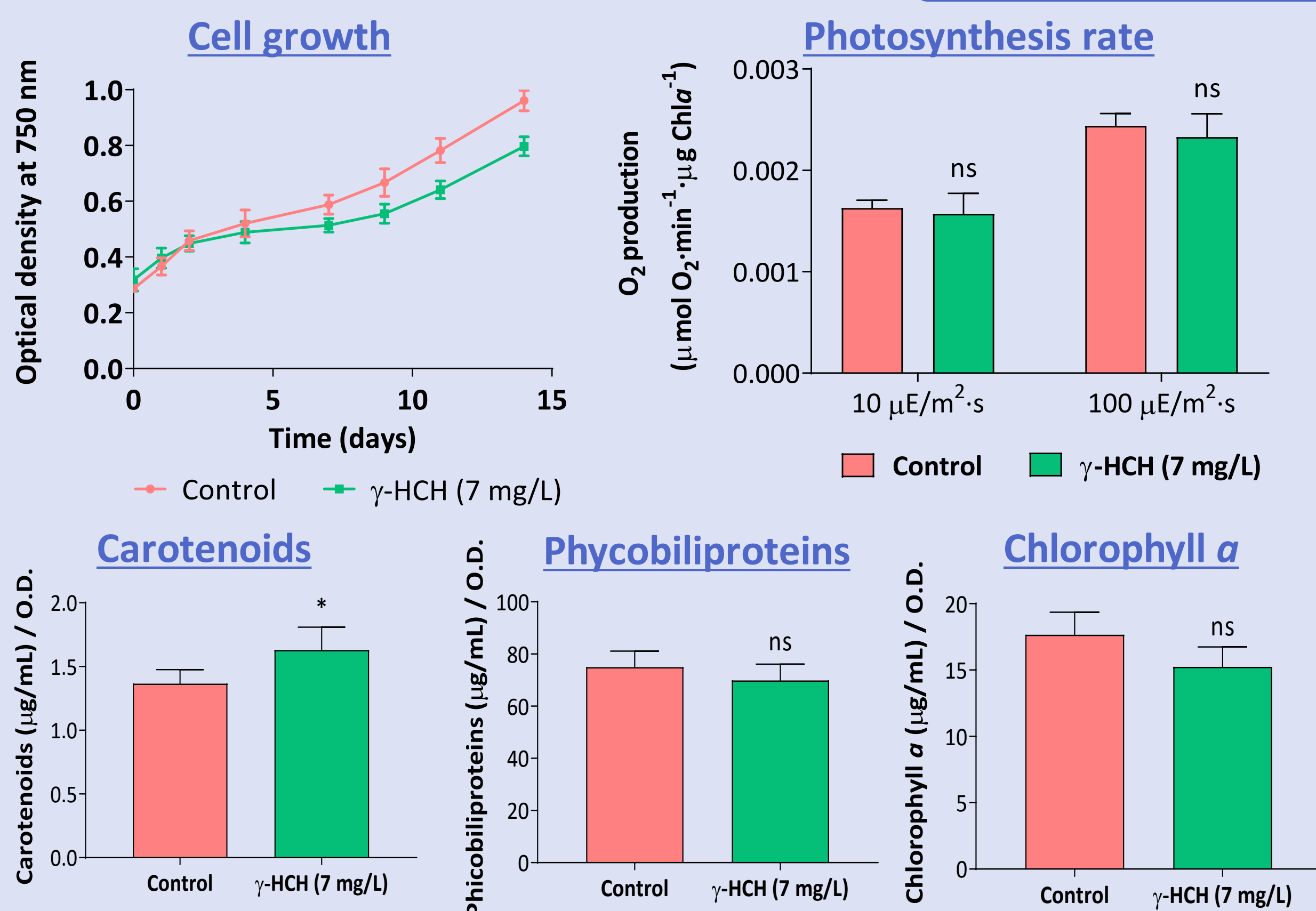
