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Photosynthetic membranes of *Rhodocyclus gelatinosus* and *Rhodocyclus tenuis*

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*Rhodocyclus gelatinosus*와 *Rhodocyclus tenuis*의 광합성막에 관하여

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ABSTRACT: Intracytoplasmic photosynthetic membranes of *Rhodocyclus gelatinosus* and *Rhodocyclus tenuis* are known to be of weakly developed type of in the Rhodospirillaceae. We compared the membrane invagination of *Rhodocyclus gelatinosus* KS-117 (isolated in our laboratory) with that of *Rhodocyclus tenuis* (ATCC 25093) after culturing under several different light intensities. We observed the significant membrane invagination in *Rhodocyclus gelatinosus*, in particular under 3,000 Lux, while none was observed in *Rhodocyclus tenuis*.

KEY WORDS□ *Rhodocyclus gelatinosus*, *Rhodocyclus tenuis*, **intracytoplasmic membranes.**

Rhodocyclus gelatinosus (= Rhodopseudomonas gelatinosa) and *Rhodocyclus tenuis* (= Rhodospirillum tenue) (Imhoff et al., 1984) have same intracytoplasmic membrane systems and belong to the same genus as *Rhodocyclus purpureus* at present (Before 1984, it belonged to different genus). But only few studies have been made on the fine structure of these two bacteria until now (Weckesser *et al.*, 1969; De Boer, 1969). *Rhodocyclus gelatinosus* as well as *Rhodocyclus tenuis* exhibit only occasional intracytoplasmic membranes (De Boer, 1969). But Drews and Oelze (1981) couldn't observe any membrane invagination while *Rhodocyclus tenuis* is growing actively under either chemotrophic or phototrophic conditions. Under three different light intensities and in the dark cultures intracytoplasmic membranes were observed with electron microscope.

MATERIALS AND METHODS

Rc. gelatinosus KS-117 (Lee and Lee, 1982) and *Rc. tenuis* (ATCC 25093) were grown anaerobically in the incandescent light (3,000 Lux, 2,000 Lux, 500 Lux) and also in the dark aerobic culture on malate medium by Ormerod (1961). All strains are harvested in 5 days old culture. For ultrathin sectioning the cells were fixed in 2.5% glutaraldehyde. Post fixation was done in 1% OsO_4. The organisms were dehydrated and embedded in Epon, staining done with uranyl acetate and lead citrate. Electron micrographs were taken with a JEOL 100 CX-II electron microscope at 80KW.

