

 melomind

by  Brain
Technologies



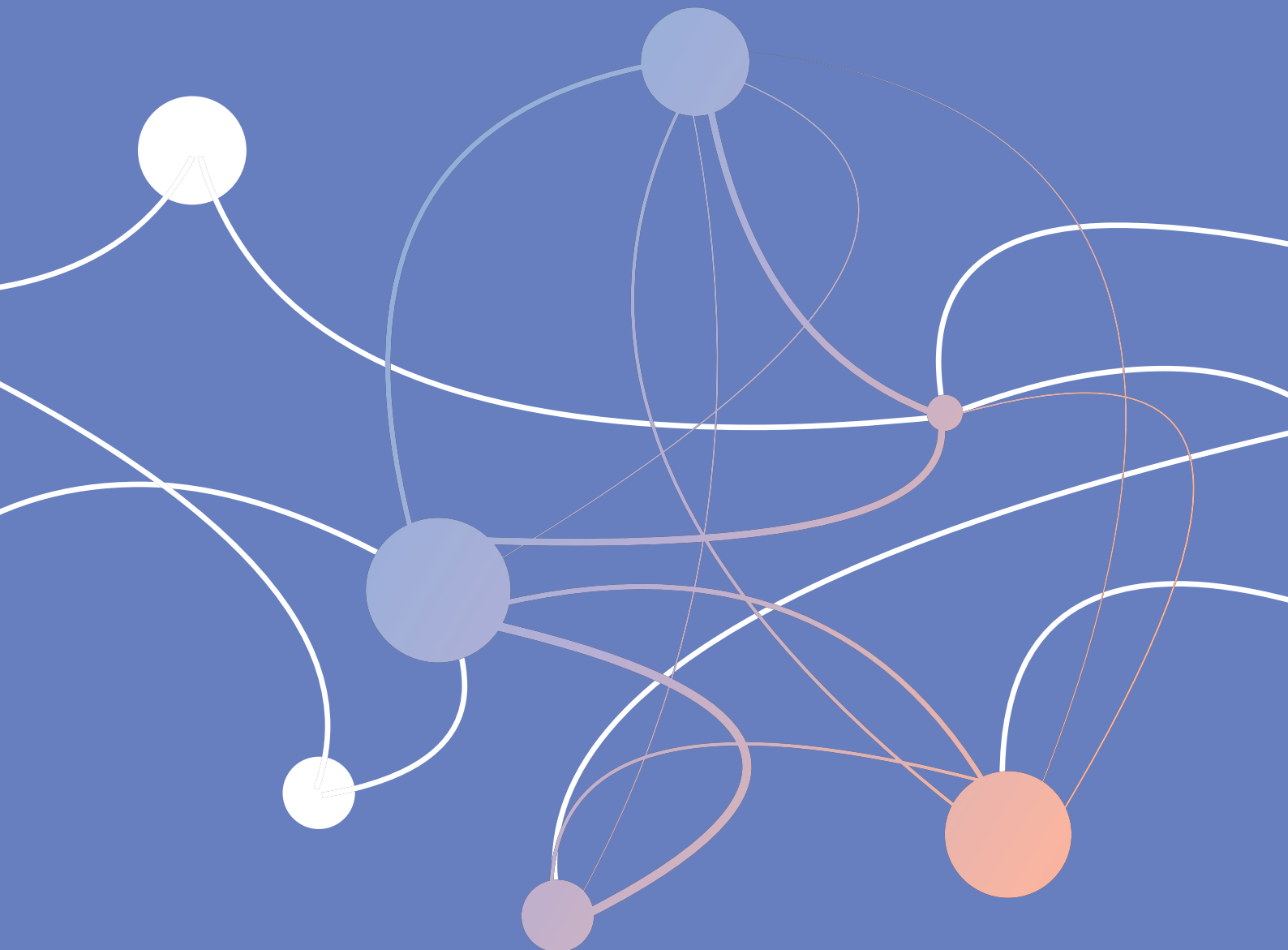
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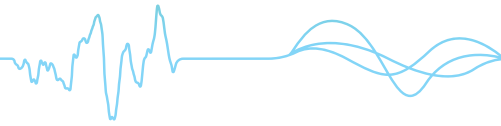
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Brain training: how and why?



As a neuroscientist, the brain has always fascinated me because of its immense capacity for learning. Sport, my second passion, has also taught me to follow a simple but essential rule: “a healthy mind in a healthy body”. That’s the balance I’m trying to achieve.