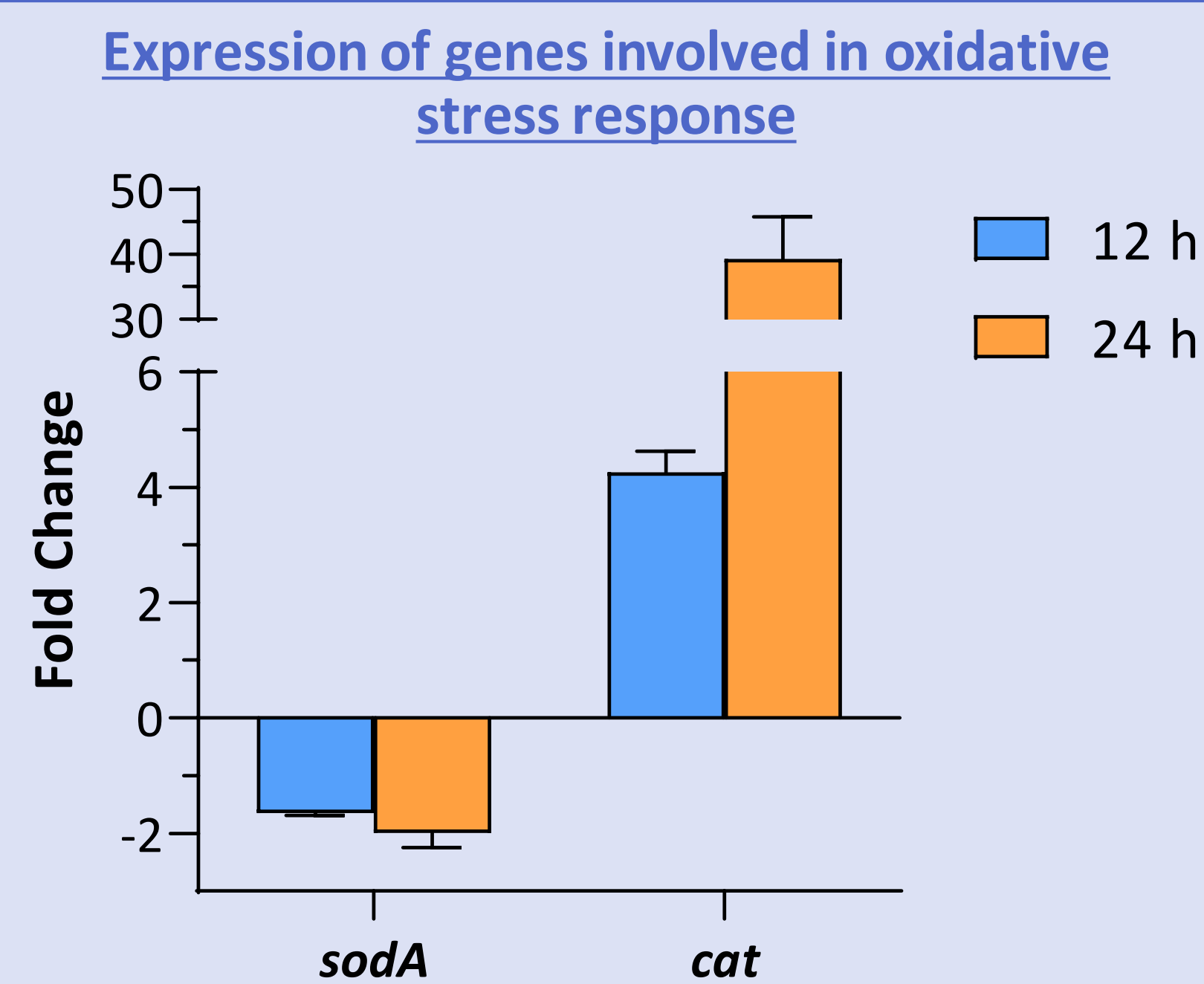


