



Subunits of the chaperonin CCT are associated with *Tetrahymena* microtubule structures and are involved in cilia biogenesis

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Abstract

The cytosolic chaperonin CCT is a heterooligomeric complex of about 900 kDa that mediates the folding of cytoskeletal proteins. We observed by indirect immunofluorescence that the *Tetrahymena* TpCCT α , TpCCT δ , TpCCT ϵ , and TpCCT η -subunits colocalize with tubulin in cilia, basal bodies, oral apparatus, and contractile vacuole pores. TpCCT-subunits localization was affected during reciliation. These findings combined with atomic force microscopy measurements in reciliating cells indicate that these proteins play a role during cilia biogenesis related to microtubule nucleation, tubulin transport, and/or axoneme assembly. The TpCCT-subunits were also found to be associated with cortex and cytoplasmic microtubules suggesting that they can act as microtubule-associated proteins. The TpCCT δ being the only subunit found associated with the macronuclear envelope indicates that it has functions outside of the 900 kDa complex. *Tetrahymena* cytoplasm contains granular/globular-structures of TpCCT-subunits in close association with microtubule arrays. Studies of reciliation and with cycloheximide suggest that these structures may be sites of translation and folding. Combined biochemical techniques revealed that reciliation affects the oligomeric state of TpCCT-subunits being tubulin preferentially associated with smaller CCT oligomeric species in early stages of reciliation. Collectively, these findings indicate that the oligomeric state of CCT-subunits reflects the translation capacity of the cell and microtubules integrity.

Keywords

- Chaperonin-CCT;
- *Tetrahymena*;
- Microtubules;
- Cilia;
- Translation GenBank ACCESSION NUMBER of TpCCT δ sequence [AY327033](#)