Nowadays, we’re all aware that we have to look after ourselves. In an increasingly demanding and stressful environment, a healthy lifestyle – both physically and mentally – is something that we all should be striving for.

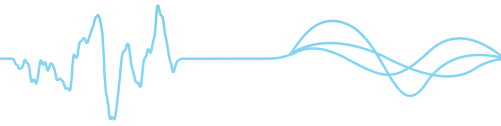
The brain plays a fundamental role in achieving that goal. Recent scientific discoveries about the way the brain works, along with incredible progress made in the fields of

neuroscience and neurotechnology, are allowing us to develop solutions to improve our health and wellbeing.

Using this new knowledge and several years of research, we have created Melomind. Our deep relaxation training method, based on the concept of neurofeedback, allows users to monitor their brain activity in real time and gradually learn to control it, making their brains more able to relax.

Today, we want to share our personalised, dynamic approach, which aims to address a social issue that has become a priority in all industrialised societies: the need for people to learn how to manage stress.

PhD, Chairman and Co-Founder
of myBrain Technologies



I. STRESS: A MAJOR ISSUE FOR HEALTH AND WELLBEING AT WORK

Brain training is the solution

More and more people are suffering from stress because of excessive workloads, an increasingly competitive environment and a hectic pace of life. The daily pressure felt by employees can damage the balance between physical and mental health by causing increasingly fast-paced lives, which can lead to burn-out. Stress and anxiety are harmful to health and have a major impact on people's mood, quality of life and performance at work.

To address these problems, companies are adopting collective prevention methods that aim to reduce stress at the source, by taking direct action in terms of their organisations, working conditions, labour relations and the mental and physical wellbeing of their employees. **Quality of life at work is now a recognised concept and a way of boosting competitiveness.**

STRESS AT WORK

Stress at work is where people experience an imbalance between the tasks and targets they have been assigned and the resources they have to fulfil them. When stressful situations persist, they affect the health of the people involved and adversely affect companies' operations by causing absenteeism, staff turnover, lower production quality and a loss of motivation.

KEY FIGURES

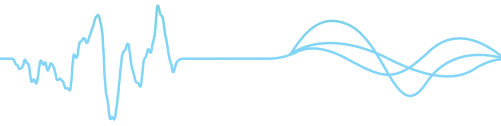
- **75%** of the world's population suffers from stress-related physical problems¹
- **41%** of French employees feel stressed²
- **89%** of employees are more motivated when employers take into account their physical and mental wellbeing at work³
- **€2 billion:** the estimated daily cost of stress at work in France (absenteeism, loss of productivity, healthcare costs, premature death etc.)⁴

1 Stress in America by The American Psychological Association (2014)

2 ANACT - CSA report on working conditions

3 Gallup

4 The French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS, 2017)



II. NEUROSCIENCE AND NEUROFEEDBACK: TRAINING THE BRAIN TO ACHIEVE WELLBEING IS POSSIBLE

Melomind: an innovative solution based on technologies developed in the clinical field

Neuroscience gather the scientific disciplines that involve studying the nervous system and the brain. Neurotechnology, meanwhile, refers to all technologies that measure and analyse the signals sent by the nervous system and therefore the brain. Combining these areas of expertise has allowed the development of “neurofeedback” solutions, which aim to optimise cognitive performance and treat certain illnesses.



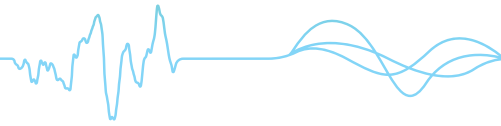
THE BRAIN

A constantly developing organ

Every new experience puts our brain to work, creating new neural connections and removing or reinforcing existing ones. Repeated experiences strengthen the neural connections involved.

The brain is constantly transforming itself to adapt as effectively as possible to its environment as part of a process called neuroplasticity.

It is possible to stimulate this natural phenomenon of neuroplasticity using a method created and used in the clinical context, i.e. **neurofeedback**.



Electroencephalography (EEG): a window into our brains' activity

EEG is a non-invasive way of exploring our brains, consisting of measuring electrical activity in the brain using passive sensors (electrodes) placed on the scalp. These sensors allow us to monitor, millisecond by millisecond, how our brains processes information when at rest, when performing a task, and during a spontaneous reaction.

When the EEG signal is recorded over time, it can be broken down into waves in different frequency ranges, just like white light can be broken down into the optical spectrum. Those waves give a dynamic picture of our mental state.