RESULT AND DISCUSSION

The cells of *Rc. gelatinosus* KS-117 cultured

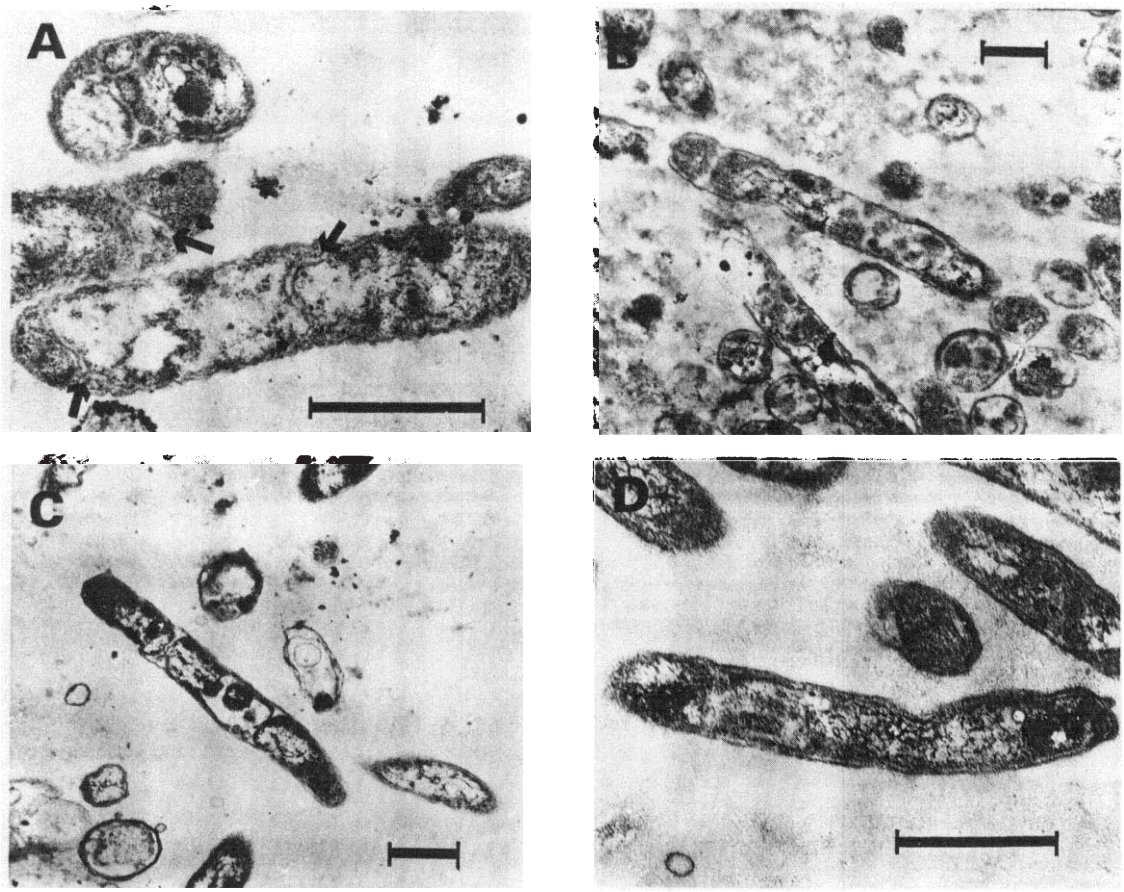

Fig. 1. *Electron micrographs of Rhodocyclus gelatinosus KS-117 and Rhodocyclustenuis (ATCC 25093) cultivated anaerobically in the light conditions.*
The bar represents 0:2 um.
A. *Rc. gelatinosus,* at 3,000 Lux.
B. *Rc. gelatinosus,* at 2,000 Lux.
C. *Rc. gelatinosus,* at 500 Lux.
D. *Rc. tenuis* treated with 10^{-5} M Auxin, at 2,000 Lux.

anaerobically in the light exhibit intracytoplasmic membranes remarkly under 3,000 Lux but less by 2,000 Lux and 500 Lux (Fig. 1. A.B.C.)

In the dark aerobic culture we have never found any detectalbe amounts of membrane invagination (Fig. 2D). However in contrast to *Rc. gelatinosus* KS-117, *Rc. tenuis* never formed even occasional intracytoplasmic membranes under the same conditions (Fig. 1D). There are many studies on the membrane invagination with relation to oxygen tension (Oelze and Drews, 1972; Kaplan, 1978; Wakim *et al.* 1978; Drews and Oelze, 1981). But only two studies are done anaerobically under light conditions by this group until now. With *Rc. gelatinosus* and *Rc. tenuis* De Boer (1969) found only occasional tubular intrusions after culturing anaerobically in the light at 50 foot candle and 2,000 ft.c.. Drews and Oelze (1981) have never observed membrane invagination in *Rc. tenuis* growing actively under either chemotrophic or phototrophic conditions. But *Rc. tenuis,* although exhibiting no significant quantities of intracytoplasmic membrane, is able to increase its cellular content of cytoplasmic membrane when adapting from chemotrophic to phototrophic conditions (Wakim *et al.,* 1978).

It is known that many bacteria from auxin in their cells and excrete it (Libbert, 1979). We

