

# Fotosintetinių anteninių kompleksų agregatų fluorescencijos temperatūrinė analizė ir nefotocheminio gesinimo prigimtis

## Temperature-dependent fluorescence from the aggregates of photosynthetic light-harvesting complexes and the origin of non-photochemical quenching

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Non-photochemical quenching (NPQ) is a self-regulatory mechanism utilized by green plants on a molecular level that allows them to operate under varying light conditions and to avoid dangerous over-excitation during intense sunlight. To get more insight into its physical origin, we performed high-resolution time-resolved fluorescence measurements of the major light-harvesting complexes (LHCII) and their aggregates across a wide temperature range (from the room temperature down to 15 K) [1]. The thorough analysis of the collected data indicated the co-existence of at least 3 distinct conformational states of the LHCII complexes: the dominating one, corresponding to the usual fluorescence around 680 nm; the red-emitting one, corresponding to the red-shifted fluorescence with spectral peak position around ~700 nm; and the third non-emitting state responsible for the excitation quenching (Fig. 1a). Based on simulations of the excitation energy transfer in the LHCII aggregate at various temperatures, we were able to associate the physical origin of these states with the underlying molecular mechanisms (Fig. 1b). Particularly, it was shown that the quenching state resembling NPQ is related to the incoherent excitation energy transfer from chlorophyll (Chl) to the short-lived carotenoid (Car) excited state, most probably the one of the lutein pigment [2]. On the other hand, the red-shifted fluorescence was shown to arise due to partial mixing of excitonic and chlorophyll–chlorophyll charge transfer (CT) states. Our results also demonstrate that the required level of photoprotection *in vivo* can be achieved by very subtle environmental-dependent variations in the number of LHCII switched to the quenched state.

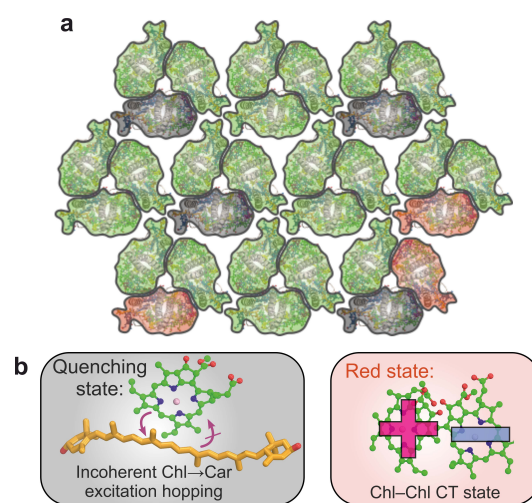


Figure 1. (a) Model of the LHCII aggregate consisting of LHCII complexes being in 3 distinct conformational states—the dominating 680-nm-emitting one (green), the red-emitting one, having fluorescence maximum at ~700 nm (red), and the quenching one (grey). (b) The proposed molecular origin of the red-emitting and quenching states of LHCII.

*Reikšminiai žodžiai: fotosintezė, pigmentai, nefotocheminis gesimas, fluorescencija, temperatūra.*

### Literatūra

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