral and aversive learning paradigms



Research Project

- **Stress effects on extinction and renewal in healthy humans**

The goal of our project is to investigate systematically how stress influences extinction and renewal. We apply acute stress at distinct points in the course of extinction memory formation and its subsequent retrieval in order to distinguish between stress effects on extinction learning, on the consolidation of extinction memory and on its retrieval. The role of contextual cues as modulators of stress effects is studied by using within-subjects A-B-AB renewal designs. In addition, we investigate whether the emotionality of the memory also plays a role by comparably applying fear conditioning and predictive learning paradigms.

The knowledge we gain in these studies significantly contributes to our understanding of modulatory factors that influence extinction in the human and is of relevance for basic science studies and clinical applications alike.

Publications

Hamacher-Dang, T.C., Engler, H., Schedlowski, M., & Wolf, O.T. (in press) Stress enhances the consolidation of extinction memory in a predictive learning task. *Frontiers in Behavioral Neuroscience*.

Hamacher-Dang, T.C., Uengoer, M., & Wolf, O.T. (2013) Stress impairs retrieval of extinguished and unextinguished associations in a predictive learning task. *Neurobiology of Learning and Memory*, 104, 1-8.

Wiemers, U.S., Sauvage, M.M., Schoofs, D., Hamacher-Dang, T.C., & Wolf, O.T. (in press) What we remember from a stressful episode. *Psychoneuroendocrinology*.

Poster presentations and talks

Hamacher-Dang, T. C. & Wolf, O. T. (2013) Effects of stress on retrieval and consolidation of extinction memory in humans. Poster presented at the 43th annual meeting of the International Society for Psychoneuroendocrinology (ISPNE), Leiden, Netherlands.

Hamacher-Dang, T. C. & Wolf, O. T. (2013) Stress beeinträchtigt den Abruf des Extinktionsgedächtnis. Talk at the 39th annual meeting "Psychologie & Gehirn", Würzburg, Germany.

Hamacher-Dang, T. C., Merz, C. J., & Wolf, O. T. (2013) Effects of acute stress on the renewal of fear-conditioned responses. Poster presented at the Fifth European Meeting on Human Fear Conditioning, Affligem, Belgium.

Hamacher-Dang, T. C. & Wolf, O. T. (2012) Einfluss von Stress auf den Renewal-Effekt. Poster presented at the 38th annual meeting "Psychologie & Gehirn", Jena, Germany.

Hamacher-Dang, T. C. & Wolf, O. T. (2012) Effects of reactivation preceding extinction on the renewal effect. Poster presented at the Fourth European Meeting on Human Fear Conditioning, Rauschholzhausen, Germany.



Dipl.-Psych. Adriane Icenhour



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Curriculum Vitae

Since 2012	PhD Student in the Lab of Prof. Sigrid Elsenbruch, University of Duisburg-Essen
2011	Diploma in Psychology, Justus-Liebig-University of Giessen
2008-2011	Diploma thesis "The influence of cortisol and sex hormones on neural and peripheral correlates of fear conditioning" (Prof.Dr. Rudolf Stark, Dr.rer.nat. Katharina Tabbert, Dr.rer.nat. Christian Merz)
2008-2009	Student research assistant at the Bender Institute for Neuroimaging (BION), Giessen
2003-2011	Studies of Psychology (major) and Medicine (minor), Justus-Liebig-University of Giessen
2001-2003	Studies of Psychology and Anglistics for a teaching profession, University of Duisburg-Essen
1999	Abitur, Karl-Ziegler-Gymnasium, Muelheim an der Ruhr

Methods and Research Interest

Neuroimaging
Neural Mechanisms of Learning and Memory
Pain Research
Sex differences and impact of sexual hormones
Stress Research

Research Projects

Neural Mechanisms of Associative Learning Processes in Visceral Pain

Little is known about the role of associative learning and memory processes in the context of chronic visceral pain such as in the Irritable Bowel Syndrome (IBS). Using functional Magnetic Resonance Imaging (fMRI) along with the assessment of Skin Conductance Responses (SCR), salivary cortisol and behavioral measures, we are investigating the neural mechanisms of acquisition, extinction and the context-dependent renewal of previously extinguished fear memories in an established visceral-aversive conditioning paradigm in humans. Given the strong female preponderance for the development of IBS, data will also be analyzed addressing potential sex differences in visceral aversive learning and memory processes.



