

**Frontiers arti**

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▶ **Editorial**

Idan Segev

Frontiers is Blossoming

The Frontiers endeavor starts its second year in full gear. Around 2,000 of the world's top researchers from 45 countries are now helping...

▶ **Global Open Access**

The Price of Knowledge

Various business models of research publishing, and diverse ways of distilling research data determine the accessibility...

▶ **Frontiers launches new Specialty Journals**

▶ **Frontiers Special Topics**

▶ **2008 scientific achievements, awards and prizes**

**Conference Reports**

▶ **Brain Tuning Workshop: Music, emotions, and brain plasticity**

Eva Istok and Kai Schirdewahn

EU-funded project 'Tuning the Brain for Music' organized the international and interdisciplinary workshop 'Music, emotions and brain plasticity' on February 5-6, 2009 in Helsinki, Finland. The workshop brought...

▶ **Computational & Systems Neuroscience: the 2009 Cosyne Meeting**

Matteo Carandini

Theoretical and computational approaches have become so important in neuroscience over the last decade that universities are devoting entire institutes to them. These approaches...

**Grand Challenge**

▶ **Walking toward a convergence in aging research**

Mark A. Smith and Gemma Casadesus

The brain is responsible for providing everything from the basic involuntary physiological events that allow one to breathe and live, to the conscious actions and thoughts that dictate the very essence of mankind. As such, the preservation of brain...

**Commentaries**

▶ **How precise is the timing of action potentials?**

Christoph Kirst and Marc Timme

Distributed spiking activity underlies the dynamics and function of neuronal circuits and thus their computational capabilities. Beyond a simple rate, often the timing of spikes also essentially contributes to information processing in these systems...

▶ **Cross-frequency coupling in parieto-frontal oscillatory networks during motor imagery revealed by magnetoencephalography**

Karim Jerbi and Olivier Bertrand

Movement execution is the end-product of multiple intricate neural processes including action selection and planning. Although the neural dynamics involved in such internal processes are generally investigated during the build-up to

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High Density Electrophysiology Recording System

**Neuro Informatics**  
2009  
Pilsen, September 6-8

movement...

▶ **Overlapping areas of neuronal activation after motor and mental imagery training**

Kenneth Hugdahl

The question whether mental imagery of perceptual and/or motor acts produces activation in the same or overlapping brain areas has fascinated neuroscientists and cognitive psychologists for several decades. For example, in a series of pioneering...

▶ **The emotional consequences of being distracted**

Francisco Barceló

Emotionally salient events have long been shown to engage attentional resources more than emotionally neutral events (Vuilleumier, 2005). In contrast, the reciprocal effect that attention also influences emotion has remained mostly unexplored...

## Focused Reviews

▶ **Bursts generate a non-reducible spike-pattern code**

Hugo G. Eyherabide, Ariel Rokem, Andreas V. M. Herz and Inés Samengo

On the single-neuron level...

▶ **KF-1 ubiquitin ligase: an anxiety suppressor**

Tamotsu Hashimoto-Gotoh, Naoyuki Iwabe, Atsushi Tsujimura, Keizo Takao and Tsuyoshi Miyakawa

Anxiety is an instinct that may have developed to promote adaptive survival by evading unnecessary danger. However, excessive anxiety is disruptive and can be a basic disorder of other psychiatric diseases such as depression. The KF-1...

▶ **Double trouble? Potential for hyperexcitability following both channelopathic up- and downregulation of  $I_h$  in epilepsy**

Jonas Dyhrfeld-Johnsen, Robert J. Morgan and Ivan Soltesz

Studies of pathological ion channel regulation as an underlying mechanism of epilepsy have revealed alterations of the h-current in several animal models. While prior reports indicate that downregulation of the h-current is pro-excitatory on the...

▶ **Left temporal lobe structural and functional abnormality underlying auditory hallucinations**

Kenneth Hugdahl, Else-Marie Løberg and Merethe Nygård

In this article...

▶ **Fluid reasoning and the developing brain**

Emilio Ferrer, Elizabeth D. O'Hare and Silvia A. Bunge

Fluid reasoning is a cornerstone of human cognition, both during development and in adulthood. In spite of this...

▶ **Virtual reality and the role of the prefrontal cortex in adults and children.**

Lutz Jäncke, Marcus Cheetham and Thomas Baumgartner

In this review the neural underpinnings of the experience of presence are outlined. Firstly, it will be shown that presence is associated with an activation of a distributed network including the dorsal and ventral visual stream...

▶ **Ontologies for neuroscience: What are they and what are they good for?**

Stephen D. Larson and Maryann E. Martone

Current information technology practices in neuroscience make it difficult to understand the organization of the brain across spatial scales. Subcellular junctional connectivity, cytoarchitectural local connectivity...

