

EARLY LIFE EXPERIENCES VULNERABILITY OR RESILIENCE?

01

WELCOME

Page 5

02

PROGRAM

Page 6

03

SCIENTIFIC COMMITTEE

Page 8

04

DETAILED PROGRAM

Page 10

05

PRACTICAL INFORMATION

Page 18

06

SUGGESTED READING

Page 19

07

OUTCOMES

Page 21

08

ORGANIZERS AND COLLABORATORS

Page 22

09

NOTES

Page 24

EARLY LIFE EXPERIENCES VULNERABILITY OR RESILIENCE?

October 25th and 26th, 2016

WELCOME

Dear Invited Speakers and Participants,

It is our pleasure to welcome you to the meeting “Early life experiences: vulnerability or resilience?”. This event is co-organized by B-DEBATE (an initiative of Biocat and “La Caixa” Foundation) and the Institut de Neurociències from the Universitat Autònoma de Barcelona (UAB). The CORE-Salut Mental UAB, the Vall d’Hebron Research Institute and the Institute for the Study of Affective Neuroscience (University of Haifa) are collaborating entities.

As the leading cause of disability in most European countries and North America, mental disorders have emerged as the single largest health cost globally, and have been pointed out as the main health challenge in the XXI century. Around 70% of mental disorders have an early onset and are the result of intricate biological and environmental interactions along development. Early life experiences could make the difference between ending as a happy, healthy and socially integrated adult or developing psychopathology. This field of research is currently under a very rapid progress, and continuously generating new results that are adding new pieces to a complex puzzle, with important implications for a number of disciplines such as Cognitive and Clinical Neuroscience, Psychology, Psychiatry, Education or Public Health.

Recent findings are changing views in regard to the role of early life experiences and our vulnerability or resilience for developing adult mental disorders. They are demonstrating their importance in shaping brain development, affecting thus cognitive and behavioral functioning during adulthood. In this sense, a thorough debate on ongoing empirical findings is extremely necessary. Recent research has illustrated how “positive” experiences shape brain maturation, through the induction of epigenetic changes that can be transmitted from one generation to another. Moreover, other studies suggest that early exposure to moderate/mild stress could exert “protective” effects to further exposures to toxic stress during adulthood. Gaining knowledge on the factors responsible for inducing vulnerability versus resilience, regarding early life stress exposure, is of vital importance as it can yield preventive and therapeutic implications. It has also been recognized that for the treatment of several psychopathologies (attention deficit hyperactivity disorders, affective disorders, conduct disorders, obsessive-compulsive disorders...) an important number of children and adolescents are exposed to several psychotropic drugs for long periods of time. There is an emerging social debate about the “beneficial” versus “detrimental” effects of such chronic treatments and this debate needs to be translated to science and novel theories to account for those differential effects need to be formulated.

We want to generate a fruitful discussion regarding the current status of research in the field of early life experiences with the participation of leading investigators and international experts in the field. Additionally, this event will explore new frontiers and possibilities to translate recent findings into prevention/treatment recommendations. At the end of this B-Debate we would like to contribute to the scientific community and in the broader sense, to society, with conclusions regarding the right ways towards shaping resilient adults, by means of fostering the adequate experiences, from conception to adolescence.

We encourage you to participate actively in all the discussions and thank you for joining us.
Yours sincerely,

Roser Nadal and Adolf Tobeña (Scientific Leaders), Scientific Committee and B-Debate

PROGRAM

Tuesday, October 25th, 2016

9:00 **Welcome**

Montserrat Capdevila, Head of research, Area of Research and Knowledge, la Caixa Foundation
Albert Barberà, CEO, Biocat
Roser Nadal, Associate Professor, INc & UAB
Adolf Tobefia, Full Professor, INc & UAB

9:30 **SESSION 1: EARLY LIFE STRESS AND VULNERABILITY TO PSYCHOPATHOLOGY**

Chair: **Antonlo Armarlo**, INc & UAB, Barcelona, Spain

Early stress, brain sensitization and adult mental health

Lourdes Fañanás, Universitat de Barcelona, Barcelona, Spain

Environmental adversity and psychosis-spectrum phenomena

Neus Barrantes-Vidal, UAB, Barcelona, Spain

10:40 **Coffee Break**

11:10 **Stress vulnerability and stress resilience in an animal model of early life stress and PTSD**

Gal Richter-Levin, University of Haifa, Haifa, Israel

Long-term programming of brain function, behavior and metabolism by peripubertal stress

Carmen Sandi, Swiss Federal Institute of Technology in Lausanne (EPFL), Lausanne, Switzerland

How early aversive experiences influence neuronal plasticity in the adult brain?

Juan Nacher, Universitat de València, València, Spain

13:00 **Open debate**

13:30 **Lunch**

15:25 **SESSION 2: BENEFICIAL LONG-TERM EFFECTS OF SINGULAR EARLY LIFE EXPERIENCES**

Chair: **Raül Andero**, INc & UAB, Barcelona, Spain

Positive early life experiences and consequences at adulthood

Roser Nadal, INc & UAB, Barcelona, Spain

Early handling-stimulation and long-term consequences

Albert Fernández Teruel, INc & UAB, Barcelona, Spain

Evidence supporting the match/mismatch hypothesis of psychiatric disorders

Mathias V Schmidt, Max Planck Institute of Psychiatry, Munich, Germany

Recognizing resilience: learning from the effects of stress on the developing brain

Ana Katharina Braun, Otto-von-Guericke-University Magdeburg, Magdeburg, Germany

17:30 **Open debate**

Wednesday, October 26th, 2016

9:00 SESSION 3: LONG-TERM EFFECTS OF PAEDIATRIC PSYCHOTROPIC DRUGS: DETRIMENTAL OR ENHANCING?

Chair: **Antoni Ramos-Quiroga**, Vall d'Hebron University Hospital, Barcelona, Spain

Translational models of early exposure to psychotropic drugs

Susan L Andersen, McLean Hospital - Harvard Medical School, Belmont, USA

Fetal alcohol spectrum disorder as a generator of pathology

Montse Pàmias, Parc Taulí Hospital, Barcelona, Spain

10:30 Coffee Break

11:15 Effects of medication in long-term outcomes of ADHD

Antoni Ramos-Quiroga, Vall d'Hebron University Hospital, Barcelona, Spain

12:00 Open debate

13:00 Lunch

14:50 SESSION 4: TRANSGENERATIONAL EFFECTS OF EARLY LIFE TREATMENTS

Chair: **Roser Nadal**, INc & UAB, Barcelona, Spain

Intergenerational and transgenerational transmission of risk for psychopathology - The olfactory system as a model

Kerry Ressler, McLean Hospital - Harvard Medical School, Belmont, USA

Transgenerational effects of early life treatments: A mouse model and potential mechanisms

Isabelle M Mansuy, Swiss Federal Institute of Technology Zürich (ETHZ), Zürich, Switzerland

Effects of the Holocaust on the next generation

Rachel Yehuda, Mount Sinai Hospital, New York, USA

16:15 Open debate

SCIENTIFIC COMMITTEE



Roser Nadal, Associate Professor of Psychobiology and ICREA Academic Professor, Institut de Neurociències, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain.

