

# Lambda waves: a remarkable electroencephalographic record of a normal physiological phenomenon

## *Ondas lambda: um notável registro eletroencefalográfico de um fenômeno fisiológico normal*

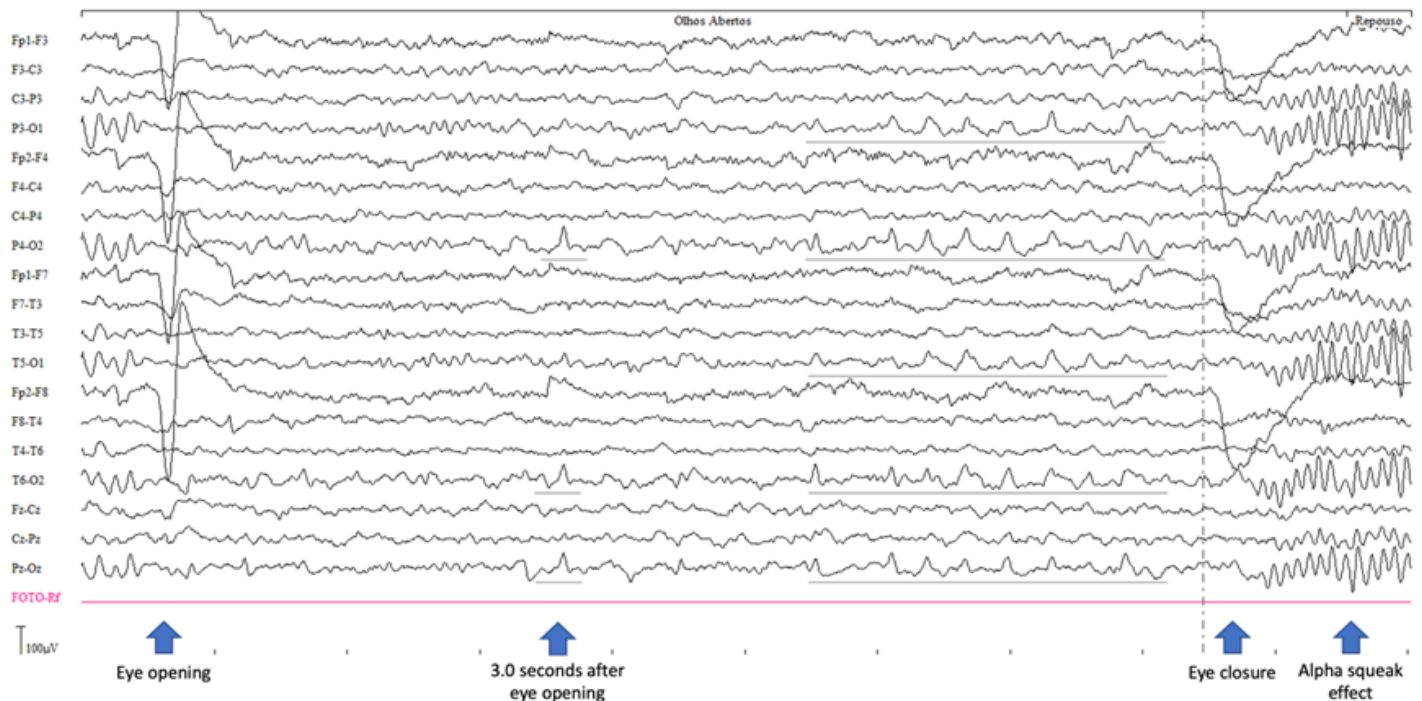
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Lambda waves are triangular-shaped monophasic electropositive sharp transients, occurring over the occipital or parieto-occipital regions<sup>1-5</sup>. They correspond to benign variants on electroencephalogram (EEG) and, sometimes can be misinterpreted as epileptiform activity due to their sharp contour<sup>1,5</sup>. They are usually symmetrical and time-locked to saccadic eye movements of awake subjects, during visual exploration, especially of a complex scene, and disappearing when eyes are closed and in sleep<sup>1,2</sup>. Their name is derived from the resemblance of the wave to the Greek capital letter lambda ( $\lambda$ )<sup>4</sup>. The expression of these waveforms seems to be secondary to a functional activation of networks probably localized within parieto-occipital regions<sup>3</sup>. Their generators, however, are not fully elucidated.

The first reports about the presence of lambda

waves date back to the early 1950s, suggesting that it is a phenomenon possibly associated with the presence of epilepsy or some organic brain disease<sup>1</sup>. Roth and Green<sup>1</sup>, however, were the first to obtain evidence that it was a normal physiological phenomenon.

Here we present a remarkable 13-year-old boy waking EEG sample, with a normal background tracing and no history of neurological or other diseases. Note the blocking reaction of the occipital alpha rhythm with eye opening, and the appearance of positive, monophasic, triangular-shaped waves about 3.0 seconds later, initially to the right and then bilaterally, corresponding to lambda waves (figures 1 and 2). After eye closure, the lambda waves disappear, and we can observe the return of a slightly accelerated posterior alpha rhythm (the alpha squeak effect) (figures 1 and 2).