Associative Learning Processes in Patients with Irritable Bowel Syndrome (IBS)

In an aversive visceral conditioning paradigm, we are assessing possible alterations in acquisition, extinction and the reinstatement of the previously extinguished pain-relevant associations in IBS-patients compared with healthy controls by analyzing fMRI, SCR, salivary cortisol and behavioral data.

Classically-conditioned Nocebo-Hyperalgesia in Visceral Pain

There is broad evidence for conditioned placebo-analgesia in the field of pain research, but far less is known about the counterpart, the learned nocebo-hyperalgesia, which could play a crucial role in the pathophysiology of chronic pain disorders. Our lab is investigating neural, psychophysiological and behavioral correlates of a classically-conditioned nocebo-effect in the context of visceral pain.

Grants

“Exploratory treasure”-Grant for young scientists within the DFG Research Unit FOR 1581 “Extinction learning: neuronal mechanisms, behavioral manifestations, and clinical implications”

Promotion of young scientists from the Deutsche Schmerzgesellschaft e.V. (Section of the International Association for the Study of Pain, IASP) (2nd prize; 1.500,00 €)



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Curriculum Vitae

Since 01/2011	Member of the DFG Research Unit 1581: Extinction learning: Neural Mechanisms, Behavioral Manifestations and Clinical Implications
Since 06/2010	PhD Student at the Institute of Medical Psychology and Behavioral Immunobiology; Experimental Psychobiology, University of Duisburg-Essen (lab of Prof. Dr. Elsenbruch)
04/2007 to 10/2009	M.Sc. studies of biology, focus neurobiology at the Ruhr-University of Bochum; Master Thesis: Neuronal principles of perceptual decision-making in pigeons, Department of Biopsychology, Institute of Cognitive Neuroscience (lab of Prof. Dr. Dr. hc. Güntürkün)
03/2007 to 08/2007	Student assistant at the Max-Planck Institute for Neurological Research in Cologne in the research group for multimodal imaging concerning experimental and clinical stroke (lab of PD Dr. Endepols)
10/2004 to 02/2007	B.Sc. studies of biology at the University of Cologne; Bachelor Thesis: Intersegmental information transfer in the central nervous system of running stick insects, Zoological Institute at the University of Cologne (lab of Prof. Dr. Büschges)
10/2003 to 10/2004	B.Sc studies of biology and psychology at the University of Vechta
2002	Abitur/A-level Exam at Siegtal Gymnasium Eitorf

Methods and Research Interests

Neural mechanisms of associative learning, neuroimaging (fMRI)

Functional genetic polymorphisms in pain sensitivity, genetic association studies (real time PCR)

Psychophysics (pressure algometry, barostat)

Programming (Presentation, Matlab, SPM8)

Main Research Projects

Neural Mechanisms of Associative Learning Processes in Visceral Pain



Fear conditioning is relevant for elucidating the pathophysiology of anxiety, but could also be useful in the context of chronic pain syndromes which often overlap with anxiety. Therefore, we implemented a fear conditioning paradigm and analyzed the conditioned response to rectal pain stimuli using functional magnetic resonance imaging (fMRI) during acquisition of fear, extinction, context dependent renewal and context independent reinstatement. Additionally, sex differences were examined given the female preponderance of chronic abdominal pain. Moreover, the putative role of fear conditioning in the cerebellum is still unknown. Hence, we investigated the cerebellar contribution to visceral aversive extinction learning.

The role of the functional genetic polymorphism COMT val¹⁵⁸met in visceral pain sensitivity

The enzyme catechol-O-methyltransferase (COMT) plays a key role in catecholamine metabolism. A common functional polymorphism (rs4680) in the COMT gene (val¹⁵⁸met) has been associated with higher pain sensitivity in several pain modalities, and has recently been linked to abdominal symptoms in irritable bowel syndrome. Therefore, we analyzed the putative role of this gene polymorphism in visceral sensitivity in healthy volunteers.

Publications

Kattoor J, Gizewski ER, Kotsis V, Benson S, Gramsch C, Theysohn N, Maderwald S, Forsting M, Schedlowski S, Elsenbruch S. Fear Conditioning in an Abdominal Pain Model: Neural Responses during Associative Learning and Extinction in Healthy Subjects. *PLoS One*. 2013;8(2):e51149. Epub 2013/03/08.

