



# History of Industrial Biotechnology

## Early History

- Long before their “ discovery, ” microorganisms were exploited to serve the needs and desires of humans, for example to preserve milk, fruits, and vegetables, and to enhance the quality of life by producing beverages, cheeses, bread, pickled foods, and vinegar. The use of yeasts dates back to ancient days
- The oldest fermentation know - how – the conversion of sugar to alcohol by yeasts – was used to make beer in Sumeria and Babylonia as early as 7000 BC .

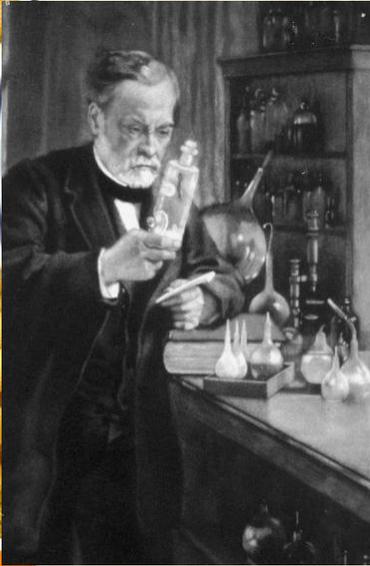
## Early History

- By 4000 BC, the Egyptians had discovered that carbon dioxide generated by the action of brewer ' s yeast could leaven bread. Ancient peoples are also known to have made cheese with molds and bacteria.
- In 100 BC, Ancient Rome had over 250 bakeries which were making leavened bread. As a method of preservation, milk was fermented to lactic acid to make yogurt and also converted into kefir and koumiss using *Kluyveromyces species in Asia*.

## Early History

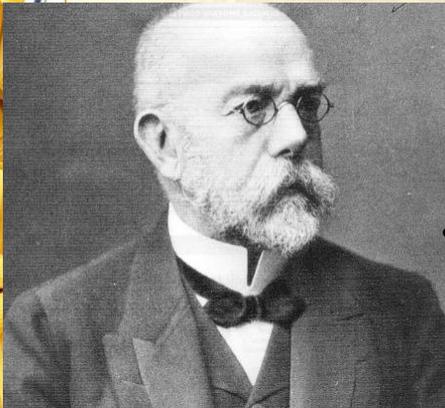
- The use of molds to saccharify rice in the koji process dates back at least to AD 700. By the fourteenth century AD, the distillation of alcoholic spirits from fermented grain, a practise thought to have originated in China or the Middle East, was common in many parts of the world.
- Vinegar manufacture began in Orleans, France, at the end of the fourteenth century and the surface technique used is known as the Orleans method

## Louis Pasteur

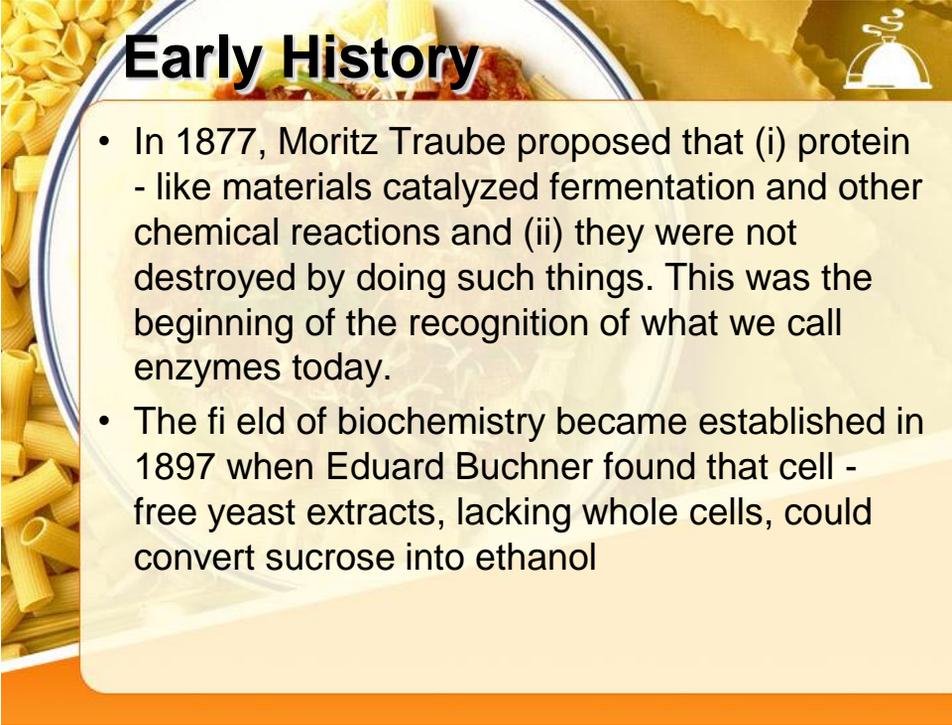


- In the 1850s, Pasteur had detected two optical types of amyl alcohol, that is, D and L , but he was not able to separate the two.
- in 1857, that fermentation was a living process of yeast.
- In 1861, Pasteur proved the presence of microbes in the air,