Neurofeedback: a cognitive exploration

Neurofeedback has been used since the 1960s¹ and is a brain training method that allows the brain to regulate itself, exerting voluntary control over certain aspects of its activity. It works by giving users real-time information about how their brain signals are developing.

Electrodes placed on the scalp capture information about electrical activity in the brain, which is then converted into a visual or audio representation that varies according to the EEG signal. Users become aware of their own brain activity and seek to change and regulate it. A poorly regulated brain may cause symptoms like stress, irritability, sleep disorders, a lack of self-confidence, difficulties with concentrating and learning, memory loss, migraines and anxiety.

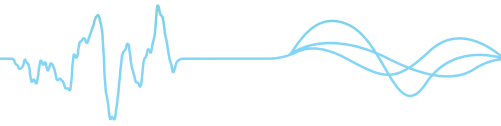


Until now, neurofeedback has mainly been developed for clinical use to address these various symptoms. With certain conditions, it allows direct action to be taken to correct damaged or unregulated brain response patterns, trying to restore them through learning. It has been shown² that the technique significantly reduces the symptoms of epilepsy, depression, certain eating disorders and dependency on alcohol and certain drugs.

Its clinical use mainly relates to attention deficit hyperactivity disorder (ADHD) in children and adults, along with anxiety or stress-related disorders, particularly post-traumatic ones.

¹ Kamyra J. 1962, Kamyra J. 1971, Hardt 1978, Sterman 1978

² Sterman, 2000. Tan et al., 2009. Baehr, Rosenfeld, & Baehr, 1997. Hammond, 2005. Paquette, Beaugregard Beaulieu-Prévoist, 2009. Peniston & Kulkosky, 1989. Sokhadze, Cannon, & Trudeau, 2008. Bartholdy, Musiat, Campbell, & Schmidt, 2013. Schmidt & Martin, 2016. Fox, Tharp, & Fox, 2005. Arns, de Ridder, Strehl, Breteler, & Coenen, 2009. Gevensleben et al., 2009. Lofthouse, McBurnett, Arnold, & Hurt, 2011. Moore, 2000. Hammond, 2005. Fisher & others, 2010. Lande, Williams, Francis, Gragnani, & Morin, 2010.



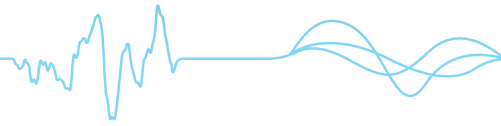
Neurofeedback is a very promising alternative therapy. Unlike drug-based treatments, transcranial magnetic stimulation or electroconvulsive therapy, which is still widely used, this method is non-invasive and totally painless.

As well as being of major interest in the clinical context, neurofeedback has also proven effective in optimising performance in healthy people. There has been a great deal of research showing that neurofeedback sessions have a positive effect on certain cognitive functions³, particularly mental imaging (the ability to picture a situation), working memory (the ability to retain information over the short term in order to perform cognitive tasks) and focusing attention (concentration).

The body of scientific data from neurofeedback studies highlights its effectiveness in treating attention- and anxiety-related symptoms. In particular, the technique seems to be an effective tool for preventing and managing stress.



³ Hanslmayr, Sauseng, Doppelmayr, Schabus, & Klimesch, 2005. Zoefel, Huster, & Herrmann, 2011. Vernon et al., 2003. Escolano, Aguilar, & Minguez, 2011. Nan et al., 2012. Egner & Gruzelier, 2001. Egner & Gruzelier, 2004.



III. **MELOMIND: A SOLUTION TO IMPROVE BALANCE AND EFFECTIVENESS AT WORK**

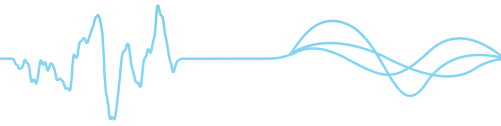
A non-invasive way to train your brain

Melomind is the first product of myBrain Technologies, a French company founded in 2014 that develops neurotechnology solutions for employees, in order to improve their quality of life and wellbeing at work.



The headset has been developed in collaboration with France's Brain and Spine Institute (Institut du Cerveau et de la Moëlle Épineière or ICM), and is intended to help users **relax** and **reduce their stress levels**.

myBrain Technologies has successfully created a brain-training solution for the general public, to be used outside the clinical context, while keeping the same scientific rigour.