Roser Nadal is an Associate Professor at the Department of Psychobiology at the UAB. After obtaining her PhD in Psychology in 1992 (UAB), completed postdoctoral stays in 1996-1997 at Wake Forest University (NC, USA) and got a tenure position in 1998. In 2000 she was Visiting Scholar at the University of California in San Francisco, in 2010 at the University of Colorado at Boulder and in 2013 at the British Columbia University. Dr Nadal's research interest is focused on Neurobiology of stress and vulnerability to Psychopathology using rodent behavioral models. She has been the INC-UAB Vicedirector (2010-2016) and has led a large number of outreach projects to disseminate public knowledge of Behavioral Neuroscience.

Dr R. Nadal has coauthored more than 70 publications and since 2003, her group belongs to the Generalitat de Catalunya Excellence Groups (SGR), the Network of Addictive Disorders (RETICS, Instituto de Salud Carlos III) and she is associated to the Network of Mental Health (CIBERSAM). She has participated (as PI or CO-PI) in more than 18 other national projects. Dr Nadal has participated in international projects (European Foundation for Alcohol Research; Integrated Collaborative Actions with Hungary) and has developed an intensive KKT activity (Collaboration agreement with Panlab-Harvard, RETOS Project with Oryzon-Genomics). She has supervised 11 PhD theses (+ 2 ongoing) and 11 Master theses. Dr Nadal actively collaborates in Gender in Science Committees and national (AGAUR, ANECA, ANEP, AVAP, Junta de Andalucía, MICINN, PNSD) and international (Slovak and Dutch Ministries of Science) funding agencies and scientific journals. She has been in the scientific Committee of several national (Mental Health CORE-UAB), and international (FENS, BARCCSYN) meetings. Dr Nadal has been recently invited to give lectures in different international centres and in 2015, received the prestigious ICREA Academia Award in Behavioral Sciences (2015-19).



Adolf Tobefia, Full Professor of Psychiatry at Institut de Neurociències, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain.

Full Professor of Psychiatry at the Universitat Autònoma de Barcelona (UAB). Research on the neurobiology of fearfulness and neuroimage of psychiatric disorders, Unit of Medical Psychology, Dept. Psychiatry, School of Medicine, Bellaterra, UAB. Author of 15 books and 160 papers published in journals of Neuroscience, Psychiatry and Psychology. Visiting Professor at the Institute of Psychiatry (University of London), and at the Universities of Groningen, Tel Aviv, Venice, Córdoba (Argentina). Invited lecturer at Universities, Research Centers and international meetings. Broadcasting programs and written columns in Barcelona media on scientific topics. City of Barcelona Award, on Science, 1992; "Avui" Award, on Scientific Journalism, 1991; "Serra i Moret" Award, on Civic Promotion, 1994; European Award "Estudio General", on Scientific Popularization, 2004 (University of Valencia). Last books: "Mártires mortíferos: biología del altruismo letal" Valencia: Bromera-PUV, 2004; "Cerebro y poder" Madrid: La Esfera de los Libros, 2008; "Values, empathy and fairness across social barriers" New York: Annals NYAS, Vol. 1167, 2009 (Co-Ed); "Píldoras o Freud" Madrid: Alianza, 2012; "Devotos y descreídos: biología de la religiosidad", Valencia: PUV, 2014.



Raül Andero, Ramón y Cajal Investigator at **Institut de Neurociències, Universitat Autònoma de Barcelona (UAB,)**, Spain and Research Fellow at **Harvard Medical School**, USA.

Dr. Andero obtained his PhD at the Universitat Autònoma de Barcelona (2010) at the laboratory of Dr. Antonio Armario and Dr. Roser Nadal. He then joined Emory University (Atlanta, USA) as Postdoctoral Fellow at the laboratory of Dr. Kerry Ressler (2011-2015). Dr. Andero was appointed Faculty Instructor in 2015 at Harvard Medical School and joined UAB in 2016 as Ramón y Cajal Investigator. His research is focused in the biological basis of the brain in fear and stress processes at a genetic and molecular level. Additionally, his studies are aimed at boosting the translation of the findings in the laboratory to the clinic in order to better discover treatments for fear-based disorders such as Posttraumatic Stress Disorder, Phobias or Panic Disorder. His work has been funded by institutions such as the National Institutes of Health (NIH, USA, Co-Investigator) and the Brain & Behavior Research Foundation (USA) with a NARSAD Young Investigator Grant as Principal Investigator. In addition, his work has been featured in media of over 25 countries including Los Angeles Times, El Pais and Scientific American.



Antonio Armario, Full Professor of Physiology, **Institut de Neurociències, Universitat Autònoma de Barcelona (UAB,)**, Barcelona, Spain.

Antonio Armario is currently Full Professor of Physiology at the Institut de Neurociències and the Department of Cellular Biology, Physiology and Immunology (Animal Physiology Unit, School of Biosciences) in the Universitat Autònoma de Barcelona. His main interests are: (1) Biological markers of acute and chronic stress; (2) Adaptation (habituation) to chronic stress; (3) Animal models of depression and posttraumatic stress disorder; (4) Brain processing of stressors: immediate early genes and epigenetics changes; (5) Interaction between stress and addictive drugs and (6) Biological bases of individual differences. He has directed or co-directed 30 doctoral dissertations and participated with invited lectures in 20 Meetings and Symposia. Dr Armario is member of the editorial board of *Frontiers in Behavioural Neuroscience*; *Pharmacology, Biochemistry and Behavior*, and *Stress*. He has published 196 papers in peer review journals and has an H index of 47. He has awarded with the IX prize in Health Sciences of the Uriach Foundation in 2006, on the topic “Stress: physiology and derived pathologies”. His last project is the study of “Uncontrollable stress in adolescence as a predisposing factor to psychopathology: role of the reorganization of prefrontal circuits and the dopaminergic System”.