## THEME: AUGMENTING COGNITION

Frontiers in Neuroscience launches a new and exciting section: the theme section! Articles in the theme section contain news & research & major player features as well as all you need to know about the industry surrounding the theme, from institutes to companies to foundations supporting the research.

In contrast to the scientific research articles published throughout Frontiers, which are openly accessible on the Frontiers internet platform, articles in the theme section are exclusive to the hardcopy edition of Frontiers in Neuroscience, which requires [subscription](#).

## Research

▶ **Overview**

Mijail Serruya

Language, memory, executive planning, and attention are often compromised by

neurological disease and injury. Physicians have few options to treat these cognitive deficits, leaving those affected unable to live independently...

▶ **Diffusion Spectrum MRI in Three Mammals - Rat, Monkey and Human**

Van J. Wedeen, Ruopeng Wang, Jeremy D. Schmahmann, Emi Takahashi, Jon H. Kaas, Patric Hagmann, W. Y. Isaac Tseng, Douglas L. Rosene and Guangping Dai

Three images are presented showing the fiber pathways of the brain reconstructed from diffusion spectrum MRI, obtained in the rat and in the rhesus monkey ex vivo in scans of 18 hrs at 4.7T...

▶ **In Search of the Inner Savant**

Darold A. Treffert

The "islands of genius" of savant syndrome, in which extraordinary ability and severe disability co-exist in the same individual, have always raised questions about brain plasticity and dormant potential within us all...

▶ **Smarter Kids**

Carol S. Dweck

Studies on Child Psychology have yielded breakthrough discoveries related to the malleability of intelligence. First, teaching students that their intelligence is expandable helps boost their learning, performance on tests of...

▶ **Cortical Dynamics for Courage**

Roger A. Drake

Shyness is characterized by relative brain activation of the right prefrontal cortex (Buss et al, 2003; Schmidt, 1999). This is supported by research that implicates this region for passivity, pessimism, and inhibition of...

▶ **Tackling Stress to Improve Cognition**

Carmen Sandi

Tackling stress can be a powerful tool to improve cognitive performance. This idea is grounded on accumulated knowledge, indicating that stress is a very strong modulator of cognition (de Kloet et al., 1999; Sandi, 2004)...

▶ **Enhancement, Treatment and PTSD**

Dan J. Stein

Advances in psychopharmacology and their potential use for enhancement purposes raise philosophical questions (Stein, 2008). Analogous issues are raised by other medical technologies. The dangers of over-medicalization...

▶ **Augmenting the Energetics of the Brain**

Pierre J. Magistretti

The brain has very high energetic demands. Essentially, one sixth of the energy of the organism is consumed by this organ; accordingly over 10% of cardiac output and of the organism's glucose consumption are necessary to...

▶ **Nutrition for Cognition**

Jeroen A. J. Schmitt and Johannes le Coutre

Nutrition and cognition go together an entire lifetime. Nevertheless, specific periods in the life of a cognescent brain involve enhanced interaction between nutrition and cognition. In particular, brain development and aging...

▶ **The Stem Cell Dream for Cognition**

Angélique Bordey

The field of stem cells has exploded with the New Millennium. The present excitement is well-founded, and began with pioneering studies using adult bone marrow stem cells to treat blood disorders four decades ago, and...

▶ **The Walk Again Project**

Miguel A. L. Nicolelis

During the past decade, neuroscientists have designed, implemented, and tested the operation of real-time brain-machine interfaces (BMI) in a variety of experimental paradigms (Carmena et al., 2003; Chapin et al., 1999...

▶ **The Future of Deep Brain Stimulation**

Zvi Israel

Since its introduction in the 1980's, Deep Brain Stimulation (DBS) has proven to be a safe and effective therapy for tremor, dystonia and many of the motor symptoms of advanced Parkinson's disease (PD). DBS parameters...

▶ **Brain - Computer - Interfaces and Neurofeedback**

Niels Birbaumer and Eilon Vaadia

Brain-computer interfaces (BCI) or brain-machine interfaces (BMI) are using brain activity measured invasively or non-invasively to drive external devices, mainly computers, robots or neuroprostheses. Neurofeedback trains...

▶ **Sensory Stimulation Therapy**

Tobias Kalisch, Martin Tegenthoff and Hubert R. Dinse

It is well established that training and practicing improves sensorimotor and cognitive functions as well as perceptual and motor abilities. For several years,

we have been developing learning protocols...

▶ **Augmenting Cognition with Music**

Marcel Zentner

The Mozart Effect: The term Mozart effect, though originating from the work of the French physician Alfred Tomatis, acquired momentum especially after a study conducted at the University of California (Irvine) in early...