Kattoor J, Thurling M, Gizewski ER, Forsting M, Timmann D, Elsenbruch S. Cerebellar Contributions to Different Phases of Visceral Aversive Extinction Learning. *Cerebellum*. 2013. Epub 2013/08/09.

Benson S, **Kattoor J**, Wegner A, Hammes F, Reidick D, Grigoleit JS, Engler H, Oberbeck R, Schedlowski S, Elsenbruch S. Acute experimental endotoxemia induces visceral hypersensitivity and altered pain evaluation in healthy humans. *Pain*. 2012;153(4):794-9. Epub 2012/01/24.

Kattoor J, Mollerus S, Benson S, Engler H, Engler A, Frey UH, Schedlowski M, Elsenbruch S. Is there a role of the functional genetic polymorphism COMT val¹⁵⁸met in human visceral pain sensitivity? *European Journal of Gastroenterology and Hepatology* (submitted)

Benson S, **Kattoor J**, Kullmann JS, Hofmann S, Engler H, Forsting M, Gizewski ER, Elsenbruch S. Towards understanding sex differences in visceral pain: Enhanced reactivation of classically-conditioned fear in healthy women. *Neurobiology of Learning and Memory* (in revision)

Grants

Grant of the “exploratory treasure” for young scientists within the DFG Research Unit 1581 “Extinction learning: neuronal mechanisms, behavioral manifestations, and clinical implications”

Teaching

Supervision of medical doctoral students; Seminar for Medical Psychology, topic: Learning / Memory



M.Sc. Biol. Daniel Lengersdorf



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Curriculum vitae

Since 10/2011 International School of Neuroscience in Bochum

Since 06/2011 PhD Student in the lab of Prof. Onur Güntürkün

2011 M.Sc. Thesis: "Adaptive choice behaviour of the pigeon in a dynamic environment and its neural representation."
(Prof. Dr. Dr. hc. Onur Güntürkün, Dr. rer. nat. Maik C. Stüttgen)

2009 – 2011 M.Sc. Biology, Ruhr-University Bochum

2009 B. Sc. Thesis: "Akustisch getriebene Antworten im auditorischen System der Schleiereule (*Tyto alba*) ermittelt mit Standardeinkanalelektroden und mit neuentwickelter Mehrkanalelektrode."
(Prof. Dr. Hermann Wagner, Martin Singheiser)

2005 – 2009 B.Sc. Biology, RWTH Aachen

Methods and Research Interests

- Neuropharmacology
- Behavioral Neuroscience
- Neuronal basis of the dynamics of learning
- Acquisition, Extinction, Renewal
- Single-unit recordings



Research Project

Neuronal Foundations of Extinction and Renewal

It has been shown that the blockade of NMDA receptors in the NCL retards reversal learning, but not the original acquisition of an operant response. Here, we seek to extend this result to investigate differential effects of context-specificity in acquisition, extinction and renewal. Aside from the nidopallium caudolaterale (a presumed functional equivalent of the mammalian prefrontal cortex), we also focus on the role of the hippocampus in contextual conditioning. In experiments, we employ a discrete occasion setter as a context for the acquisition and extinction of learned associations. During task executions, the activity of specific brain regions are modified through pharmacological interventions.

Awards

RWTH UROP (Undergraduate Research Opportunities Program; 2008)

Publications

Lengersdorf D, Stüttgen MC, Uenguer M, Günterkün O. Transient inactivation of the pigeon hippocampus or the nidopallium caudolaterale during extinction learning impairs extinction retrieval in an appetitive conditioning paradigm. Behav Brain Res. Submitted Sept 2013.

Stüttgen MC, Kasties N, Lengersdorf D, Starosta S, Güntürkün O, Jäkel F. Suboptimal criterion setting in a perceptual choice task with asymmetric reinforcement. Behav Processes. 2013 Jun;96:59-70.