J. Antoni Ramos-Quiroga, Associate Professor at **Vall Hebron Research Institute (VHIR)**, Barcelona, Spain.

Antoni Ramos-Quiroga, (1971) is Associate Professor of Psychiatry at the Universitat Autònoma de Barcelona and Head of Department of Psychiatry of the Hospital Universitari Vall d’Hebron. He is principal investigator of the Vall Hebron Research Institute (VHIR) and member of the Centre for Biomedical Research in Mental Health Network (CIBERSAM). He conducts research focused on ADHD in adolescents and adults, including clinical trials, drug trials, studies of neuroimaging and genetics. He is author of more than 110 international publications and 5 books on ADHD. He has been speaker in national and international conferences on ADHD.

INVITED SPEAKERS

Thursday, October 13th, 2016

Session 1: Early life stress and vulnerability to psychopathology



Antonio Armario, Full Professor of Physiology, Institut de Neurociències, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain.

(See his CV at the Scientific Committee section)

Chair of the **SESSION 1**



Lourdes Fañanás, Associate Professor, University of Barcelona, Barcelona, Spain.

Lourdes Fañanás Saura obtained her degree on Biology at the Universitat de Barcelona and on Medicine and Surgery at the Universitat Autònoma de Barcelona. Her PhD project was focused on the study of biological and genetic risk factors in Schizophrenia, and she received her PhD title in Biological Sciences with honours at the Universitat de Barcelona in 1988. Dr. Fañanás performed her post-doctoral research between 1994 and 1997, in several stays at the Institute of Psychiatry and University College of London. Because of her collaboration, she was nominated as Honorary Senior Lecturer. Dr Fañanás is Associate Professor at the Faculty of Biology of the University of Barcelona since 1997. She is currently professor in the Biomedical Sciences Degree from the University of Barcelona, and she participates in the doctoral programs of Physical Anthropology (Interuniversity UB-UAB) and Biomedicine. Regarding research activities, She leads the research group "Genes and environment in the comprehension of diversity of human behaviour and the ethiopathogeny of mental illness ", which is accredited as a Consolidated Research Group by the Generalitat de Catalunya. Also this research group is part of various national competitive research institutes and networks. The scientific production related to these projects is reflected by the publication of more than a hundred original articles in peer-reviewed International journals, books and book chapters.

Early stress, brain sensitization and adult mental health

Psychosocially stressful events usually trigger the adult onset of an extremely high percentage of mental disorders. Recently, major attention from the scientific community has been paid to the major causal role of early adversity and psychosocial stress in the sensitization to suffer psychopathology in adulthood; nevertheless, the biological pathways underlying this association remain unknown. The long latency between early exposure to environmental risk factors and the late onset of a pathological status is widely observed in several complex disorders such as cancer, metabolic diseases and psychiatric conditions. Early life events, such as prenatal stress or childhood adversity, may have the potential to modify later vulnerability to complex disorders due to developmental plasticity, i.e. the ability to develop in various ways depending on the early environment, thus allowing an organism to adapt. This evolutionary competence is probably mediated, at least in part, by epigenetic mechanisms, such as histone modifications and DNA methylation, and has recently received much more attention because of its potential role as a biological mediator of the pathogenic factor of maltreatment in mental disorders.



Neus Barrantes Vidal, Associate Professor at the **Universitat Autònoma de Barcelona (UAB)**, Barcelona, Spain.

Dr. Neus Barrantes-Vidal is a Clinical Psychologist and Associate Professor at the Universitat Autònoma de Barcelona. She heads the research group “Person-Environment Interaction in Psychopathology”, which focuses on the interaction of genotype, person and psychosocial environment in configuring several etiological pathways to psychosis. She holds an Adjunct Associate Professorship at the University of North Carolina at Greensboro (US) and has been granted the ICREA Academia to Distinguished Research Award. Recently, she has been appointed by the Scientific Policy Department of the Spanish Ministry of Economy and Competitiveness as member of the Committee managing the national call of R+D+I projects in Psychology (2015-17). In addition, she serves as a Research Consultant for one of the nine clinical centers in Catalonia with a specialized service for Early Psychosis, the Department of Mental Health at the Sant Pere Claver Health Foundation (Barcelona).

Environmental adversity and psychosis-spectrum phenomena

Although substantial research has linked a range of adverse environmental factors with the risk for psychosis-spectrum phenomena, we still lack a clear understanding of the mechanistic processes involved. This presentation will describe recent findings from PSYRIS-Barcelona (a longitudinal investigation examining risk and resilience for psychosis across its clinical and subclinical manifestations) on one such environmental factor—namely, childhood adversity. Specifically, the presentation will address plausible mechanisms implicated in the associations between childhood adverse experiences and psychosis-spectrum phenomena, with a particular focus on results supporting the notion that specific forms of attachment insecurity and increased reactivity to momentary stress in daily life (assessed via experience sampling methodology) are relevant psychological mechanisms involved in these associations. Gene-environment interaction results will also be presented, providing evidence of the interplay between childhood adversities and variation within certain relevant stress-related genes in the expression of psychotic phenomena and/or stress-reactivity. Finally, limitations and challenges in the field will be discussed as well as the significance of delineating mechanistic processes for identifying potentially useful targets for intervention strategies.



Gal Richter-Levin, Director of the Institute for the Study of Affective Neuroscience (ISAN), **University of Haifa**, Haifa, Israel.

Prof. Gal Richter-Levin is the founder and head of the Haifa Forum for Brain and Behavior, and the director of the Institute for the Study of Affective Neuroscience (ISAN), at the University of Haifa. He obtained his PhD in Neurobiology (1992) at the Weizmann Institute, Rehovot, Israel, and after two years as an HFSP postdoctoral fellow at the National Institute for Medical Research, London, UK, he joined the University of Haifa in 1995. Since 2006 he is a full professor in both the Sagol Department of Neurobiology and the Department of Psychology. In 2009-2013 He was elected as Dean of the Faculty of Natural Sciences, University of Haifa. He was the president of the Israeli Society for Biological Psychiatry (2006 – 2008). He is a member of the Scientific Advisory Board of the National Institute for Psychobiology, member of the European Dana Alliance for the Brain (EDAB), and a member of the British-Israeli Science Council. Last year he was elected as the president of the Israel Society for Neuroscience (ISFN) (2015-2017).

Stress vulnerability and stress resilience in an animal model of early life stress and PTSD

Although Psychiatric diagnosis in humans is based on comparing individuals to the normal population, many animal models analyze averaged group effects, thus compromising their translational power. In our Posttraumatic stress disorder (PTSD) rat model, we utilize a behavioral profiling approach that allows the classification of affected and unaffected individuals. Rats were exposed to underwater-trauma (UWT) and four weeks later their performances in the open-field and elevated-plus-maze were compared to those of the control group, allowing the identification of affected and resilient UWT-exposed rats. Behavioral profiling revealed that only a subset of the UWT-exposed rats developed long-lasting behavioral symptoms. The proportion of affected rats was further enhanced by pre-exposure to juvenile stress, a well-described risk factor of PTSD. We analyzed the levels of GABAA receptor subunits $\alpha 1$ and $\alpha 2$ in the hippocampus and amygdala. Increased expression, mainly of $\alpha 1$, was observed in ventral but not dorsal hippocampus of exposed animals, which would traditionally be interpreted as being associated with the psychopathology. However, behavioral profiling revealed that this alteration was confined to exposed-unaffected individuals, suggesting a resilience-associated expression regulation. The results provide evidence for the importance of employing behavioral profiling in order to better understand stress vulnerability and resilience.