Lindane ( $\gamma$ -HCH) is an organochlorine pesticide which causes huge environmental concerns worldwide due to its recalcitrance and toxicity. The use of the cyanobacterium *Anabaena* sp. PCC 7120 in aquatic lindane bioremediation has been suggested but the information relative to this process is scarce. In the present work, data relative to the growth, pigment composition, photosynthetic rate and oxidative stress response of *Anabaena* sp. PCC 7120 in the presence of lindane at its solubility limit in water are shown. In these conditions this cyanobacterium displayed a suitable tolerance to the presence of lindane. In addition, degradation experiments revealed almost a total disappearance of lindane in the supernatants of *Anabaena* sp. PCC 7120 cultures after 6 days. Finally, in order to identify genes potentially involved in lindane degradation, genes homologous to the *lin* genes of *S. paucimobilis* B90A were searched *in silico* in the genome of *Anabaena* sp. PCC 7120. Five putative orthologs with different degrees of homology were found and differential expression analyses in the presence of lindane revealed a strong upregulation of one of the potential *lin* genes of *Anabaena* sp. PCC 7120.

## 1. Tolerance of *Anabaena* sp. PCC 7120 to lindane



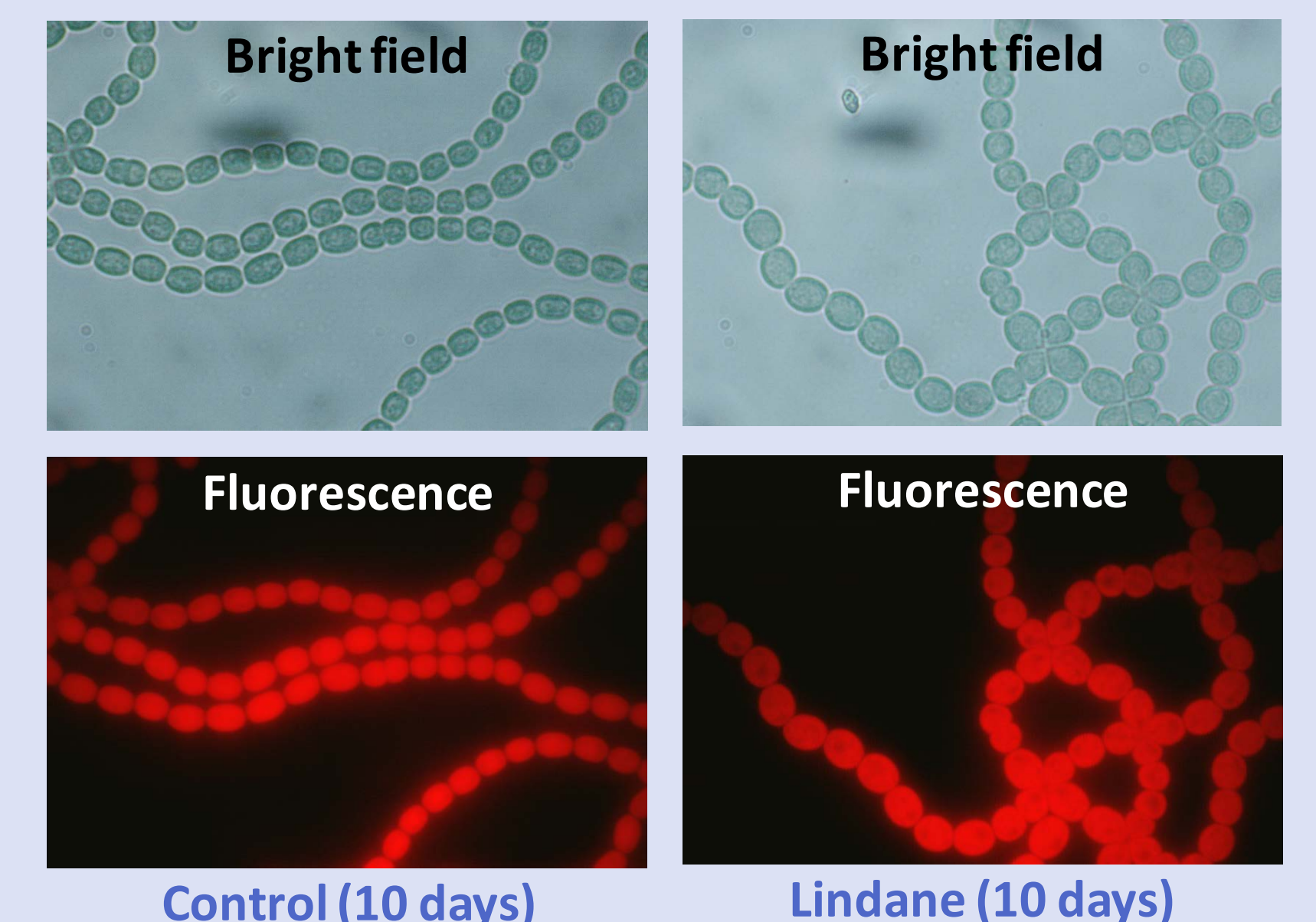
*Anabaena* sp. PCC7120 presents **good tolerance** to lindane (7 mg/L) since **cell growth** is hardly affected and **photosynthesis rate** is not altered. Determination of photosynthetic pigments showed that **chlorophyll a** and **phycobiliproteins** are not affected but **carotenoids** are slightly incremented, suggesting oxidative stress