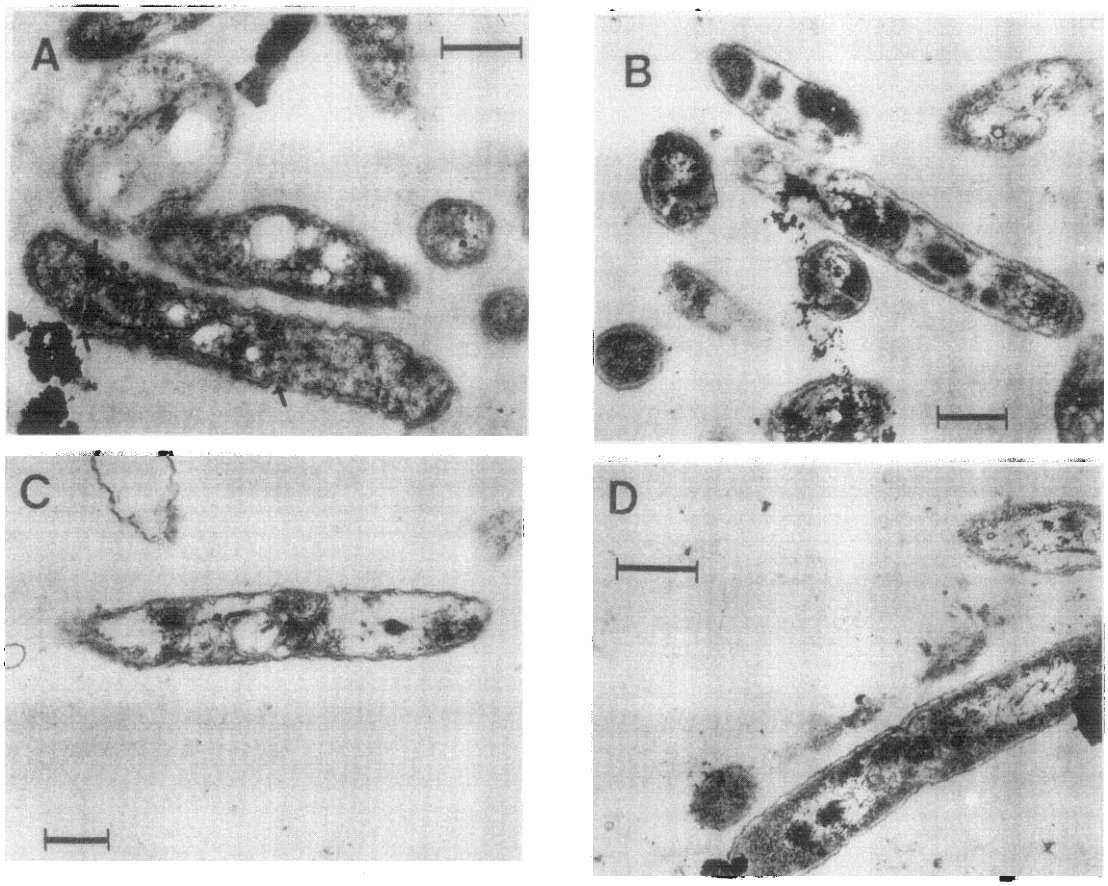

Fig. 2. *Electron micrographs of Rhodocyclus gelatinosus KS-117 cultivated anaerobically in the light and dark conditions, treated with 10^{-5} M Auxin.*
The bar represents 0.2 um.
A. at 3,000 Lux. B. at 2,000 Lux. C. at 500 Lux. D. in the dark.

wanted to know if auxin has any influence on intracytoplasmic membranes. It is added 10^{-3} M and 10^{-5} M auxin to ordinary media (Methods and Materials). At 10^{-3} M auxin there was no growth detectable and at 10^{-5} M there was no remarkable difference in intracytoplasmic membrane as they had grown well regardless of auxin (Fig. 2.A.B.C).

Rc. gelatinosus KS-117 formed intracytoplasmic membranes very well under 3,000 Lux, and didn't form it aerobically in the dark. But Rc. tenuis didn't form it anaerolically in the light. This agrees with results of Drews and Oelze (1981). Auxin had no remarkable influence on membrane invagination at 10^{-5} M.

적 요

세가지 다른 광전조건하에서 (3,000 Lux, 2,000 Lux, 500 Lux) *Rc. gelatinosus*와 *Rc. tenuis*의 intracytoplasmic membrane 형성을 전자 현미경으로 관찰한 결과 3,000 Lux 하에서의 배양에서는 *Rc. gelatinosus*에서 가장 잘 membrane invagination을 관찰할 수 있었고 *Rc. tenuis*에 대해서는 막의 invagination을 관찰할 수 있었다는 것과 관찰할 수 없었다는 두 가지 연구보고가 있는데, 본 연구에서는 후자와 일치하였고 auxin (10^{-5} M)은 생장에 지장이 없었으나 intracytoplasmic membrane 형성에는 별 영향이 없는 것으로 관찰되었다.

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