1. ***Introduction to industrial microbiology***

Traditional fermentation processes, such as those involved in the production of fermented dairy products and alcoholic beverages, have been performed for thousands of years. However, it is less than 150 years ago that the scientific basis of these processes was first examined. The birth of industrial microbiology largely began with the studies of **Pasteur**. In 1857 he finally demonstrated beyond doubt that alcoholic fermentation in beer and wine production was the result of microbial activity, rather than being a chemical process. Prior to this, **Cagniard-Latour**, **Schwann** and several other notable scientists had connected yeast activities with fermentation processes, but they had largely been ignored. Pasteur also noted that certain organisms could spoil beer and wine, and that some fermentations were aerobic, whereas others were anaerobic. He went on to devise the process of pasteurization, a major contribution to food and beverage preservation, which was originally developed to preserve wine. In fact, many of the early advances of both pure and applied microbiology were through studies on beer brewing and wine making.

Pasteur’s publications, *Études sur le Vin* (1866), *Étudessur la Bière* (1876) and others, were important catalystsfor the progress of industrial fermentation processes.Of the further advances that followed, none weremore important than the development of pure culturetechniques by **Hansen** at the Carlsberg Brewery in Denmark. Pure strain brewing was carried out here for the first time in 1883, using a yeast isolated by Hansen, referred to as Carlsberg Yeast No. 1 (*Saccharomyces* *carlsbergensis*, now classified as a strain of *Saccharomyces* *cerevisiae*).

A typical operation involves both **upstream processing** (USP) and **downstream processing** (DSP) stages (Fig.i). The USP is associated with all factors and processesleading to and including the fermentation, and consistsof three main areas.

1 The producer microorganism.

2 The fermentation medium.

3 The fermentation.

**Environmental roles of microorganisms**

***Part 1*** ***Microbial cell structure and function***

**Prokaryotes**

Prokaryotes have been separated into two distinct groups on the basis of the study of phylogenetic (evolutionary) relationships. They are the **archaebacteria** or **archaea** (‘ancient’ bacteria) and the **eubacteria** (‘true’ bacteria), the group that contains almost all established industrial prokaryotes

**Archaea**

These prokaryotes are quite different from eubacteria and have some features, especially aspects of the transcription and translation machinery associated with protein synthesis, that are similar to eukaryotic cells.

**Eubacteria**

The eubacteria are a very diverse group that may be divided into 12 subgroups. However, almost all industrial bacteria are contained within just two of them, the proteobacteria and the Gram-positive eubacteria.