Analysis of the expression of genes involved in oxidative stress response showed that:

- The expression of **superoxide dismutase A** is **not affected** by the presence of lindane
- The **expression of catalase increases 4-fold** after 12 h of exposure to lindane and **40-fold** after 24 h of exposure to lindane

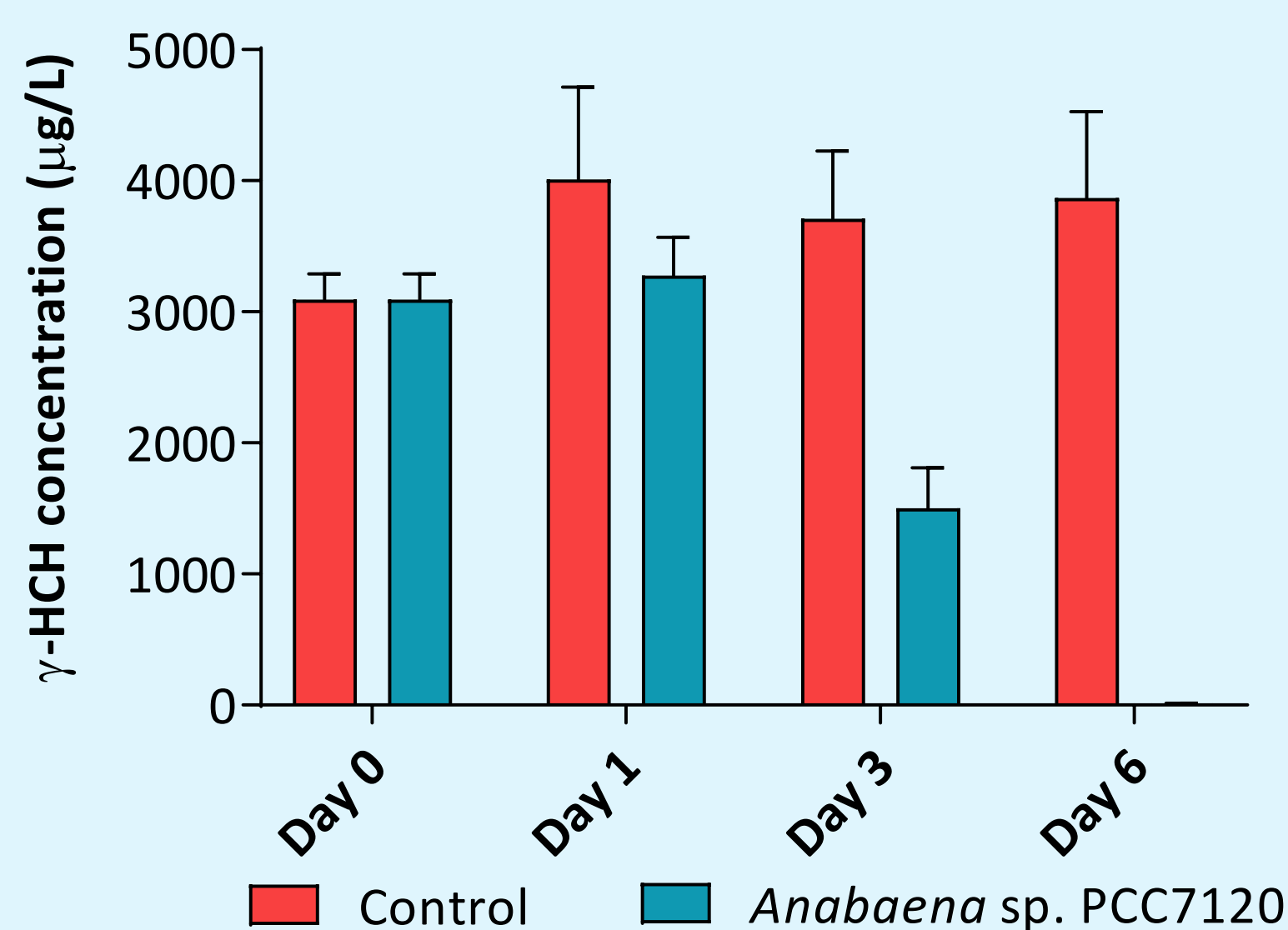
## Analysis of cell morphology



Analysis of **cell morphology** after 10 days of exposure to lindane (7 mg/mL) showed that cells were **not strongly affected by this compound**, since no cell disruption or loss of fluorescence was observed.

