Uncovering episodes of (dis)connected consciousness in clinically unresponsive emergency patients: study protocol for a prospective study

P. Fritz[1,2], A. Ancion[3], N. Lejeune[1,2,4], G. van der Lande[1,2], S. Laureys[1,2], A.Ghuysen[3], O. Gosseries[1,2]*, C. Martial [1,2]*

[1]Coma Science Group, GIGA-Consciousness, University of Liège, Liège, Belgium; [2]Centre du Cerveau[2], University Hospital of Liège, Liège, Belgium; [3]Department of Emergency, University Hospital of Liège, Liège, Belgium; [4]William Lennox Neurological Hospital, Ottignies-Louvain-la-Neuve, Belgium;

* contributed equally

Background

- **Disconnected consciousness (DC)** [1-2]

  Presence of mental content but without connection to the environment in clinically unconscious states
  - Near-death experiences (NDE)
  - Dreams

- **Connected consciousness (CC)** [1,3]

  Subjective experience of connection to the external world in clinically unconscious states
  - Paralysis with awareness

- **DC & CC** and their **consequences**:
  → **under-studied**

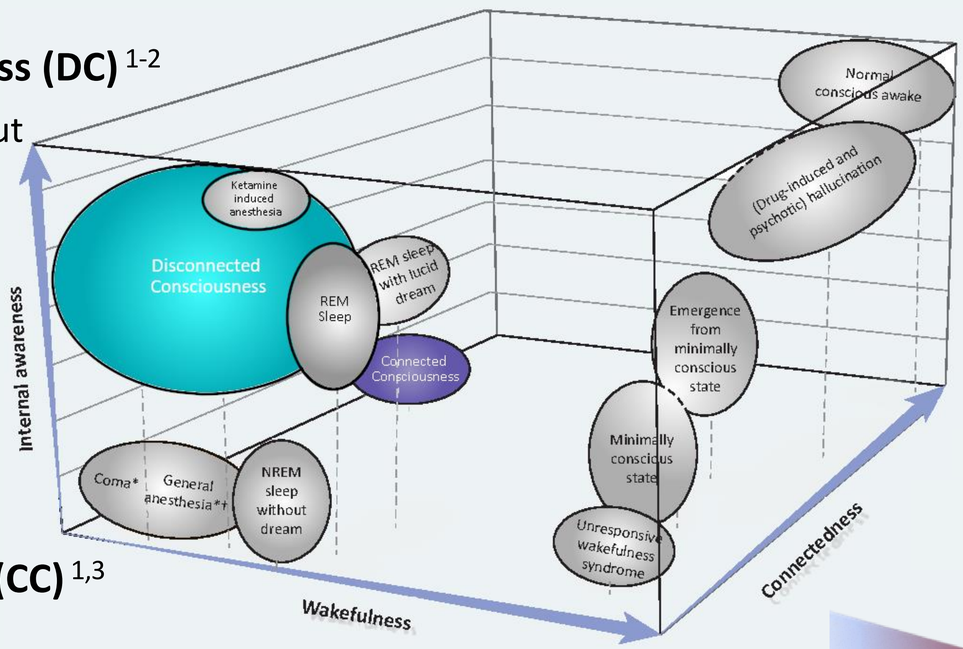


Figure 1 - Schematic illustration of disconnected and connected consciousness (adapted from Martial *et al.*[1])