Carmen Sandi, Professor and Director of the Brain Mind Institute , **Swiss Federal Institute of Technology in Lausanne (EPFL)**, Lausanne, Switzerland.

Carmen Sandi is Professor of Neuroscience at the Swiss Federal Institute of Technology in Lausanne (EPFL), Switzerland, where she is the Director of the Brain Mind Institute and leads the Laboratory of Behavioral Genetics. She did her Ph.D. studies in Neuroscience at the Cajal Institute, in Madrid, and had postdoctoral appointments at the University of Bordeaux II-INSERM, and the Open University, UK.

Then, she was recruited as Associate Professor at UNED University in Madrid where she directed the Laboratory Stress and Memory. After a sabbatical stay at the University of Bern in 2003, she joined the EPFL.

Her goal is to understand how stress affects brain function and behavior. Her work has been pioneering in identifying the neurobiological mechanisms whereby stress affects cognitive function and psychopathology. Currently, her lab is developing an ambitious research program combining approaches in rodents and humans that focuses on the understanding of stress effects in the social brain and the emergence of violence, including the factors that define individual differences in resilience and vulnerability to stress. A special emphasis is placed on the regulation of brain bioenergetics in the long-term programming of behavior and peripheral metabolism by early life stress. Recently, they have identified a key role for mitochondrial function in the nucleus accumbens in the link between anxiety and social competition.

Long-term programming of brain function, behavior and metabolism by peripubertal stress

Stressful life events are key contributors for the development of psychopathological and metabolic alterations and, when experienced early in life, they can have long-term consequences in adult life. I will present data from peripubertal stress models in rats and mice on long-lasting alterations in depression- and anxiety-like behaviors, aggression and abdominal fat levels. I will also present findings on enduring alterations in brain structure and gene expression levels in different brain regions, and evidence for a role of the hypothalamic-pituitary-adrenal axis in the definition of divergent phenotypes.



Juan Nàcher, Associate Professor at the **Universitat de València**, Barcelona, Spain.

Juan Nàcher is Associate Professor in the Neurobiology Unit of the Universitat de València, he is also associated to the Spanish Research Network on Mental Health (CIBERSAM) and is currently vice-president of the Spanish Neuroscience Society (SENC). He received his Ph.D. in Neurobiology in the U.V. and developed postdoctoral work in Bruce McEwen's lab in Rockefeller University, studying the effects of stress and NMDA receptor manipulation on adult neuronal structural plasticity. After coming back to Valencia he has continued his research on this plasticity, focusing on its alterations in psychiatric disorders and on the impact produced by aversive experiences during early life and adolescence (<http://www.nacherlab.com>).

How early aversive experiences influence neuronal plasticity in the adult brain?

Aversive experiences, such as stress, during infancy or adolescence are risk factors for different psychiatric disorders, including schizophrenia. In this talk I will present recent data from our laboratory and others on the neurobiological basis of the consequences of peripubertal stress on the adult brain. I will focus specially on the impact of this stress on inhibitory neuronal networks and on its effect on neuronal plasticity. We will also discuss about aggravating factors, such as cannabis abuse, and on the development of innovative therapies to revert the impact of stress during adolescence.

Session 2: Beneficial long-term effects of singular early life experiences



Raül Andero, Ramón y Cajal Investigator at **Institut de Neurociències, Universitat Autònoma de Barcelona (UAB)**, Spain, and Research Fellow at **Harvard Medical School**, USA.

(See his CV at the Scientific Committee section)

Chair of the **SESSION 2**



Roser Nadal, Associate Professor of Psychobiology and ICREA Academic Professor, **Institut de Neurociències, Universitat Autònoma de Barcelona (UAB)**, Barcelona, Spain.

(See her CV at the Scientific Committee Section)

Positive early life experiences and consequences at adulthood

Several early life experiences exert important long-term consequences in the behavior and physiology of the central nervous system. In my presentation I will give a general background of the most studied situations focusing in animal models, such as postnatal handling, environmental enrichment or adequate maternal care. I will illustrate with representative works the important effects of those treatments and I will introduce other less studied or controversial situations. Among them is the exposure of some type of early stressors which may confer resilience to further encounters with other stressors at adulthood. Some of the early life experiences described induce persistent epigenetic changes and their effects, under some circumstances, may be even be transmitted intergenerationally. These experiences open several windows of opportunity to counteract the impact of “negative” stimuli and have important preventive consequences.



Albert Fernández Teruel, Associate Professor at the **Institut de Neurociències, Universitat Autònoma de Barcelona (UAB)**, Barcelona, Spain.

He obtained his PhD in Psychology (1989) at the Universitat Autònoma de Barcelona (UAB). He has been researcher at the University of Cagliari (Italy, 1987, 1991), and visiting scientist at the ETH-Zentrum (Switzerland, 1990, 1994-1995), at the Department of Pharmacology- Universidad de Cantabria (1995), at the Department of Environmental and Life Science-University of Cagliari (Italy, 2016). He was Associate Professor of Psychopharmacology and Psychobiology at the University of Santiago de Compostela (1996-1998), and he is currently Associate Professor at the Department of Psychiatry & Forensic Medicine (UAB, since 1998), where he leads the Animal Research Laboratory and the “Animal and human models of mental disorders” SGR group.

Early handling-stimulation and long-term consequences

Between 1956 and 1957 Seymour Levine was first to report the long-term beneficial effects of neonatal handling (early handling –EH-, a type of mild neonatal stimulation) on emotional learning and physiological signs of stress in rodents. During adulthood, EH rats were less anxious/fearful, showed lowered physiological responses to stress and improved coping responses, as well as enhanced cognitive abilities. Further work (from Meaney’s group, our group and others) during the 1980s and 1990s, confirmed Levine’s findings and extended it to show that EH led to profound long-term neural plasticity consequences, such as improvements of hippocampal long-term potentiation and prevention of age-related hippocampal neurodegeneration. We have shown that EH can reverse (or attenuate) some genetically-based emotional and cognitive phenotypes and, in parallel, it produces long-lasting reductions of hippocampus and amygdala volume specifically in high anxious rats. These structural effects are in turn correlated with the behavioural changes induced by EH. Early handling-like treatments have also been applied to humans, particularly to preterm infants, with very positive neurodevelopmental and behavioural effects being observed at follow-up. The specific factors (e.g. mother-infant separation, isolation, tactile stimulation) contributing to the long-term behavioural and neural effects of early handling-stimulation will be discussed.