## 2. Lindane degradation by *Anabaena* sp. PCC7120

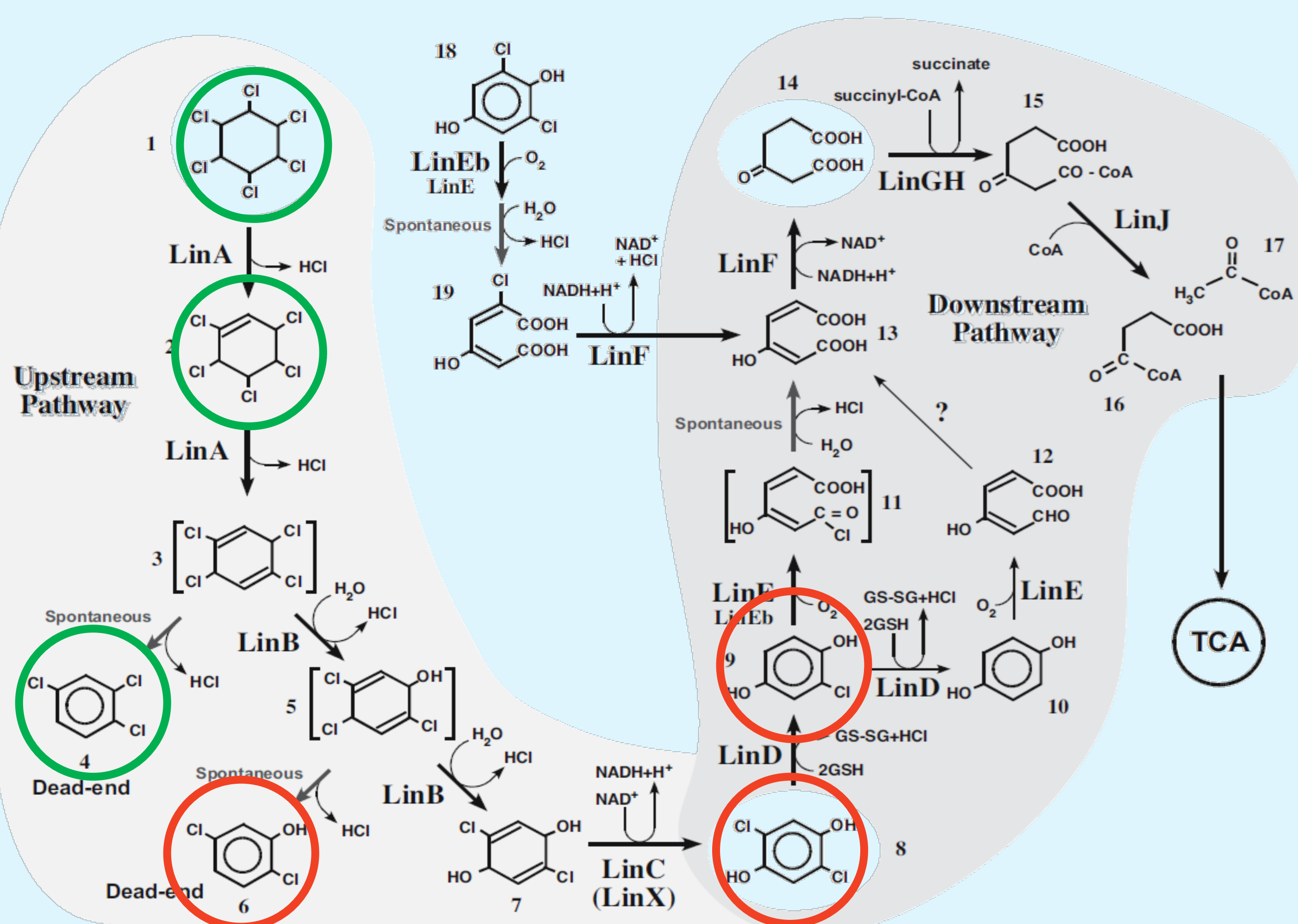
### Evolution of $\gamma$ -HCH concentration



$\gamma$ -HCH is completely eliminated from the supernatant after 6 days.