Dipl.-Psych. Sara Lucke



Philipps-Universität Marburg

Fachbereich Psychologie

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Curriculum Vitae

- 02/2013 Research intern at Ruhr-University Bochum (Prof. Onur Güntürkün, "Influence of attention on the context-specificity of acquisition and extinction learning")
- Since 08/2011 Postgraduate Training in Clinical Psychology (Cognitive-Behavioral-Treatment) at the „Institut für Psychotherapieausbildung an der Philipps-Universität Marburg“ (IPAM)
- Since 04/2011 PhD Student in the lab of Prof. Harald Lachnit
2011 Diploma in Psychology, Philipps-Universität Marburg
- 2006-2011 Title of diploma thesis: Influence of prolonged training and extinction on resurgence of instrumental behavior (Prof. Dr. Harald Lachnit, Dr. Anja Lotz)
2006 Data collection: University of Vermont, Biobehavioral Psychology, lab Mark Bouton
 Psychology, Philipps-Universität Marburg
 School leaving examination (Abitur) at Städtisches Gymnasium Kreuztal (ehem. Friedrich-Flick-Gymnasium)

Methods and Research Interests

- ◆ Attentional Processes in human predictive and eye tracking paradigms
- ◆ Post-extinction phenomena and their underlying mechanisms

Research Projects

- ◆ The Role of Attention in Renewal
We investigate the role of attention for renewal regarding context-dependent behavior in humans. Therefore, we try to influence the amount of attention to contextual stimuli by manipulation of either the informational value of contexts or the degree of expectancy violation experienced within a context.



◆ Extinction in Evaluative Conditioning

We are interested to reverse effects of affective learning. In an evaluative conditioning paradigm we investigate different treatments to change affective acquisition learning.

Publications

- ◆ Winterbauer, N. E., Lucke, S., & Bouton, M. E. (2013). Some factors modulating the strength of resurgence after extinction of an instrumental behavior. *Learning and Motivation, 44*(1), 60-71.
- ◆ Lucke, S., Lachnit, H., Koenig, S., & Uengoer, M. (2013). The informational value of contexts affects context-dependent learning. *Learning & Behavior, 41*(3), 285-297.
- ◆ Lucke, S., Lachnit, H., Stüttgen, M., & Uengoer, M. (submitted). Binding extinction to contexts: The impact of context relevance during extinction learning.

Grants/Scholarships

- ◆ Grant of the “exploratory treasure” for young scientist within the DFG Research Unit FOR 1581 “Extinction learning: neuronal mechanisms, behavioral manifestations, and clinical implications”
- ◆ Since 2008 Scholarship for highly-qualified students awarded by Evangelisches Studienwerk Villigst e.V. (German official scholarship organization)

Teaching

WS 11/12	Seminar “Introduction to academic research”
WS 09/10	Tutor for Research practical “Associative learning of negative correlations between events”
WS 08/09, WS 09/10	Tutor for “Introduction to academic research”



Dr. Christian Josef Merz, Dipl.-Psych.



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Fax: +49 234 3214308

Curriculum Vitae

Studies

2002-2007 Studies of Psychology at the Justus Liebig University Giessen, Germany;
Diploma in 2007

Professional experiences

2006-2007 Student assistant in degree programme "Psychological Psychotherapy
(Cognitive Behavioural Therapy)", Justus Liebig University Giessen, Germany

2008 Student assistant at the Bender Institute of Neuroimaging, Justus Liebig
University Giessen, Germany

2008-2011 Research assistant at the Department of Cognitive Psychology (Prof. Dr. O.
Wolf), Ruhr-University Bochum, Germany

February 2011 PhD (Dr. rer. nat.) at the Faculty of Psychology, Ruhr-University Bochum,
Germany; Title of the Dissertation: "The influence of stress and sex hormones
on fear conditioning in different learning conditions" (Grade: summa cum
laude)

2011-2012 Research fellow at the Department of Psychotherapy and Systems
Neuroscience and at the Bender Institute of Neuroimaging (Prof. R. Stark),
Justus Liebig University Giessen, Germany

Since October 2012 Postdoc at the Institute for Cognitive Neuroscience, Department of Cognitive
Psychology (Prof. Dr. O. Wolf), Ruhr-University Bochum, Germany



Scholarships/Grants

2009 Grant for the project "Neurobiological bases of social anxiety in women" (together with Dr. Andrea Hermann) from the women's representative of the Justus Liebig University Giessen, Germany

2011 Scholarship for the participation in the Spring School of the DGPA "Genes, brain, and behavior: From personality to psychopathology" in St. Goar, Germany

2011 Young Investigator Award of the International Society for Psychoneuroendocrinology

2012 Research grant for the project „Neuronal basis of generalization of extinction learning“from the Justus Liebig University Giessen, Germany (joint application with Dr. A. Hermann)

