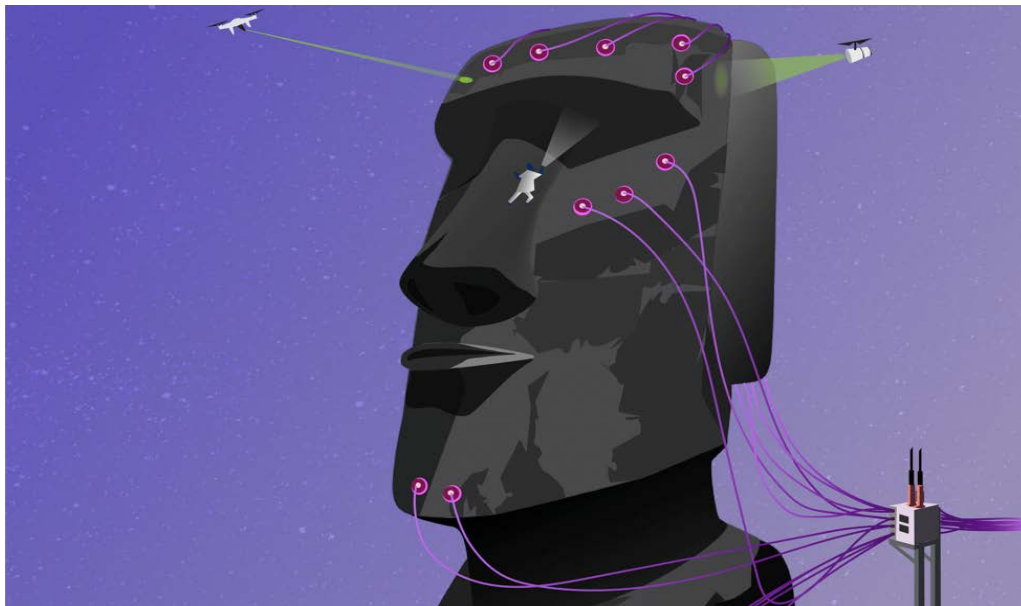


## PRESS RELEASE

## A better prognosis for the return to consciousness in intensive care patients

Paris, May 30, 2024

When a patient is admitted to intensive care because of a disorder of consciousness (DOC)—a coma, for example—establishing his or her neurological prognosis is a crucial and often difficult step. To reduce the uncertainty that precedes a medical decision, a group of clinician-researchers from the Brain Institute and the Pitié-Salpêtrière Hospital, led by Lionel Naccache (Sorbonne University/AP-HP), Jacobo Sitt (Inserm) and Benjamin Rohaut (Sorbonne University/AP-HP), evaluated the value of a multimodal approach, combining numerous clinical, electrophysiological, behavioral and neuroimaging indicators. Their results, published in the journal *Nature Medicine*, show that this approach leads to better prognosis.



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After severe head trauma or cardiac arrest, some patients admitted to intensive care show little or no response to their environment, and are sometimes unable to communicate. This is known as a Disorder of Consciousness (DoC), and includes comas, vegetative states and states of "minimal consciousness".

This disorder may persist for several days or weeks. In such cases, it is essential for care teams and relatives alike to obtain the most precise answers possible about the patient's cognitive recovery capacities. A neurological prognosis is usually based on a

number of indicators, including standard measurements of brain anatomy (CT and MRI scans) and function (electroencephalogram).

*"Even with this information in hand, there often remains a degree of uncertainty in the prognosis, which can have an impact on medical decision-making. And yet, these patients are often very fragile and exposed to numerous complications, which always raises the question of the intensity of care,"* explains Benjamin Rohaut (Sorbonne University/AP-HP), neurologist-resuscitator, researcher and first author of the study. Furthermore, doctors sometimes observe a dissociation between patient behavior and brain activity: some patients in a vegetative state seem to understand what is being said to them, but are unable to communicate this to caregivers.