Inside *Anabaena* sp. PCC7120 cells,  **$\gamma$ -pentachlorocyclohexane** and **1,2,4-trichlorobenzene** were formed. However, **1,4-dichlorophenol**, **chlorohydroquinone** and **2,5-dichlorohydroquinone** were not detected

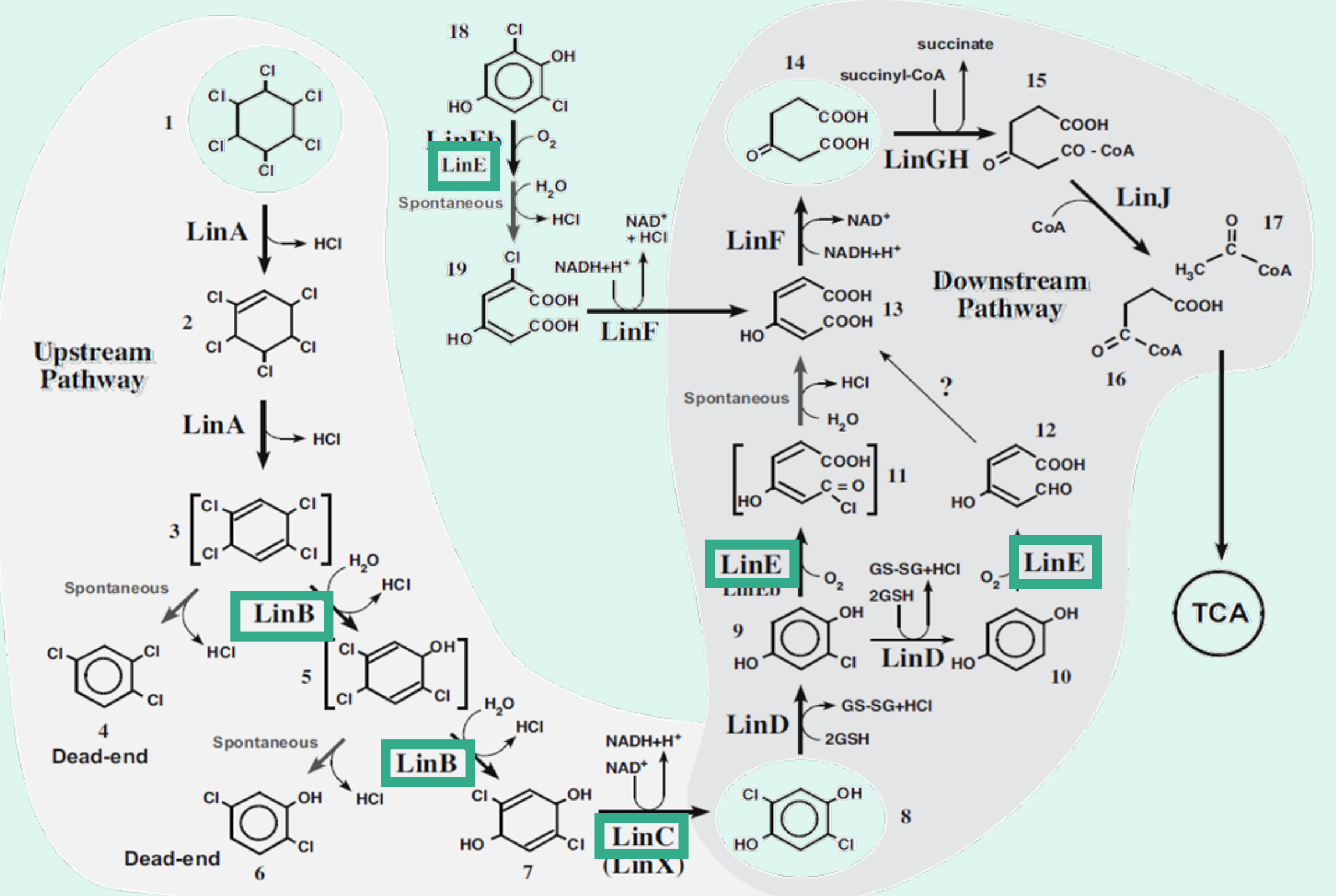
### Degradation intermediaries formation