2012 Funding of a conference trip to New Orleans: „Neuroscience 2012“ (DAAD)

2013 Research grant from the German Research Foundation (DFG) for studies concerning the topic “Neurobiology of context-dependent extinction learning: modulation by multiple extinction contexts and cortisol” (joint application with Dr. A. Hermann)

2013 Principal Investigator of the DFG Research Unit 1581 “Extinction Learning: Neural Mechanisms, Behavioural Manifestations, and Clinical Implications”

Publications

Merz, C.J., Hermann, A., Stark, R. & Wolf, O.T. (in press). Cortisol modifies extinction learning of recently acquired fear in men. *Social Cognitive and Affective Neuroscience*, doi: 10.1093/scan/nst137.

Merz, C.J., Tabbert, K., Schweckendiek, J., Klucken, T., Vaitl, D., Stark, R. & Wolf, O.T. (2012). Neuronal correlates of extinction learning are modulated by sex hormones. *Social Cognitive and Affective Neuroscience*, 7, 819-830.

Merz, C.J., Tabbert, K., Schweckendiek, J., Klucken, T., Vaitl, D., Stark, R. & Wolf, O.T. (2012). Oral contraceptive usage alters the effects of cortisol on implicit fear learning. *Hormones and Behavior*, 62, 531-538.

Merz, C.J., Tabbert, K., Schweckendiek, J., Klucken, T., Vaitl, D., Stark, R. & Wolf, O.T. (2010). Investigating the impact of sex and cortisol on implicit fear conditioning with fMRI. *Psychoneuroendocrinology*, 35, 33-46.

Merz, C.J., Wolf, O.T., Schweckendiek, J., Klucken, T., Vaitl, D. & Stark, R. (in press). Stress differentially affects fear conditioning in men and women. *Psychoneuroendocrinology*, doi: 10.1016/j.psyneuen.2013.05.015.



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Curriculum Vitae

Education	
Since 05/2013	Research assistant at the Department of Clinical Psychology and Psychotherapy, Ruhr University Bochum
2013	M. Sc. Thesis: "Einfluss der Stimme des Therapeuten in der Psychotherapie – Zusammenhänge zwischen Stimmparametern, Kompetenzmaßen und dem Therapieerfolg " (Prof. Dr. Jürgen Margraf, Dr. Armin Zlomuzica)
2010-2013	M. Sc. Clinical Psychology, Ruhr University Bochum
2010	B. Sc. Thesis: "Persönlichkeit und Selbstdarstellung im Web 2.0 – ein Vergleich zwischen Netzwerk- und Datingplattform" (Prof. Dr. Hans Werner Bierhoff, PD Dr. Elke Rohmann)
2007-2010	B. Sc. Psychology (focus on Cognitive Neuroscience), Ruhr University Bochum
2007	Abitur / A-level Exam Nellenburg Gymnasium Stockach
Work and Internships	
04/2012-05/2012	Internship in psychiatry, psychotherapy and preventive medicine at the LWL Universitätsklinikum Bochum
08/2011-09/2011	Internship in psychosomatic medicine and psychotherapy at the LWL Universitätsklinikum Bochum
01/2011-12/2011	Student assistant at the department of social psychology, Ruhr University Bochum
06/2010-10/2010	Student assistant at the department of developmental psychology, Ruhr University Bochum
02/2010-05/2010	Research internship at the department of developmental psychology, Ruhr University Bochum



Methods and Research Interests

Etiology and therapy of anxiety disorders

neurobiology and psychophysiology of anxiety disorders

virtual reality exposure therapy

Research Project

Clinical Implications of Extinction and Renewal



Dipl. Biol. Kathrin Orlowski



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Curriculum Vitae

Since 10/2011	Associate member of the International Graduate School of Neuroscience (IGSN), Bochum, Germany
Since 01/2011	Member of the DFG Research Unit 1581: Extinction learning: Neural Mechanisms, Behavioral Manifestations, and Clinical Implications
Since 01/2011	PhD Student in the Institute of Medical Psychology and Behavioral Immunobiology of Prof. Dr. rer. biol. hum. Schedlowski
12/2010 to 01/2011	Tutor for biological questions for a "Jugend forscht" project ("Youth researchers")
06/2009 to 07/2010	Diploma thesis at the Department of Neuropharmacology in Tübingen, Germany: The influence of NOS+ interneurons and serotonin on the haloperidol-induced catalepsy sensitization in the rat
02/2006 to 03/2006	Internship in a pharmacy
10/2004 to 09/2010	Diploma in Biology, Eberhard-Karls-University of Tübingen, Germany
08/1995 to 06/2004	Abitur/A-level Exam at Friedrich-Harkort-Schule in Herdecke (secondary school)

