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### The intimate relationship between coalescent generators in early premature neonates

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**Background** Spontaneous endogenous generators are key elements in immature systems. Theta activity (TA) and the coalescent slow waves (SW) occur from 25wGA and address the basic mechanisms of cross frequency interdependencies in oscillations that compose brain rhythms in premature.

**Objectives** To evaluate the interactions between the two oscillations using phase-amplitude coupling.

**Methods** EEGs of 34 pretermes (25–27wGA) were analyzed. Temporal relationships between TA and SW were assessed, using event-locked analysis. SW and TA were automatically detected. Artifact-free epochs time locked to the SW trough were extracted. Time-frequency representations (TFRs) were calculated. To quantify locking between the SW phase and the TA power, a synchronization index was computed. To investigate the temporal relationships between SW and TA, event histograms were created referenced to the SW trough and TA peak.

**Results** TFR analysis demonstrated that TA power was increased during the SW descending slope and around the SW trough and showed a lasting suppression during the SW peak. Event histogram analysis confirmed the consistent timing of TA during SW cycle. Maximum TA was reached before the SW trough.

**Conclusion** This cross frequency coupling with a so precise intimate temporal relationship between rapid and slow oscillators constitutes an index of "ideal" mechanisms with unique functional and structural wiring in the auditory network, disruptions of which might be of dramatic neurodevelopmental consequences. Coupling between the phase of the slow oscillations and the amplitude of theta oscillations in this early neural biomarker might suggest developing network level dynamics in early prematurity.

**Keywords** Phase-amplitude coupling; Premature; Spontaneous generators

**Disclosure of interest** The authors declare that they have no competing interest.

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### Plasticity of neonatal neuronal networks in very premature infants: Source localization of temporal theta activity, the first endogenous neural biomarker, in temporoparietal areas

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**Background** Temporal theta slow-wave activity (TTA-SW) in premature infants is a specific signature of the early development of temporal networks, as it is observed at the turning point between nonsensory driven spontaneous local processing and cortical network functioning. Previous studies have demonstrated that preterms from 28 weeks of gestational age (wGA) are able to discriminate phonemes and voice, supporting the idea of a prior genetic structural or activity-dependent fingerprint that would prepare the auditory network to compute auditory information at the onset of thalamocortical connectivity.

**Objectives** To specify the role in development and the specific location of TTA-SW.

**Methods** We recorded TTA-SW in 26–32 wGA preterms. The rate of TTA-SW in response to click stimuli was evaluated using low-density EEG in 30 preterms. The sources of TTA-SW were localized by high-density EEG using different tissues conductivities, head models and mathematical models.

**Results** We observed that TTA-SW is not sensory driven. Regardless of age, conductivities, head models and mathematical models, sources of TTA-SW were located adjacent to auditory and temporal junction areas. These sources become situated closer to the surface during development.

**Conclusion** TTA-SW corresponds to spontaneous transient endogenous activities independent of sensory information at this period, which might participate in the implementation of auditory, language, memory, attention and or social cognition and represents a general interaction between the subplate and the cortical plate.

**Keywords** Development; Endogenous oscillations; Source localization

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### Preterm modulation of connectivity by endogenous generators: The theta temporal activities in coalescence with slow waves

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**Background** The neuronal activity of the preterm brain is characterized by various endogenous activities whose roles in neurodevelopmental maturation processes have not been fully elucidated. The preterm EEG is characterized by discontinuities composed of short bursts of activity with dominant low frequencies. One of the earliest endogenous activities is the theta temporal acti-