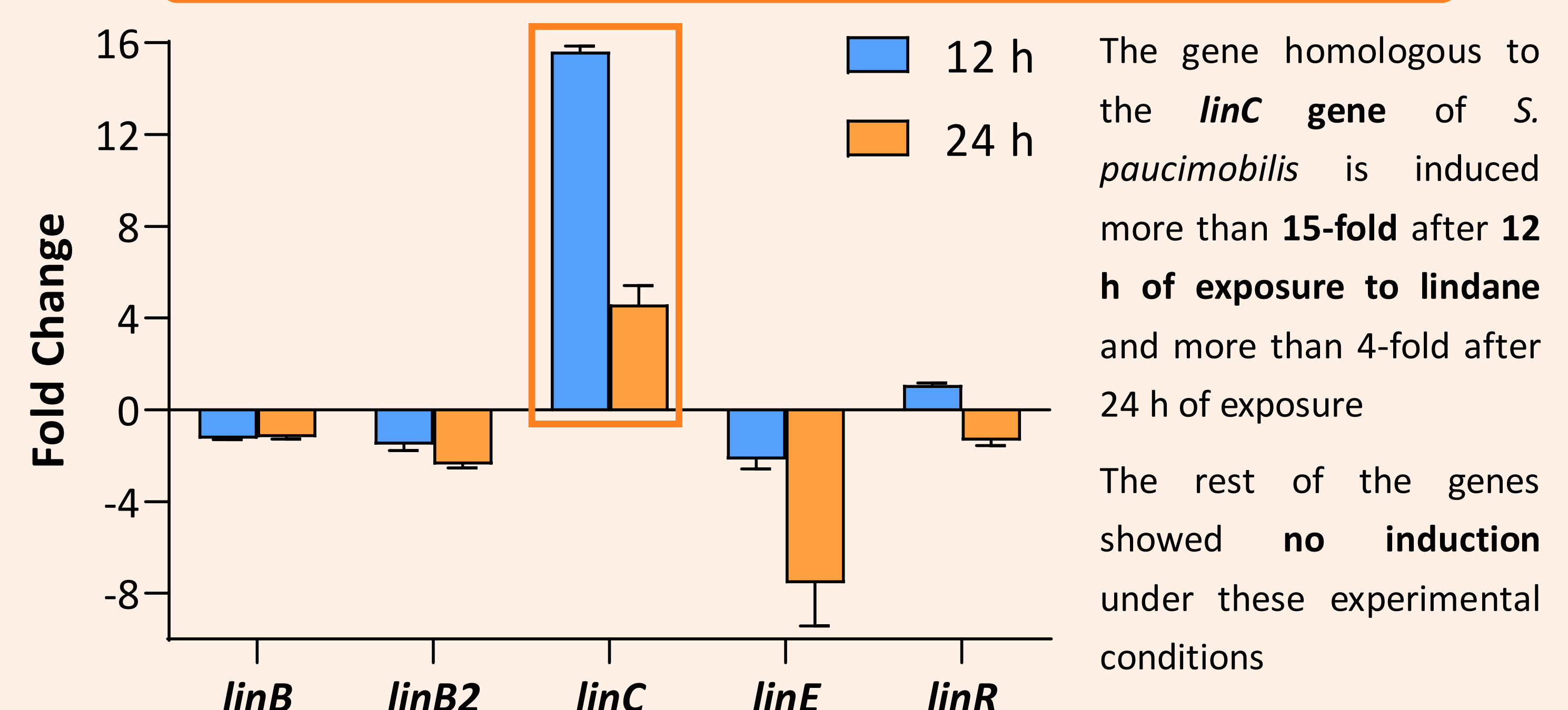
## 3. Identification of *lin* genes in *Anabaena* sp. PCC7120

Comparative genomic studies between *Anabaena* PCC7120 and *S. paucimobilis* have identified possible **homologues** for *S. paucimobilis* *lin* genes in *Anabaena* PCC7120:

- linB* (haloalkane dehalogenase)
- linC* (2,5-DDOL dehydrogenase)
- linE* (CHQ 1,2-dioxygenase)
- linR* (transcriptional regulator)



## 4. Induction of putative *lin* genes in *Anabaena* sp. PCC7120



The gene homologous to the *linC* gene of *S. paucimobilis* is induced more than **15-fold** after **12 h** of exposure to lindane and more than 4-fold after 24 h of exposure

The rest of the genes showed **no induction** under these experimental conditions

## CONCLUSIONS

- Anabaena* sp. PCC 7120 is able to **degrade lindane** at its solubility limit in water and shows a **good tolerance** to this compound
- Anabaena* sp. PCC 7120 contains genes homologous to the *lin* genes of *S. paucimobilis*, one of which is induced in the presence of lindane