Methods and Research Interests

Intracerebral lesions and implantations of cannula for pharmacological manipulation

Associative learning paradigms

Neurodegenerative diseases



Main Research Projects

Extinction, Reconsolidation and Renewal in behaviorally conditioned immunosuppression

Reconsolidation of the conditioned immune response after heterotopic heart transplantation

Neurobehavioral consequences of acute mTOR blockade (Rapamycin)

Influences of small molecule immunosuppressive drugs on behavior and immune response

Publications

Martin Hadamitzky, Arne Herring, Kathy Keyvani, Raphael Doenlen, Ute Krügel, Katharina Bösche, Kathrin Orlowski, Harald Engler, Manfred Schedlowski (2013) Neurobehavioral consequences of acute mTOR blockade. *Neuropharmacology* (*submitted*)

Abstracts:

Kathrin Orlowski, Martin Hadamitzky, Katharina Bösche, Harald Engler and Manfred Schedlowski (2013) Repeated anisomycin microinjections into the insular cortex delay extinction of conditioned taste aversion, 43rd annual meeting of the Society for Neuroscience, San Diego

Kathrin Orlowski, Katharina Bösche, Martin Hadamitzky, Jan Claudius Schwitalla, Harald Engler, and Manfred Schedlowski (2013) Mediation of the extinction process in behaviorally conditioned immunosuppression, 10th Congress of the German Endocrine Brain Immune Network (GEBIN), Regensburg

Kathrin Orlowski, Katharina Bösche, Martin Hadamitzky, Geraldine Prager, Timo Wirth, Harald Engler, Manfred Schedlowski (2012) Interfering in learning processes with a protein-synthesis inhibitor, Conference entitled "Molecular Mechanisms of Synaptic Processing, Function and Dysfunction", Bochum

Grants

Grant of the "exploratory treasure" for young scientists within the DFG Research Unit 1581 entitled "Effects of Tetrodotoxin in the conditioned taste aversion paradigm"

Teaching

Supervision of medical students and interns



M.Sc. Psych. Sarah Starosta



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Curriculum Vitae

Since 05/2011	PhD Student in the lab of Prof. Onur Güntürkün Associated member of the International Graduate School of Neuroscience
2011	M.Sc. Thesis: "Representation of value and reinforcement in the avian brain as assessed with a generalization task" (Prof. Dr. Dr. hc. Onur Güntürkün, Dr. rer. nat. Maik C. Stüttgen)
01/2011-03/2011	Research intern at the Istituto Superior di Sanità, Rome, Italy (Dr. Igor Branchi, "Epigenetic influences of the early social environment on brain and behavior development")
2010/2011	Erasmus scholarship, University "La Sapienza", Rome, Italy
2008-2011	M.Sc. Psychology, Ruhr-University Bochum
2008	B.Sc. Thesis: "Aktivität striataler Neurone während klassischer Konditionierung mit verschiedenen Belohnungsgrößen" (Prof. Dr. Dr. hc. Onur Güntürkün, Dr. rer. nat. Jonas Rose)
2005-2008	B.Sc. Psychology, Ruhr-University Bochum
2005	Abitur/ A-level Exam Stadtgymnasium Dortmund

Methods and Research Interests

- Single-unit recordings in freely-moving animals
- Neuronal basis of the dynamics of learning
- Animal learning theory
- Value coding in the brain



Research Projects

- **Neuronal Foundations of acquisition, extinction and reacquisition**

We are interested in the neuronal basis of extinction as a new and probably specific learning process. We are using single neuron recording techniques to investigate neuronal activity in avian forebrain areas during acquisition, extinction and reacquisition of positively reinforced operant behavior.

- **Influence of attention on the context-specificity of acquisition and extinction learning**

We are investigating the influence of context-directed attention on the context-specificity of acquisition and extinction by manipulating expectancy violation in a sign tracking paradigm. Expectancy violation is operationalized by the magnitude of a reward which is expected but not delivered.

