modulin of *Tetrahymena* and *Trypanosomes* has been characterized\(^\text{15}\) and appears to be different from higher organisms. Partial cure of *Leishmania* infection by CPZ has been reported\(^\text{16}\). Further work is needed on the characterization of protozoal calmodulin and related reactions of calcium metabolism to understand the precise mode of antiprotozoal action of phenothiazine. Suitably modified phenothiazines and other modulators of calcium metabolism hold promise in antiprotozoal chemotherapy.

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PHOTOSYNTHETIC BACTERIA FROM THE COASTAL BOARD ECOSYSTEMS

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The role of photosynthetic bacteria in the synthesis of organic matter in aquatic biotopes is well-recognized\(^1\). Following the early work of Warming\(^2\), who reported on the mass development of purple sulphur bacteria on the Danish Coast, many papers have appeared on the distribution of photosynthetic bacteria\(^3\). Generally,
the photosynthetic bacteria are more numerous in the estuarine environment than in the open ocean. Recent reports clearly indicate that the productivity of photosynthetic bacteria is comparatively higher than that of phytoplankters. Only limited information is available on the ecology of photosynthetic bacteria from the Indian waters. The present study deals with the enrichment and isolation of purple and green photosynthetic bacteria from the sediment of the Pichavaram mangroves near Porto Novo.

The sediment samples were collected below 40 cm water column from the mangrove vegetation-lined channels. Due to falling of leaves the sampling site had high organic matter deposition. The sampling site is influenced by semidiurnal tides. The samples were brought to the laboratory within 3 hr in a presterilized MacCartney bottle, to minimize any change in the microflora. Hydrographical parameters were also recorded during sampling.

For the culture of purple bacteria (Chromatium sp), a small amount of sediment was added to a flask containing sterile estuarine water, adding to it pieces of boiled egg to enable the production of H₂S to stimulate anoxic condition. The flask was sealed air tight and kept under constant fluorescent illumination. After a week of incubation, the bacterial growth was discernible by the development of bright red colour in the medium. It was subcultured and pure cultures were made using the Agar-shake method.

For the culture of the green bacteria (Chlorobium sp), the sample of mud was filled in a glass bottle (350 ml capacity) up to a third of its volume. The medium was prepared as recommended by Skerman and stoppered tightly and kept under fluorescent illumination. Subcultures were made using fresh medium.

Figures 1A and B. Photomicrograph of bacterial colonies of A. Chromatium sp and B. Chloroflexus sp.

Estimations of bacteriochlorophylls were based on the methods of Strickland and Parsons and Takahashi and Ichimura. Chlorophyll extracts from the bacterial cultures were made by using 90% acetone and visible light absorption spectra were recorded.

| Table 1 Bacterio-chlorophyll biomass (mg/m³) and the hydrographical data |
|---------------------------------|---|---|---|---|
| **Type of bacteria**            | **Chl. a** | **Chl.650** | **Chl.660** | **B. Chl** |
| 1) Red sulphur bacteria         | 1.83        | 16.80        | 19.40        | 91.80       |
| 2) Green sulphur bacteria       | 0.60        | 49.95        | 87.95        | 20.19       |

**Hydrographical data**

(i) Water salinity: 32%  
(ii) Temperature  

a) Atmosphere = 34°C  
b) Water = 31.5°C  
(iii) Dissolved oxygen = 3.10 ml/l  
(iv) pH = 8.6
(400–850 nm). The pure cultures were identified following the usual methods\textsuperscript{17,18}.

The calculated values of bacteriochlorophylls and the hydrographical data observed at the time of sampling are given in Table 1. Bacterial colonies of purple and green bacteria are shown in Figure 1 (A & B). Light absorption spectra of purple and green bacteria are shown in Figures 2 and 3.

The morphological features of the red sulphur bacterial isolates showed that they were microscopic, oval-shaped, highly motile, gram-negative cells with the deposit of sulphur globules inside their cells. Light absorption spectra showed two major peaks at the wavelengths of 480 and 772 nm and three minor peaks at 450, 470 and 680 nm. Of these observed peaks, the peak at 772 nm might be due to the contribution of Bchl. c, d and carotenoids. Similar observations have been reported by Truper and Genovese\textsuperscript{3}. The peak at 772 nm might indicate the presence of *Chromatium* sp observed earlier by Jimbo\textsuperscript{19}.

Although *Chlorobium*-like organisms appeared initially in the green bacterial cultures they were subsequently outgrown by gliding filamentous green organisms. Microscopic observation of the green mats showed the presence of sheathed green filaments, showing characteristic gliding movements with sulphur globules being deposited around these filaments. Spherical shaped yellow coloured organisms were also observed in small numbers. Light absorption spectra showed two major peaks at wavelengths of 430 and 670 nm and 3 minor peaks at 480, 620 and 760 nm. Of these, the peaks at 480 and 760 nm might be due to the contribution of Bchl. a and carotenoids. The above characteristics recorded agree with the observations of Pierson and Castenholz\textsuperscript{18}. Based on these characteristics the above mentioned bacterium is inferred to be a member of the species of the genus, *Chloroflexus*.

In the experimental studies the observed values of bacteriochlorophyll content showed higher value for purple bacteria (Table 1). Santhanam and Krishnamurthy\textsuperscript{19} found that abundance of sulphur bacteria coincided with the dominance of rotifers in the Pichavaram mangroves and that they formed an

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**Figure 2.** Light absorption spectra of purple-bacterial culture (*Chromatium* sp)

**Figure 3.** Light absorption spectra of gliding green bacterial culture (*Chloroflexus* sp).
important link in food chain. Photosynthetic bacteria
present just above the anoxic zone could serve as food
for zooplankters also. The photosynthetic bacteria
also flourish in the area and in the mudflats having fine
organic detritus and rich in humic substances.

The strains isolated in the cultures of purple and
green sulphur bacteria identified as belonging to
Chromatium sp (Family: Thiorhodaceae), Chloroflexus
sp (Family: Chloroflexaceae) respectively were found to
utilize H$_2$S for their growth in the laboratory
studies.

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NOTE ADDED IN PROOF

Since sending our communication, we have come
across recently in Current Science (April 20, 1986) 55(8)
pp. 426-427, a similar report by P. A. Lokabharathi
and D. Chandramohan, from the Lakshadweep area.
The findings are interesting. Our purple sulphur
bacteria do not seem to belong to the species
Chromatium violascens. Green sulphur bacteria have
been tentatively identified as, Chloroflexus sp, because
of their characteristic gliding nature, filamentous
appearance and specific absorption peaks in contrast to
Prosthecocloris sp of Lokabharathi and Chandramohan.
The differences in species composition of bacteria could be due to the habitats from
where the samples were collected in both the reports.

USE OF DIGESTIVE ENZYMES OF
INDIGENOUS SNAIL ARIOPHANTA
LINGULATA FOR YEAST PROTOPLAST
PRODUCTION

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Protoplasts have become a very important tool for
genetic manipulation and in the breeding of yeasts.
For protoplasting, commercial enzyme preparations
like digestive enzymes of the snail Helix pomatia or
enzymes from Arthrobacter, Cytophaga or
Streptomyces are in common use. Since snails