A) THE *MELOMIND* SYSTEM



1. Headphones
2. Connector for the headset's two dry electrodes
3. App, which processes the data
4. Textile electrodes inside the headphones

The *Melomind* system consists of two elements:

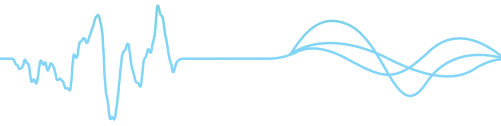
1. An EEG acquisition system to measure brain activity.

It is easy and quick to position on the head, and sends EEG signals to a mobile device (tablet or smartphone) securely via Bluetooth. The system includes a pair of headphones, through which users can listen to music. Two dry electrodes are located within the headphones, around the mastoid bones, and are used to provide a reference for recordings. The two main dry electrodes are positioned around the parietal bones and are linked to the headset using a plastic connector.

2. A mobile app, which processes the EEG signals captured by the headset in real time and provides audio feedback to the user. This real-time feedback about the user's brain activity is what constitutes neurofeedback.

***Melomind's* key features**

- Proprietary algorithms and a proprietary headset, protected by a solid patent portfolio.
- A combination of cognitive neuroscience and data science expertise within a centre of scientific excellence, in partnership with the ICM.
- Skills that are unique in the market, from acquisition electronics to the cloud-based personalised analysis platform.



B) **MELOMIND**: HOW IT WORKS

With **Melomind**, users take 15-minute neurofeedback sessions in order to improve their ability to relax.

To provide the audio feedback, several pieces of ambient music have been created:

- a very calm melodic layer that serves as an indicator of how relaxed the user is,
- environmental sounds.

They are each intended to evoke a peaceful, easily identified setting, such as a forest or waterfall.

Melomind calculates the user's relaxation level in real time using the EEG signal recorded using the two parietal electrodes connected to the headset. Changes in the user's level of relaxation are reflected in the music, by changing the volume of the melodic layer in real time.

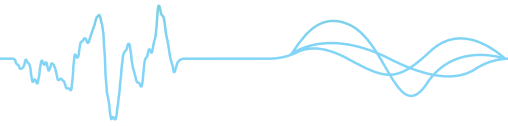


A neurofeedback session involves a sequence of several soundscapes, to give users the feeling of going on a journey through different environments.



Users change their relaxation level in real time, working with the musical feedback.

Over time, the more they train their brains in this way, the more able they are to manage stressful situations. The audio stimulation does not directly train the brain: users do it themselves by exerting control over their own brains.



Melomind is based on numerous scientific and clinical studies published over a period of more than 50 years.

The results of internal studies carried out by myBrain Technologies are consistent with the long history of scientific studies on neurofeedback⁴.

Finally, the first results obtained using **Melomind** in a real-life situation – i.e. outside the lab – also show that neurofeedback is highly effective.

Melomind corporate programmes are available for a minimum term of three months for each user licence. It is recommended that users take at least two sessions per week,

but they can take many more if they wish to. Traditional clinical systems, on the other hand, are non-mobile, use wet electrodes and involve shorter programmes of 10-20 neurofeedback sessions, and are only available on prescription.

As with sportspeople, the aim is to train a specific muscle. The results depend on how regularly users train, and the rate at which neurofeedback-based learning takes place is different for each user.

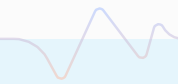
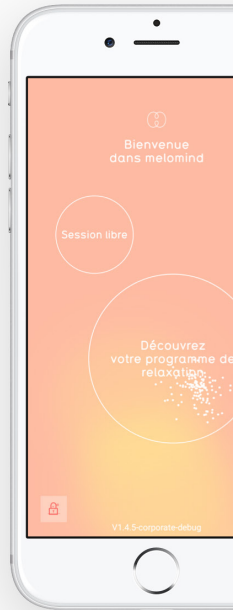


⁴ See appendixes



Platform for analysing your personal results

Users' personalised training programmes take into account their individual characteristics. Using statistical learning algorithms, the analysis platform adapts to users' habits and tracks their daily progress in order to make personalised suggestions to them. A precise analysis of results and perceived benefits is produced, allowing users to monitor their overall progress and ability to maintain a relaxed mental state.



myBrain Technologies follows the recommendations of French national data protection commission CNIL as regards to managing the data collected, in accordance with the GDPR (General Data Protection Regulation).

myBrain Technologies undertakes to use the data collected solely for internal research, academic and clinical purposes.