Publications

Starosta, S., Güntürkün, O., Stüttgen, M.C., Stimulus-Response-Outcome Coding in the Pigeon Nidopallium Caudolaterale, PLoS ONE (2013)

Stüttgen, MC., Kasties, N., Lengersdorf, D., Starosta, S., Güntürkün, O., Jäkel, F., Suboptimal criterion setting in a perceptual choice task with asymmetric reinforcement, Behavioural Processes (2013)

Starosta, S.*, Stüttgen, MC.* Güntürkün, O., Recording single neurons' action potentials from freely moving pigeons across three stages of learning, accepted by the Journal of Visualized Experiments.

Grants

- Grant of the "exploratory treasure" for young scientist within the DFG Research Unit FOR 1581 "Extinction learning: neuronal mechanisms, behavioral manifestations, and clinical implications" ; Title: "Influence of reward expectancy on the context-specificity of acquisition and extinction"

Teaching

SS 13	Research practical "Introduction to programming in MATLAB"
WS 12/ 13	Research practical "Influence of reward expectancy on the context-specificity of acquisition and extinction"
SS 09, SS 10	Tutor for the Painting and Crafts Workshop on the Human Brain
WS 09/10	Tutor for the Seminar "Learning"



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Curriculum Vitae

Since 09/2008	PhD Student in the lab of Prof. Dr. Timmann-Braun
2008	M.Sc. Thesis: "Messung von Partikeln mittels Lichtstreuung" (Prof. Dr. H. Franke)
2006	M.Sc. Thesis: "Homogenisierung und Gamma-Konvergenz in Linearer Elastizität und Magnetismus" (Prof. Dr. S. Conti)
2000-2008	Studies of physics, University Duisburg-Essen
2000-2006	Studies of mathematics, University Duisburg-Essen
2000	Abitur/ A-level Exam Gustav-Heinemann-Gesamtschule, Mülheim a.d. Ruhr

Methods and Research Interests

- Structural and functional MRI including DTI with a focus on the cerebellum
- fMRI and structural MRI of the cerebellar nuclei
- MRI data acquisition and data processing using SPM, ECCET, MRICRON, FSL, SPSS, Matlab
- 7T MRI

Research Projects

- Eyeblink conditioning in healthy subjects using 7T fMRI
- Focus is on interposed nuclei and cerebellar cortex; compare acquisition, extinction and renewal
- Structural MRI of cerebellar patients
- Lesion symptom mapping in patients with focal and degenerative disease including VBM; analyze cerebellar areas related to extinction of cognitive and motor associative learning.



Publications

Thieme A*, Thürling M*, Galuba J, Burciu RG, Göricke S, Beck A, Aurich V, Wondzinski E, Siebler M, Gerwig M, Bracha V, Timmann D., Storage of a naturally acquired conditioned response is impaired in patients with cerebellar degeneration, *Brain*. 2013 Jul;136(Pt 7):2063-76.

Rosenberger C*, Thürling M*, Forsting M, Elsenbruch S, Timmann D, Gizewski ER., Contributions of the cerebellum to disturbed central processing of visceral stimuli in irritable bowel syndrome, *Cerebellum*. 2013 Apr;12(2):194-8.

Maderwald S*, Thürling M*, Küper M, Theysohn N, Müller O, Beck A, Aurich V, Ladd ME, Timmann D., Direct visualization of cerebellar nuclei in patients with focal cerebellar lesions and its application for lesion-symptom mapping, *Neuroimage*. 2012 Nov 15;63(3):1421-31.

Thürling M, Hautzel H, Küper M, Stefanescu MR, Maderwald S, Ladd ME, Timmann D., Involvement of the cerebellar cortex and nuclei in verbal and visuospatial working memory: a 7 T fMRI study, *Neuroimage*. 2012 Sep;62(3):1537-50.

Thürling M, Küper M, Stefanescu R, Maderwald S, Gizewski ER, Ladd ME, Timmann D., Activation of the dentate nucleus in a verb generation task: A 7T MRI study, *Neuroimage*. 2011 Aug 1;57(3):1184-91.

* contributed equally to the work

Grants

Grant of the “exploratory treasure” for young scientist within the DFG Research Unit FOR 1581 “Extinction learning: neuronal mechanisms, behavioral manifestations, and clinical implications”

Teaching

Co-supervision of medical students who work on their doctoral thesis



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