Mathias V. Schmidt, Group Leader at the Department of Stress Neurobiology and Neurogenetics at the **Max Planck Institute of Psychiatry**, Munich, Germany.

Mathias V. Schmidt is a group leader at the Department of Stress Neurobiology and Neurogenetics at the Max Planck Institute of Psychiatry in Munich (Germany). He received his PhD in 2004 at the University of Leiden (Netherlands) for his work on the mechanisms of early life stress in mice. His current research, which is funded by a number of national and international grants, focuses on the impact of stress during different life stages on individual health and disease. Using a wide array of behavioral, neuroendocrine and molecular approaches, Mathias Schmidt is pursuing the question why some individuals are resilient to severe stress exposure and thrive even in the face of adversity. His work is published in over 85 peer-reviewed research articles. Among his awards are the Ernst and Berta Scharrer Award of the German Endocrine Society and the NARSAD Young Investigator Award.

Evidence supporting the match/mismatch hypothesis of psychiatric disorders

Chronic stress is widely regarded as key risk factor for a variety of diseases, including depression. Yet, while some individuals are vulnerable to stress, others are remarkably resilient. It seems clear that genetic predispositions interact with environmental demands such as chronic stress and modulate its long-term outcome. In addition, there is abundant evidence that environmental circumstances early in life are capable of shaping the adult phenotype. In the last years two seemingly opposing views on early life stress have emerged, the two-hit model and the mismatch model. While the first hypothesis states that aversive experiences early in life predispose individuals to be more vulnerable to aversive challenges later in life, the second hypothesis argues that aversive experiences early in life result in individuals that are better adapted to aversive challenges later in life. There are published data in animals as well as in humans that support either hypothesis, but the interaction with genetic predispositions has rarely been addressed. In my presentation I will propose that both views may be accurate and that the outcome of an early-life stress exposure depend on the genetic background of the individual. In addition, even within the same individual certain phenotypes may be progressively affected by multiple stress exposures (two-hit model), while other phenotypes would be most affected under mismatched conditions. I will illustrate the potential of genetic variations to modulate the outcome of early life adversity and discuss research strategies necessary to address the issue of genetic*development*environment interaction.



Anna Katharina Braun, Chair of Dept. Zoology & Developmental Neurobiology at the **Otto von Guericke-University Magdeburg**, Magdeburg, Germany.

Professor Anna Katharina Braun obtained a PhD degree in Zoology at the Technical University in Darmstadt. After several years of postdoctoral research at the University of Washington, Seattle, she was appointed chair of the department “Zoology and Developmental Neurobiology” at the Otto von Guericke University Magdeburg, Germany. She was visiting professor at the Weizmann Institute of Science in Israel and at Keio University in Tokyo. She has published more than 140 peer reviewed articles, her research focuses on the ontogeny of emotional and cognitive behavior and the underlying neuronal and molecular mechanisms in prefronto-limbic brain circuits. In a variety of animal models she investigates epigenetic and brain structural plasticity underlying the long-term impact of early life challenges on behavioral and brain functions with focus on sex-specific vulnerability and resilience, respectively. In a novel animal model she investigates the contribution of paternal care to the functional maturation of brain and behavior in the offspring and she also investigates the plasticity of the paternal brain in response to the interaction with his offspring. Another focus of her research lies on long-term consequences of learning in infancy on adult learning competence.

Recognizing resilience: learning from the effects of stress on the developing brain

Development is a dynamic process involving the interplay between genes and the environment that can lead to diverse phenotypic outcomes. Withdrawal or variations of maternal care, deprivation, neglect and exposure to early life stress have long-term consequences on brain functions and thereby alter stress reactivity, fear responses, affect, cognition and social/reproductive behavior in offspring. However, there is increasing evidence from animal experimental approaches that early life adversities do not always induce negative consequences but may also induce resilience. Resilience can be defined as individual ability to withstand and adapt to adverse and traumatic events. For instance, we showed that early life stress, induced by brief periods of separation from the mother or from both parents, induces sex-specific epigenetic and brain structural changes in prefrontal and limbic brain regions, which appear to be beneficial for the offspring’s cognitive and emotional development. Moreover, exposure to multiple stress episodes does not necessarily increase vulnerability towards stressors: Early life stress may act as “stress inoculation” and thereby induce resilience towards stressors in later life. Unveiling the neuronal mechanisms mediating resilience is an essential prerequisite to optimize preventive and therapeutic approaches.

Wednesday, October 26th, 2016

Session 3: Long-term effects of paediatric psychotropic drugs: detrimental or enhancing?



J. Antoni Ramos-Quiroga, Associate Professor at Vall Hebron Research Institute (VHIR), Barcelona, Spain.

(See his CV at the Scientific Committee Section)

Effects of medication in long-term outcomes of ADHD

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder with a high prevalence in childhood (5-6% of the general population) that continued in adulthood in around 50% of cases. Drug treatment is one of the therapeutic options in moderate and severe ADHD. Several studies were carried out over the last years evaluating the long-term outcomes of ADHD with the goal of identifying long-term outcomes and the impact that pharmacological treatment has on ADHD long-term outcomes. The outcomes studied were criminality, risk of attempt suicide, car accidents, scholar achievement or risk of other mental disorders, as depression. The results of these studies support the premise that without treatment, people with ADHD often experience poorer long-term outcomes and that treatment may improve the long-term outcomes of ADHD for some individuals, but not necessarily to the degree of healthy controls.

Chair of the **SESSION 3**



Susan L Andersen, Associate Professor of Psychiatry at Harvard Medical School, Belmont, MA, USA.

Dr. Susan Andersen is currently an Associate Professor of Psychiatry at Harvard Medical School. She received her Ph.D. from the State University of New York in Binghamton, and went to McLean Hospital for her post-doctoral fellowship where she is the Director of the Laboratory of Developmental Neuropharmacology. Dr. Andersen is a Fellow of the American College of Neuropsychopharmacology and the International Behavioral Neuroscience Society, serves on the editorial boards for the journals, Psychopharmacology, Pediatric Rehabilitation, and Synapse, and has recently co-edited the book "The Neurobiology of Childhood" with Dr. Daniel Pine and published by Springer. She also serves on the executive board of the National Prevention Science Coalition, which aims to help our most vulnerable populations achieve their fullest potential. Dr. Andersen's interests focus on normal and abnormal changes in the developing brain, but also on its resilience when exposed to a preventative intervention. Her approach is multi-faceted, including neuroimaging, behavior, and biochemistry, and translational in nature with relevance to ADHD, addiction, and depression.