To enrich the description of these patients' state of consciousness, the "PICNIC" team, co-directed by Lionel Naccache at the Brain Institute, has been working for some fifteen years to define new cerebral measurements and new clinical examination signs. Progressively, their approach has evolved towards "multi-modality", i.e. the combination of PET scan, multivariate EEG analysis algorithms, functional MRI, cognitive evoked potentials (electrical responses to sensory stimulation), and other tools.

### **Consciousness markers scrutinized**

To assess the clinical value of this approach, the team worked with the neurologically-oriented Intensive Care Unit at Pitié-Salpêtrière Hospital in Paris. Led by Benjamin Rohaut and Charlotte Calligaris (AP-HP), the clinician-researchers followed and evaluated 349 intensive care patients between 2009 and 2021. At the end of each multimodal assessment, they formulated a prognostic opinion of "good", "uncertain" or "unfavorable".

Their results indicate that patients with a "good prognosis" (22% of cases) showed a much more favorable evolution of their cognitive abilities than patients with a prognosis judged "uncertain" (45.5% of cases) or "unfavorable" (32.5% of cases). In particular, none of the patients assessed as "unfavorable" had regained consciousness after one year. Above all, this prognostic performance correlated with the number of modalities used: as the number of indicators used increased, so did the accuracy of the prognosis, and so did the team's confidence in their own assessments.

*"This long-term study shows for the first time the benefit of the multimodal approach, which is essential information for intensive care units worldwide. It also provides empirical validation of recent recommendations by the European and American Academies of Neurology,"* explains Jacobo Sitt, who co-supervised the study with Lionel Naccache.

### **Towards a standardized neuropronostic approach**

The multimodal approach is not, however, a magic wand. It provides the best possible information to caregivers and families in these situations of uncertainty—which represents ethical progress in patient care—but does not guarantee bias-free decision-making.

Finally, there is the question of access to assessment tools, which are costly and require specific expertise. *"We are aware that multimodal assessment is not accessible to all intensive care units that receive these patients,"* continues Lionel Naccache. *"We therefore propose to build a network of collaborations at national and European level. Thanks to the use of telemedicine tools and automated analysis of EEG or brain imaging, all intensive care units could have a first level of access to multimodal assessment. Should this prove insufficient, recourse to a regional expert center would provide a more in-depth assessment. Finally, in the most complex situations, it would be possible to call on all available experts, wherever they may be. Ultimately, our aim is to*

*ensure that all patients presenting with a disorder of consciousness can benefit from the highest standards of neurological prognosis."*

This study was funded by the James S. McDonnell Foundation, the Fondation pour la Recherche Médicale (FRM), UNIM, the Académie des Sciences' Lamonica Prize, the European Partnership for Personalised Medicine (PerMed) and the Investissements d'avenir program.

Jacobo Sitt and Lionel Naccache are co-founders and shareholders of Neurometers, a company dedicated to the medical use of electroencephalogram (EEG) to quantify brain signatures of consciousness and cognition.

**For more information:**

Rohaut Benjamin, Calligaris Charlotte, Sitt Jacobo, Naccache Lionel, « Multimodal assessment improves neuroprognosis performance in clinically unresponsive critical care patients with brain injury », *Nature Medicine*, 30 mai 2024, <https://www.nature.com/articles/s41591-024-03019-1>

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*Created in 2010, the Brain Institute is a scientific and medical research center of excellence dedicated to the study of the brain and the discovery of new treatments for diseases of the nervous system. Its innovative model brings together patients, doctors, researchers and entrepreneurs with a common goal: to transform fundamental discoveries into therapeutic solutions via a translational and interdisciplinary approach. Located in Paris at the heart of the Pitié-Salpêtrière Hospital - Europe's largest neurology center - the Brain Institute brings together over 900 international experts in 26 research teams, 11 cutting-edge technology platforms, a clinical investigation center, a training organization, a living lab and a business incubator. It is based on the association of a joint research unit (CNRS, Inserm and Sorbonne University) and a private foundation recognized as being in the public interest, the ICM Foundation, in partnership with AP-HP. [institutducerveau-icm.org](https://institutducerveau-icm.org)*

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