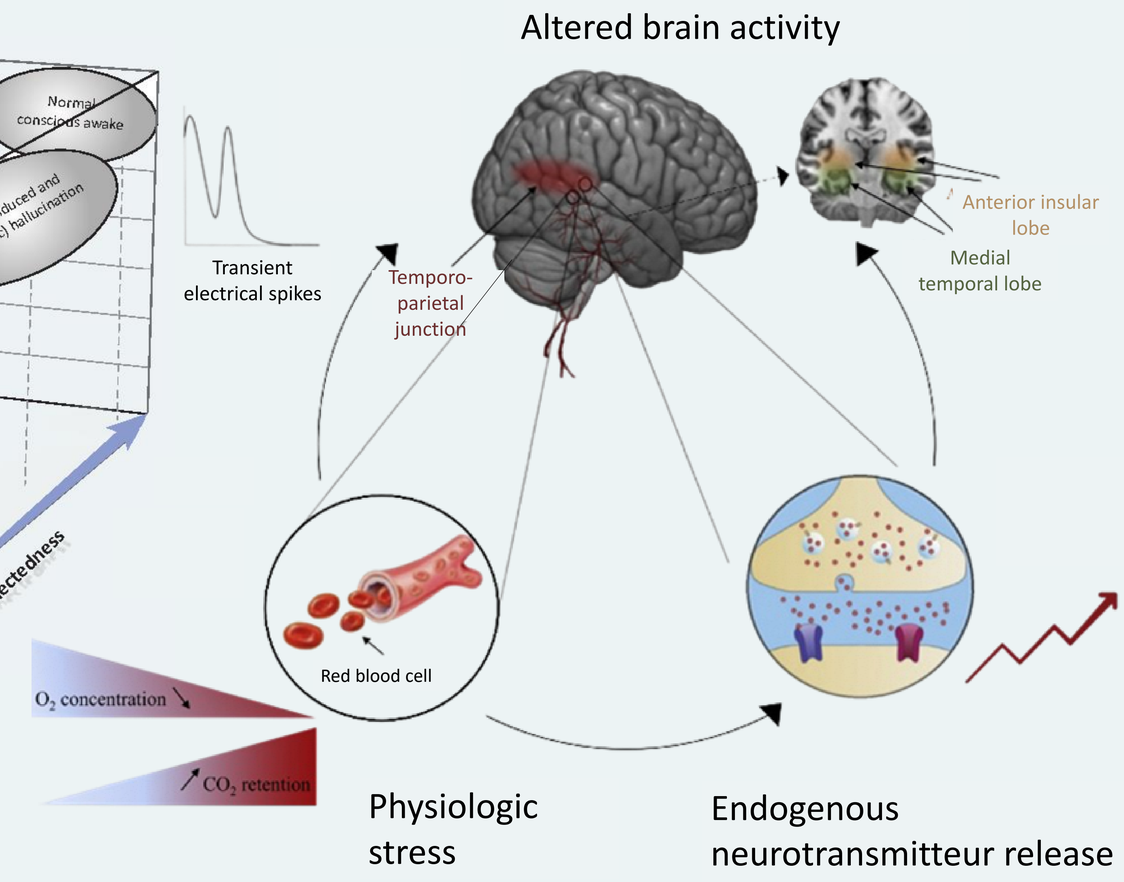


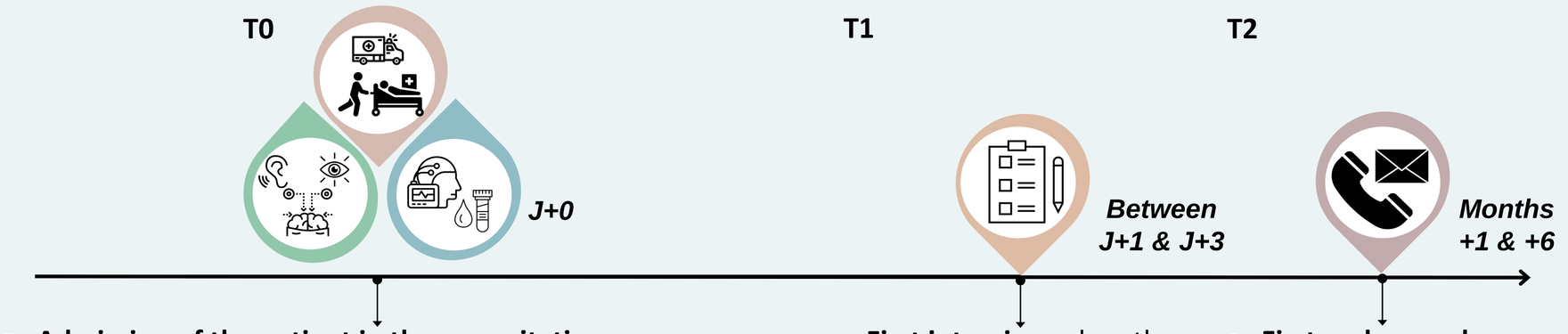
Figure 2 - Neurobiological disconnected - neurophysiological mechanisms that may be involved in the emergence of episodes of DC (adapted from Martial *et al.*[1])

Methods

- **Inclusion**

  201 patients included in the video-monitored two-bed resuscitation room (aged > 18, all etiologies)

  - **Group 1** : **Clinically unconscious patients**
  - **Group 2** : **Patients with consciousness fluctuations**
  - **Group 3** : **Conscious patients**



- **Admission of the patient in the resuscitation room**
- **Unexpected visual stimuli**
  - ✓Stickers, objects (pink plush elephant, trophy, Eiffel tower sticker, ...)
- **Unexpected auditory stimuli**
  - ✓Words from the same semantic category & animals sounds
- **Biological & neurophysiological data acquisition**
  - ✓Cerebral oximetry (SedLine® device)
  - ✓Frontal EEG (SedLine® device)
  - ✓Blood sample biomarkers (β-endorphin & epinephrine)

- **First interview** when the patient is declared medically fit :
  - ✓Connected consciousness: Free recall & Implicit recall
  - ✓Disconnected consciousness: NDE & Dreams Questionnaires

- **First and second follow-up sessions :**
  - ✓PTSD questionnaires
  - ✓Quality of life questionnaires
  - ✓Anxiety questionnaires

Hypothesis & Expected Results

- **CC and DC episodes** : 10% - 20 % experience episodes of CC & DC [1,2,4,5]
- **Blood gases** : ↗ CO_2 & ↘ o2 = DC[4-5]
- **Blood samples** : ↗ β-endorphin & epinephrine ➔ CC or DC[1]
- **EEG cortical peak** : Patient state index (Psi) peak & raw EEG spikes ➔ DC/CC episodes [6]

Conclusion

- **First rigorous prospective study** → audio and video recordings.
- First study to **test the "neurobiological disconnected model"** through a multimodal approach.
- **Clinical implication** for both patients & clinical team.
- **Large-scale study** → significant amount of valuable data that will allow future studies.

References: [1] Martial et al., (2020). Trends Cogn. Sci. [2] Parnia et al., (2014). Rescucitation. [3] Lennertz et al., (2023). BJA. [4] Lempert et al., (1994). Ann. Neurol. [5] Klemenc-Ketis et al., (2010). Crit. Care. [6] Chawla et al., (2009). J. Palliat. Med.

pauline.fritz@uliege.be