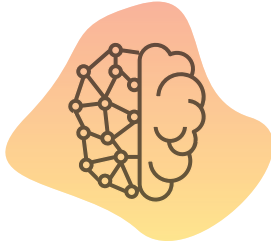




c) **MELOMIND**: WHAT ARE THE BENEFITS?



Increased resilience to stress and a reduction in its indirect effects, particularly in terms of anxiety, mood and attention.



Sustained improvement in voluntary relaxation ability: a single Melomind session increases users' feelings of relaxation by 30%.

d) **MELOMIND SERVICES**: HOW ARE THESE BENEFITS MONITORED?



Personalised, detailed analysis of each user's progress.



Personalised coaching: the system's algorithms continuously adapts to the brain training sessions' evolution.



E) FRANCE'S BRAIN AND SPINE INSTITUTE: A CENTRE OF EXCELLENCE IN NEUROSCIENCE SUPPORTING *MELOMIND*



Melomind has been developed by myBrain Technologies in partnership with France's Brain and Spine Institute (Institut du Cerveau et de la Moëlle Épineière or ICM).



myBrain Technologies works with the ARAMIS Lab – Brain Data Science team, which enables it to:

- have access to the CENIR EEG/MEG neuro-imaging platform,
- compare technologies with those traditionally used in academic research,
- assess the effectiveness of myBrain Technologies' solutions as part of neuroscience studies supported by the CNRS (French National Center for Scientific Research),
- develop brain analysis algorithms.

F) SCIENTIFIC COMMITTEE

myBrain Technologies works with three key partners at the ICM.



Dr Nathalie George

PhD, CNRS research director working at the ICM



Laurent Hugueville

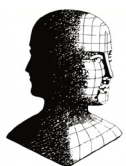
Research engineer, technical manager of the CENIR EEG/MEG imaging platform



Dr Mario Chavez

PhD, CNRS researcher working at the ICM, ARAMIS Lab

G) *MELOMIND*: INTERNATIONAL RECOGNITION



JANUS 2018 DE LA SANTÉ

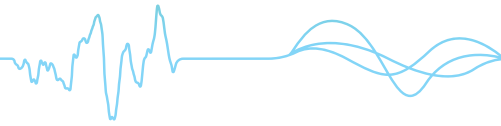


OBSERVEUR DU DESIGN

LABEL 2019



INNOVATION 2030 CONCOURS MONDIAL D'INNOVATION



H) TESTIMONIALS FROM *MELOMIND* USERS



Jean-Francois Rimoux, Head of Communication and CSR — Klesia

"We first heard about Melomind because Klesia is a sponsor of the ICM. The system has many benefits for the employees who use it, and it could eventually be rolled out across our member companies. Melomind allows French companies to achieve a paradigm shift, because a relaxed and happy employee is an incredible asset."



Hugues Miquet, Head of Information Systems, HR, Communication, Communities and Support — Enedis

"I'm delighted to have put my trust in Melomind's team and their solution. We were attracted by how they were able to adjust to our business culture, how good their support is and how easy the headsets are to use. All employees have been able to use on their own this innovative and revolutionary tool."



I'm still fascinated by the science behind Melomind, which allows you to find out how relaxed your brain is and how to train it. We are delighted to be working closely with a start-up that shares our beliefs regarding health and wellbeing at work."



Dr Richard Vericel, ENT specialist

"My interest in neuroscience and my experience in managing stress and anxiety mean that I'm a big fan of Melomind, which I've been using every day for several months now. Melomind's neurofeedback has a rapid and significant effect on reducing fatigue and improving wellbeing and mood. I think that it's a promising solution for both patients and healthcare professionals alike."



IV. THE MYBRAIN TECHNOLOGIES TEAM

myBrain Technologies is a team of 31 people with high expertise in neuroscience, EEG-based systems engineering and intelligent data analysis.

This range of disciplines means that the company can offer a wide variety of solutions (monitoring, diagnosis, prevention, neurofeedback etc.) through various methods such as relaxation, emotion management and breathing.

Management team

Dr Yohan Attal – Co-founder and CEO



Yohan holds a PhD in brain imaging and signal processing from the Orsay Faculty of Science at the University of Paris XI. He is currently using his scientific and entrepreneurial skills in order to bring the latest neuroscience discoveries to the global market.

For several years, he was a researcher at France's Brain and Spine Institute (Institut du Cerveau et de la Moëlle Épineière or ICM). His work focused mainly on cardiovascular events and memory processes, along with associated illnesses such as Alzheimer's, using EEG, MEG¹ and MRI² brain imaging methods.