**Figure 1.** A waking EEG sample showing the appearance of positive, monophasic, triangular-shaped waves over the occipital region, 3.0 seconds after eye opening, initially to the right and then bilaterally, corresponding to lambda waves (underlined). After eye closure, their disappearance, and the return of the slightly accelerated posterior alpha rhythm (the alpha squeak effect) is observed.

Parameters: bipolar longitudinal montage; sensitivity 10  $\mu$ V/mm; time constant 0.3 seconds; velocity 30mm/second; high-frequency filter 70 Hz

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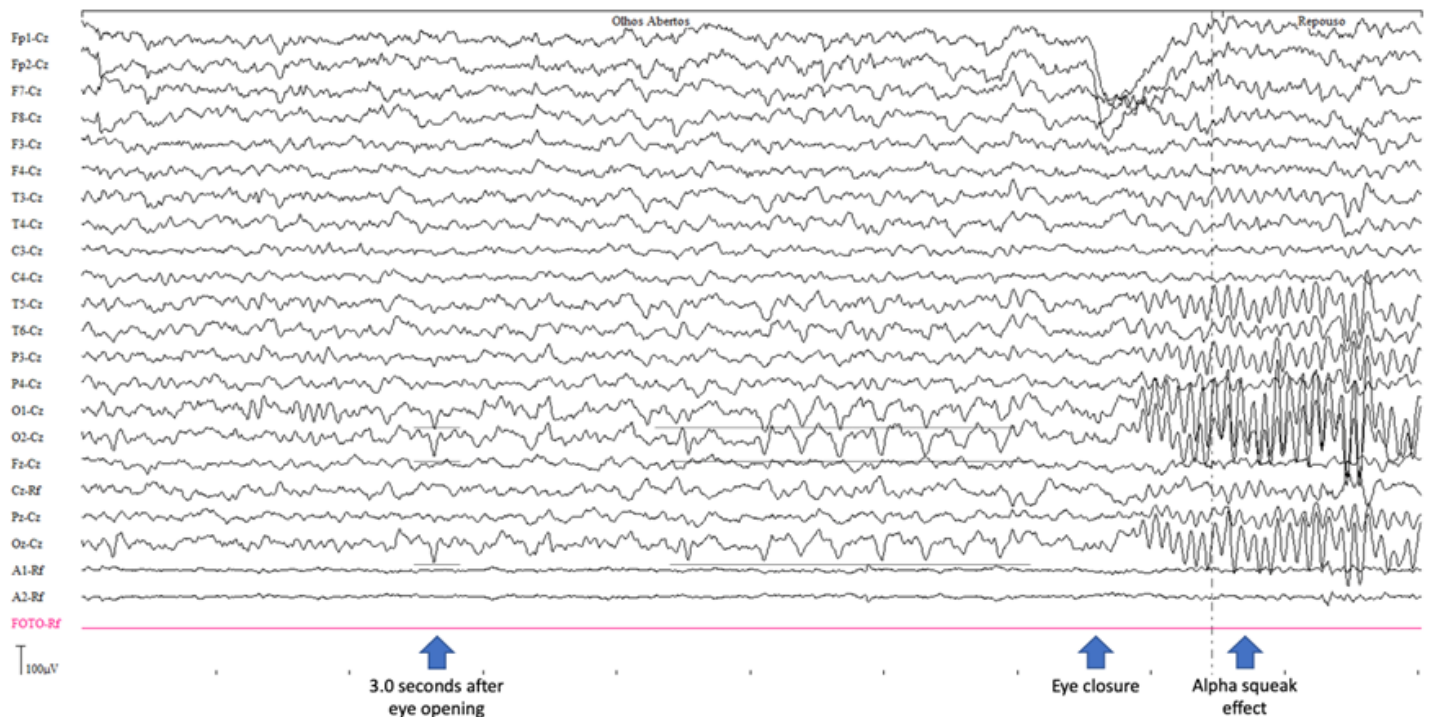
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**Figure 2.** The same epoch as Figure 1 in a referential montage (central reference - Cz). Three seconds after eye opening, the lambda waves (underlined) appear as downward deflections over the occipital region, initially to the right and then bilaterally.

Parameters: referential (central-Cz) montage; sensitivity 10  $\mu\text{V/mm}$ ; time constant 0.3 seconds; velocity 30mm/second; high-frequency filter 70 Hz.

The importance of recognizing lambda waves consists in identifying them as physiological and non-epileptiform graphoelements. Furthermore, some authors draw attention to their clinical significance, suggesting that the presence of lambda waves and a low normal posterior rhythm would be related to an intact cerebral health, excluding the presence of encephalopathies<sup>6</sup>.

#### Author contributions:

M.E.C. Andraus: research, writing, analysis, and interpretation of data. A.Q.B. Togbe: drafting, revision, and suggestions. A.C.M. Santiago: drafting, revision, and suggestions. C.M. Mpingiabo: revision and suggestions. C.F. Andraus: revision and suggestions.

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