Translational models of early exposure to psychotropic drugs

Early intervention for any disorder, including attention deficit hyperactivity disorder (ADHD), can have long-term consequences. Enduring outcomes will depend on the timing of the intervention, the sex of the subject, the severity or nature of the disorder itself, and the treatment will interact with development to fully manifest. Studying the long-term effects of an intervention in humans is difficult due to a number of factors. However, clinical research shows that prepubertal treatment with psychostimulants can reduce the risk of substance use by adolescence in a subset of patients. Methylphenidate treatment (followed by cessation) increases blood flow in key regions that are involved in the pathophysiology of ADHD in children, but not adults. When studied under stringent laboratory conditions, these observations parallel pharmacMRI findings in male rats treated with methylphenidate pre-pubertally and suggest a change in physiology that is conserved across mammalian species. Further, treated male rats also demonstrated reduced preferences for cocaine-associated environments that are mediated by reduced cortical D3 receptors and plasticity mediated by lower BDNF. The role of sex and severity in translational models is also a factor. Treatment effects in typical females suggest adverse effects, whereas treatments in animal models of ADHD show beneficial effects.



Montse Pamias, Head of Child and Adolescent Psychiatry at **Corporació Sanitària Parc Tauli de Sabadell**, Barcelona, Spain.

Graduated in Medicine by the University of Navarra. Specialist in Psychiatry. Head of Child and Adolescent Psychiatry in Corporació Sanitària Parc Tauli de Sabadell (Barcelona). President of the Catalan Society of Child and Adolescent Psychiatry. Professor at the International University of Catalonia (Faculty of Medicine). Areas of interest and scientific publications: ADHD, autism, mood disorder in children and adolescents. Resource management in Community Psychiatry. Interdisciplinary work in Psychology and Education.

Fetal alcohol spectrum disorder as a generator of pathology

Fetal alcohol spectrum disorder are a group of conditions that occur in a person whose mother drank alcohol during pregnancy. Epidemiology data show that it affect between 2 and 5 % of people in the US and Western Europe. In this conference we will discuss the neuropsychological aspects of the FAS, and learning consequences during the lifespan. I'll talk about the more frequent psychiatric comorbidities, like ADHD syndrome, autism spectrum disorder syndrome, and personality dysfunction, regarding their childhood traits and adult life consequences. Finally i will review the psychosocial treatment, and evidence based pharmacological strategies.

Session 4: Transgenerational effects of early life treatments



Roser Nadal, Associate Professor of Psychobiology and ICREA Academic Professor, **Institut de Neurociències, Universitat Autònoma de Barcelona (UAB)**, Barcelona, Spain.

(See her CV at the Scientific Committee Section)

Chair of the **SESSION 4**



Kerry Ressler, Chief Scientific Officer, and Chief of the Division of Depression and Anxiety Disorders at **McLean Hospital** and Professor at **Harvard Medical School**, Belmont, MA, USA.

Kerry J. Ressler, MD, PhD, is Professor of Psychiatry at the Harvard Medical School and the James and Patricia Poitras Chair in Psychiatry, Chief Scientific Officer, and Chief of the Division of Depression and Anxiety Disorders at McLean Hospital. He began this role in August, 2015, after serving at Emory University in Atlanta for 18 years. He is also the 2016 President-Elect of the US Society for Biological Psychiatry. He received his Bachelor of Science degree in molecular biology from M.I.T., and his M.D./Ph.D. from Harvard Medical School. In 1992 at Harvard, he was the first student of Dr. Linda Buck (Nobel Prize, 2004), helping to identify the molecular organization of the olfactory receptor system. Dr. Ressler is a previous Investigator of the Howard Hughes Medical Institute and a current member of the National Academy of Medicine (formerly the IOM). His work focuses on translational research bridging molecular neurobiology in animal models with human genetic research on emotion, particularly fear and anxiety disorders. He has published over 250 manuscripts ranging from basic molecular mechanisms of fear processing to understanding how emotion is encoded in a region of the brain called the amygdala, in both animal models and human patients.

Intergenerational and Transgenerational Transmission of Risk for Psychopathology - The Olfactory System as a Model

Trajectories towards risk or resilience in psychiatric disorders are influenced by acquired and inherited factors. More recently, evidence from rodent studies suggest that acquired risk factors can be transmitted through epigenetic mechanisms to subsequent generations, potentially contributing to a vicious cycle of disease and disease risk. Here, I review examples of transmission of environmental factors across generations and illustrate the difference between behavioral transmission and epigenetic inheritance. To address the question of intergenerational transmission of emotion-related traits in a reduced and mechanistic way, our group recently developed a paradigm to follow the structural representation of olfactory processing across generations. Epigenetic analyses indicated that these neuroanatomical changes result from heritable and

long-lasting DNA changes resulting in increased transcription of receptor genes that detect conditioned odors (Dias et al., Nature Neurosci, 2014; Dias et al., Trends in Neurosci, 2015; Klengel et al., Neuropsychopharm, 2016). Together, these studies with in vitro fertilization and across generations, show that these transgenerational phenomena are inherited via the gametes, suggesting that parental olfactory experience before conception may be inherited at the level of structure / function in the nervous system. I will then summarize how such phenomena may influence understanding of psychiatric disorders in the future.



Isabelle M Mansuy, Professor in Neuroepigenetics, **Swiss Federal Institute of Technology Zürich (ETHZ)**, Zürich, Switzerland.

Isabelle Mansuy is Professor in Neuroepigenetics at the Medical Faculty of the University Zürich and the Swiss Federal Institute of Technology Zürich (ETHZ). She obtained a PhD in Developmental Neurobiology at the Université Louis Pasteur Strasbourg, France then trained as a postdoctoral fellow at Columbia University, New York before establishing her lab in Zürich (1999). Her research examines the epigenetic basis of complex brain functions and the heritability of acquired traits across generations in mammals. It focuses on the mechanisms underlying the expression and the inheritance of the effects of environmental factors such as traumatic stress in early life, on behavior and physiology, and their link with diseases in humans.