Julien Fiszman – Co-founder and Chief Business Officer



Julien holds a Masters' degree in Innovation and Technology Management from Sorbonne-Panthéon (Paris 1) university, and gained his first entrepreneurial experience working for information and communication technology companies. He has helped organise technology events such as Tedx Panthéon-Sorbonne and Les Mardis de l'Innovation. He also coached start-ups within several business accelerators in Paris such as Agoranov and Centquatre-Paris, before joining the myBrain Technologies team.

Estelle Eulriet – CTO



Estelle is a self-taught IT specialist from an open-source background, and has been a member of Scientipôle Initiative's funding approval committees for several years. She has completed numerous IT projects for both start-ups and large corporations. She evaluated and supported several start-ups and led a number of entrepreneurial projects before joining myBrain Technologies.

Antoine Meillez – COO



Antoine holds an engineering degree from École des Mines in Nantes and a Masters' degree with a specialisation in entrepreneurship from HEC Paris. After gaining experience working in the IT departments of large corporations and as a management consultant, he joined myBrain Technologies, where he is implementing major business development projects. He is excited about the social changes arising from technological innovation, and teaches introductory neurotechnology classes at HETIC.

1 Magnetoencephalography
2 Magnetic resonance imaging



V. APPENDIXES

INTERNAL STUDIES

myBrain Technologies has carried out three internal studies. The results have been presented in several scientific conferences in 2018:

1. ASSESSMENT OF *MELOMIND'S* EEG SYSTEM

Quality assessment of the *Melomind* headset's EEG acquisition compared with a brand-name clinical headset featuring wet electrodes:

- Grosselin et al 2018 - Quality assessment of electroencephalographic signal in real-time: building of an artificial intelligence - *Cell-NERF Symposium: Neurotechnologies*
- Pandremmenou et al 2018 - Using melomind for cognitive research studies: The epitome of ergonomic and affordable EEG technology - *Cell-NERF Symposium: Neurotechnologies*

2. UNDERSTANDING RELAXATION

Describing the brain processes involved in relaxation and how they relate to the various brain waves, particularly alpha waves:

- Breton et al 2018 - Relaxation is a matter of brain: alpha and theta oscillations are sensitive to different states of relaxation - *Cell-NERF Symposium: Neurotechnologies*

3. PRE-CLINICAL TRIAL STUDY

Neurolax pre-trial study to assess *Melomind's* neurofeedback protocol:

- Grosselin et al 2018 - Neurofeedback program using a portable EEG device based on alpha rhythms reduces perceived stress - *Cell-NERF Symposium: Neurotechnologies*



NEUROLAX STUDY

The Neurolax clinical trial, which started in mid-2018 and is expected to continue until 2019, forms part of a collaboration between the ICM's MEG-EEG Centre and myBrain Technologies. It aims to:

- 1) Describe the short- and medium-term effects of neurofeedback on brain networks involved in the relaxation process.
- 2) Assess the possibility of achieving neurofeedback using recordings made with a device featuring only two dry, mobile electrodes.

The study aims to pinpoint the long-term (electro)physiological effects (changes in neuron response) and/or behavioural effects (reduced susceptibility to anxiety) resulting from neurofeedback training. It will assess whether the *Melomind* neurofeedback system allows users to relax independently, and if so, how many sessions are required.

myBrain Technologies has offered a series of neurofeedback training sessions to 60 healthy volunteers aged 18-60, along with various measures to assess their level of relaxation according to two criteria:

1. **Perceived relaxation**, assessing each volunteer's level of relaxation using questionnaires before and after each neurofeedback training session. The volunteers fill in the questionnaires themselves, providing answers on a given scale (estimated level of relaxation, stress, anxiety and affect)¹.
2. **Electrophysiological relaxation**, using various measurements: EEG (changes in the amplitude of oscillations, more specifically changes in the energy of alpha frequency ranges, and on a secondary basis, theta frequency ranges), ECG (heart-rate variability) and AED (indicator of the state of excitement of the autonomic nervous system), before and after neurofeedback training sessions.

¹ Position on a visual analogue scale (VAS) and additional measures of psychological stress using the perceived stress scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983; Quintard, 1994), the level of anxiety using the STAI-YA State-Trait Anxiety Inventory (Spielberger, 1983) and affect using the PANAS Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988; Caci & Baylé, 2007).