***Attractor dynamics of cortical assemblies underlying the transition from deep to light anesthesia***

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Cortical slow oscillations (<1 Hz) are a universal hallmark of slow-wave sleep and deep anesthesia (Steriade *et al.*, 1993; Sanchez-Vives and Mattia, 2014). These slow oscillations are characterized by periods of neuronal activity (Up states) and periods of silence (Down states) showing a low degree of complexity that opens a window on understanding the brain multiscale organization, on top of which cognitive functions emerge during wakefulness. Understanding the transition across different levels of vigilance might shed light on the emergence of the rich repertoire of neuronal dynamics underlying brain computations.

Here we investigated the dynamics of the transition from deep anesthesia towards wake-fulness by recording from neuronal assemblies of layer 5 in the primary visual cortex of the ketamine/medetomidine anesthetized rat. Our results indicate that, far from being a continuum, the transition from deep anesthesia to wakefulness is characterized by both gradual and abrupt changes in the local field potential and multi-unit activity. Crucially, we found that the sleep-like rhythms fade out when wakefulness is approached not only through the destabilization of Down states, but also through the appearance of a novel activity pattern which consists in a slow ($\sim$ 0.2 Hz) alternation between highly regular slow oscillations and short periods of awake-like activity or micro-arousals. Interestingly, the appearance of this activity pattern is accompanied by an increase in the power of beta and gamma frequency bands, associated during wakefulness to increased attentiveness and arousal (Steriade, 2005).

We reproduced these transition in a mean-field computational model of a cortical net-work (Mattia and Sanchez-Vives, 2012) by modulating the excitability and the fatigue level of the modeled network, and we identified a competition between two metaestable attractor states underlying the transition. Our model suggests that the micro-arousal pe-riods could be explained by a Hopf-like transition from a limit cycle to a stable fixed point at a high level of activity, where the slow alternation between periods of slow oscillations and micro-arousals is led by a slowly oscillating ($\sim$ 0.2Hz) excitatory input of extracortical origin. We tested our model predictions as the anesthesia faded out, finding a remarkable evidence of the proposed dynamical framework.

This is a joint work with Cristiano Capone, Maurizio Mattia, María V. Sanchez-Vives.

## References

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