Transgenerational effects of early life treatments: A mouse model and potential mechanisms

Behavior in mammals is strongly influenced by environmental factors, particularly when experienced during early postnatal life. While positive factors can favor proper behavioral responses, negative factors such as traumatic events can alter behavior and induce diseases like borderline personality disorder, bipolar depression and antisocial behaviors. Such disorders are usually marked in the individuals directly exposed but can affect their offspring sometimes across several generations. The biological mechanisms responsible for the transmission of trauma-induced symptoms from parent to offspring are thought to involve non-genetic mechanisms. This talk will present an experimental model of early traumatic stress in mice and show evidence for the implication of non-genetic mechanisms in the expression and inheritance of the impact of such trauma. This mouse model exhibits altered social behaviors, depressive-like symptoms, cognitive deficits, and impaired glucose regulation in adulthood. The symptoms are pronounced and persist throughout life, but are also transmitted to the following offspring across several generations, through both females and males. They are associated with epigenetic alterations involving persistent changes in DNA methylation at the promoter-associated CpG island of several genes, in the brain of the offspring and the germline of their father. Further to DNA methylation, other non-genetic mechanisms involving regulation by non-coding RNAs and histone posttranslational modifications are also involved. These findings suggest that non-genetic processes largely contribute to the impact of negative environmental factors in early life on adult behavior, and its inheritance.



Rachel Yehuda, Professor of Psychiatry and Neuroscience at the Icahn School of Medicine at **Mount Sinai** and Director of the Mental Health Patient Care Center at the **James J. Peters Bronx Veterans Affairs hospital**, New York, USA.

Rachel Yehuda, Ph.D. is a Professor of Psychiatry and Neuroscience at the Icahn School of Medicine at Mount Sinai and Director of the Mental Health Patient Care Center at the James J. Peters Bronx Veterans Affairs hospital, both in New York City. She has published several hundred papers and compiled over 10 edited volumes examining diverse aspects of traumatic stress in various populations. Her research on PTSD has included both human populations and animal models, neuroendocrinology, neuroimaging, genomic and molecular biological studies of trauma, experimental therapeutics including both pharmacological and psychotherapy trials, biomarkers, studies of genetic and epigenetic heritability, gender differences, and suicide.

Effects of the Holocaust on the Next Generation

This presentation will summarize clinical, functional and molecular data demonstrating effects of parental Holocaust exposure. Adult offspring of Holocaust survivors appear to be at greater risk for the development of PTSD, mood and anxiety disorders, and maternal PTSD appears to be the salient risk factor. Our data have demonstrated differences in neuroendocrine and molecular factors that are linked to maternal exposure and PTSD, raising the possibility that in utero factors may be involved. Data from babies born to women who were pregnant during the WTC attacks on 9/11 have supported this hypothesis, and have demonstrated evidence of early glucocorticoid programming. Though it is difficult to make attributions about mechanism in retrospective studies of adult Holocaust offspring, data from recent gene expression and methylation studies are consistent with the idea that offspring show multiple and early adaptations to parental trauma exposure that result in longstanding behavioral and biological phenotypes.

PRACTICAL INFORMATION

Venue: CosmoCaixa Barcelona



CosmoCaixa Barcelona
C/ Isaac Newton, 26
08022 Barcelona, Spain

Conferences
Agora room on -3 floor

Contact persons during the event



Roser Bastida

Communication Department, **Institut de Neurociències - UAB**
comunicacio.inc@uab.cat | Phone: +34 660605772 | +34 935813327
<http://inc.uab.cat/English/#!/home>



Marta Soler

Head of Research and Scientific Debate, **Biocat**
msoler@biocat.cat | Phone: +34 662315500 | +34 93 310 33 57
www.bdebate.org | www.biocat.cat

SUGGESTED READING

Strategic Plans or Manifesto

The National Institute of Mental Health Strategic Plan:

<http://www.nimh.nih.gov/about/strategic-planning-reports/index.shtml>

<http://www.nimh.nih.gov/about/director/2014/mental-health-in-davos.shtml>

International Society for Developmental Origins of Health and Disease. The Cape Town Manifesto – November 2015:

<https://dohadsoc.org/about/>

<https://dohadsoc.org/wp-content/uploads/2015/11/DOHaD-Society-Manifesto-Nov-17-2015.pdf>

Global Strategy for Women's, Children's and Adolescents Health 2016-2030, WHO:

<http://www.who.int/life-course/publications/global-strategy-2016-2030/en/>

Ensure healthy lives and promote well-being for all at all ages, Sustainable Development Goals, UN:

<http://www.un.org/sustainabledevelopment/health/>

Maternal Mental Health Alliance:

<http://maternalmentalhealthalliance.org/>

Scientific Societies

International Marcé Society for Perinatal Mental Health:

<https://marcesociety.com/>

International Society for Developmental Psychobiology:

<http://www.isdp.org/>

Center for Mental Health. Child and youth resources:

<http://www.centreformentalhealth.org.uk/Pages/Category/child-pubs>

Scientific reviews

Bohacek J, Mansuy IM. *Molecular insights into transgenerational non-genetic inheritance of acquired behaviours*. **Nature Reviews Genetics** 2015;16(11):641-52.

Bowers ME, Yehuda R. *Intergenerational transmission of stress in humans*. **Neuropsychopharmacology**. 2016;41(1):232-44.

Brenhouse HC, Andersen SL. *Developmental trajectories during adolescence in males and females: a cross-species understanding of underlying brain changes*. **Neuroscience and Biobehavioral Reviews**. 2011;35(8):1687-703.

Fernández-Teruel A, Giménez-Llort L, Escorihuela RM, Gil L, Aguilar R, Steimer T, Tobeña A. *Early-life handling stimulation and environmental enrichment: are some of their effects mediated by similar neural mechanisms?* **Pharmacology, Biochemistry and Behavior**. 2002;73(1):233-45.

Horovitz O, Tsoory MM, Hall J, Jacobson-Pick S, Richter-Levin G. *Post-weaning to pre-pubertal ('juvenile') stress: a model of induced predisposition to stress-related disorders*. **Neuroendocrinology**. 2012;95(1):56-64.

Klengel T, Dias BG, Ressler KJ. *Models of Intergenerational and transgenerational transmission of risk for psychopathology in mice*. **Neuropsychopharmacology**. 2016;41(1):219-31.

Matas E, Bock J, Braun K. *The impact of parent-infant interaction on epigenetic plasticity mediating synaptic adaptations in the infant brain*. **Psychopathology**. 2016;49(4).

McEwen BS, Morrison JH. *The brain on stress: vulnerability and plasticity of the prefrontal cortex over the life course*. **Neuron**. 2013;79(1):16-29.

Nederhof E, Schmidt MV. *Mismatch or cumulative stress: toward an integrated hypothesis of programming effects*. **Physiology and Behavior**. 2012;106(5):691-700.

Palma-Gudiel H, Córdova-Palomera A, Leza JC, Fañanás L. *Glucocorticoid receptor gene (NR3C1) methylation processes as mediators of early adversity in stress-related disorders causality: A critical review*. **Neuroscience and Biobehavioral Reviews**. 2015;55:520-35.