▶ **Dance Therapy for Cognitive Enhancement in the Elderly**

Jan C. Kattenstroth, Tobias Kalisch, Martin Tegenthoff and Hubert R. Dinse

Our work focuses on the functional relevance of neural plasticity and the possibility of modulating plastic processes for augmenting sensorimotor and cognitive performance. Here we report our studies...

▶ **Improvisation for Neurorehabilitation**

Son Preminger

Prefrontal lobe damage, results in various impairments in cognitive-executive, behavioral, emotional, self regulatory, and meta-cognitive functions (Stuss, 2006; Stuss and Knight, 2002). These include...

▶ **Sleep: The Easy Road to Cognitive Enhancement**

Robert Stickgold

The last ten years have produced a wealth of research on the role of sleep in cognition, primarily in sleep-dependent memory "consolidation". More accurately, these studies suggest that there are a wide range of...

▶ **Brain State Conditioning in Neurodegenerative Disease**

Vijendra Singh and Lee Gerdes

Neurodegenerative diseases such as Alzheimer's disease (AD) and Parkinson's disease (PD) affect the lives of millions of people worldwide. Patients show a wide range of neurological and psychiatric problems, including...

▶ **Cognitive Enhancement for older adults**

Jerri D. Edwards

This article summarizes research on cognitive speed of processing training for older adults and indicates directions for future research efforts. Research on cognitive training points to the ability of older adults to...

▶ **Video Game Based Learning**

Daphne Bavelier and C. Shawn Green

Over the past three decades the prevalence of video games in our society has increased exponentially. While for most of that time the predominant societal attitude was that video games were something for 'kids,' or more...

▶ **Total Control in Virtual Reality and Robotics**

Olaf Blanke and Roger Gassert

Recent developments in virtual reality (VR) and robotics are opening novel technology and neuroscience-inspired avenues for human enhancement of sensorimotor and cognitive function. VR integrates real-time computer...

▶ **Closed-loop Augmented Reality for Movement Disorders**

Yoram Baram

Neurological disorders, such as Parkinson's disease (PD) and multiple sclerosis (MS), often entail mobility impairment. Traditionally, gait rehabilitation, whether by means of physiotherapy or pharmacological treatment, has...

▶ **Cognitive Enhancement and Longevity**

Kayoko Ishii

Human lifespan has been already augmented. Even in the group of mammals living relatively long to grow old, the length of post-reproductive survival in human is exceptionally long. Some people propose...

▶ **Pharmaceutical Cognitive Enhancement and Society**

Paul A. Martin and Simon J. Williams

There appears to be a growing consensus that the age of cognitive-enhancing drugs (CEDs) is upon us or imminent, with a perception that a number of relatively safe products are already in widespread use and...

▶ **Research Highlights**

▶ **Feature Scientist: Michael Merzenich**

Difficult to believe, but Michael Merzenich has retired. Born in 1942, he grew up fascinated by science, and at 26 years, earned his PhD in Physiology at Johns Hopkins Medical School in the lab of Vernon Mountcastle...

▶ **Book Recommendation**

▶ **Global Research**

The world map shows the location of the authors that contributed articles on Augmenting Cognition.

## Industry

### ▶ The Augmenting Cognition Industry

Augmented Cognition Technologies (ACTs) are forming the basis of a rapidly emerging industry. Frontiers' research division set out to explore this new market to bring...

### ▶ Preparing Society for the Cognitive Age

Alvaro Fernandez

Groundbreaking cognitive neuroscience research has occurred over the last 20 years - without parallel growth of consumer awareness and appropriate professional dissemination. "Cognition" remains an elusive concept with...

### ▶ Industry Highlights

### ▶ On the Horizon

### ▶ Statistics

### ▶ Global Industry

In the Global Industry section you will find some key companies involved in Augmenting Cognition from across the world. These companies are developing treatments, cures and technologies...

## Foundation

### ▶ Global Neuroscience Funding

In order to get the bigger picture of the most supported research related to restoring and augmenting cognition and the amounts invested in this field from both public and private sources, we refer to...

### ▶ A Brief Look - AugCog Past and Future

Cali M. Fidopiastis, Sae Schatz and Denise Nicholas

The field of Augmented Cognition (AugCog) owes much to the research visions and subsequent funding opportunities provided by the United States Department of Defense (DoD) agencies...

### ▶ Foundation Highlights

### ▶ Statistics

### ▶ Global Foundation

The map provides a non-exhaustive global view of some of the major Foundations supporting research into restoring and augmenting...

## Frontiers Activity Reports

### ▶ Frontiers Journal Report

Frontiers is announcing the launch of 9 new journals, led by 11 new highly motivated Editors. The most frequently read journal is Frontiers in Human Neuroscience...

### ▶ Editors on the Frontiers

Frontiers is starting its second year at top speed. Around 2,000 of the world's top researchers from 45 countries now edit Frontiers. You can view Frontiers Editorial Board at any time on the Frontiers website...