Russo SJ, Murrough JW, Han MH, Charney DS, Nestler EJ. *Neurobiology of resilience*. **Nature Neuroscience**. 2012;15(11):1475-84.

Sandi C, Haller J. *Stress and the social brain: behavioural effects and neurobiological mechanisms*. **Nature Reviews Neuroscience**. 2015;16(5):290-304.

OUTCOMES

B·Debateca

On the website of B·Debate, you will find all the information related with the celebration of the meeting that includes reports, conclusions, scientific documents, interviews with the experts, speaker's CVs, videos, images, press documentation and other related materials. We invite you to visit the section B·Debateca on www.bdebate.org

Contents of the meeting “Early Life Experiences. Vulnerability or Resilience?”

The screenshot shows the B-DEBATE website interface. At the top left is the B-DEBATE logo with the text 'International Center for Scientific Debate BARCELONA'. To the right are logos for 'biocat' and 'Obra Social 'la Caixa''. Below the logos is a navigation menu with items: INICI, B-DEBATE, CONVOCATÒRIA, DEBATECA (circled in blue), NOTÍCIES, SINOPSIS, PREMSA, and CONTACTE. A search bar is located to the right of the menu. Below the menu are three event cards, each with a 'B-DEBATE · OPEN REGISTRATION' header. The first card, titled 'Early Life Experiences. Vulnerability or Resilience?' with dates '25/10/2016 a 26/10/2016', is circled in blue. The second card is 'Imaging for Life. From Molecules to Diagnostics and Therapy' (08/11/2016 a 09/11/2016). The third card is 'Drug Repurposing for Rare Diseases. The Cure for the 21st Century' (17/11/2016 a 18/11/2016). Below these are three more sections: 'PROGRAMA 2016' (Programa d'activitats de B-Debate del 2016), 'SINOPSIS' (Microbioma: dels nostres microbis a les noves medicines), and 'CONVOCATÒRIA B-DEBATE' (La convocatòria de presentació de propostes per al programa d'activitats de 2017 ja ha tancat) with a 'LLEGEIX MÉS' button.

FOLLOW US ON SOCIAL MEDIA



#Bdebate #EarlyLife

@Bdebate

ORGANIZERS



International Center
for Scientific Debate
BARCELONA



B-Debate International Center for Scientific Debate Barcelona is a **Biocat** initiative with support from “**la Caixa**” **Foundation**. It drives first-rate international scientific debates, to foster dialogue, collaboration and open exchange of knowledge with prestigious national and international experts, to approach complex challenges of high social interest in life sciences. B-Debate sees debate as a powerful, effective way to generate knowledge and strives to help position Barcelona as a benchmark in generating knowledge and Catalonia as a country of scientific excellence.

B-Debate sees debate as a powerful, effective way to generate new knowledge. The debates are top-notch international scientific meetings featuring a selection of experts of renowned international prestige and scientists that work in Barcelona and Catalonia, moderated by scientific leaders. Since 2009 B-Debate has invited about 1200 recognized speakers and over 7.000 attendees. B-Debate seeks out answers to the challenges and needs of society in the field of life sciences, taking into account the complex, ever-changing conditions of this global world. The debates foster the integration of different disciplines of science and deal with such diverse topics as ageing, new therapeutic approaches to various diseases, innovative technology to improve knowledge of the human genome, food resources, new tools to integrate knowledge management, clinical genomics, neurosciences, climate change, and new energy sources, among others. The knowledge and results obtained through these events is spread throughout both the scientific community and general society through the various **B-Debate** channels and instruments.

More info: www.bdebate.org



In 2003 molecular biologists, physiologists, biochemists, pharmacologists, neuropathologists, histochemists, psychologists, psychobiologists and bioinformatics working at the UAB created the **Institut de Neurociències (INC) in the Universitat Autònoma de Barcelona (UAB)** with the main strategic goal of leaving traditional disciplines behind, and engaging in a multidisciplinary and translational approach to key issues about the brain in the XXI century: neurodegeneration, neuroregeneration, and the underpinnings of the normal and disturbed mind. We are interested in how the normal brain works, what happens when it gets sick, and how to cure it. We explore all levels of biological organization from the interaction among single molecules to complex behaviours using cell cultures, animal models and human patients. And we aim at applying novel molecular, cellular, genetic and psychological therapies to brain pathology. Currently the INC involves 200 researchers and is one of the premier research institutions in the field of brain and nervous system disorders in Spain.

More info: <http://inc.uab.cat/English/#!/home>

COLLABORATORS



The **CORE in Mental Health** is an initiative of the UAB created in 2014 to generate and promote networking, joining efforts and coordinating actions, transversally sharing resources and information within the UAB Campus of Excellence to increase the quality of research and innovation actions and to foster the transfer of results to both industry and society. Its main research lines are: (1) Biomarkers in Mental Health; (2) Information and Communication Technologies applied to Mental Health, and (3) Vulnerability Factors in Psychopathology.

More info: <http://www.uab.cat/web/research/cores-uab/core-in-mental-health/research-network-in-mental-health-1345698259611.html>



The **VHIR** is a public sector institution that promotes and develops the biomedical research, innovation and teaching at Vall d'Hebron University Hospital (HUVH), the hospital of Barcelona and the largest of Catalan Institute of Health (ICS). Since its creation in 1994, VHIR works to find solutions to the health problems of society, and contribute to spread them around the world. In the VHIR are working more than 1,300 people, of which over 1,200 doing research and others, around 100, help to do it or transfer it to the society once made, whether in the form of projects, technology transfer and innovation, communication or fundraising, among others.

More info: <http://en.vhir.org/portal1/homepage.asp>



The **ISAN** at the University of Haifa promotes original research, both basic and clinical, towards understanding the emotional brain and particularly focus on the causes, phenomenology, mechanisms, and treatment of affective and related disorders. ISAN operates in close cooperation with several labs from Psychology and Neurobiology Departments in the University of Haifa (Israel).

More info: <http://isan.haifa.ac.il/>



CosmoCaixa offers interactive, enjoyable science and an open door for anyone who is eager to learn and understand and who never stops wondering why things are the way they are. **CosmoCaixa Barcelona** boasts the Geological Wall and the Amazon Flooded Forest, which features more than 100 plant and animal species that convince visitors they have been transported from the Mediterranean to the very heart of the tropical jungle. In addition to its permanent facilities and its open areas, CosmoCaixa offers a scientific and educational programme that includes exhibitions, workshops, conferences, courses and debates involving experts from all over the world.

More info: www.obrasocial.lacaixa.es