## Robert Koch.

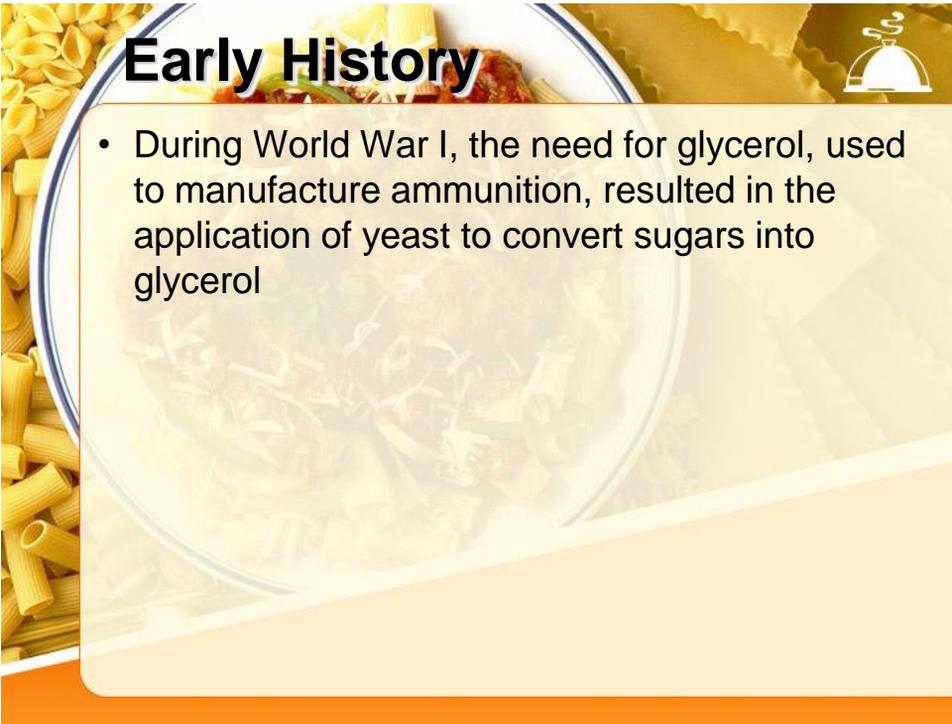


- In 1876, the great German microbiologist Robert Koch proved that bacteria from anthrax infections were capable of causing the disease
- Postulate Koch



## Early History

- In 1877, Moritz Traube proposed that (i) protein - like materials catalyzed fermentation and other chemical reactions and (ii) they were not destroyed by doing such things. This was the beginning of the recognition of what we call enzymes today.
- The field of biochemistry became established in 1897 when Eduard Buchner found that cell - free yeast extracts, lacking whole cells, could convert sucrose into ethanol



## Early History

- During World War I, the need for glycerol, used to manufacture ammunition, resulted in the application of yeast to convert sugars into glycerol

## Chaim Weizmann



- Chaim Weizmann at the University of Manchester applied the butyric acid bacteria used for centuries for the retting of flax and hemp, for production of acetone and butanol
- His use of *Clostridium* to produce acetone and butanol was the first non - food fermentation developed for large - scale production;

## The Penicillin Story

- The golden era of antibiotics began with the accidental discovery of penicillin by Alexander Fleming in 1929 in England
- He also observed that filtrates of the mold lysed the staphylococci and were non - toxic in animals The importance of Fleming ' s discovery was that it led to penicillin, the first successful chemotherapeutic agent produced by a microbe, thus initiating the golden age of the wonder drugs

## strain improvement

- In the 1940s, a period of intense development in microbial genetics began
- These early genetic studies concentrated heavily on the production of mutants and the study of their properties.
- Strain selection began with *Penicillium chrysogenum* NRRL 1951. This strain was capable of producing 60 µg/ml.
- Cultivation of spontaneous sector mutants and
- single - spore isolations led to more productive cultures from NRRL 1951. One of these, NRRL 1951 - 1325, produced 150 µg/ml.

## strain improvement

- It was next subjected to X - ray treatment by Demerec of the Carnegie Institution at Cold Spring Harbor, New York, and mutant X - 1612 was obtained. This yielded 300 µg/ml.
- Workers at the University of Wisconsin then obtained ultraviolet - induced mutants of Demerec's strain. One of these, Q - 176, which produced 550 µg/ml
- The “ Wisconsin family ” of superior strains became well known all over the world, some producing over 1800 µg/ml

## The Penicillin Story

- By the 1950s, it was realized that *P. chrysogenum* could use additional acyl compounds as side - chain precursors (other than phenylacetic acid for penicillin G) and produce new penicillins;
- penicillin V (phenoxymethylpenicillin), achieved commercial success.
- The biosynthesis of penicillin from its precursors, L - cysteine, L - valine, and phenylacetic acid, was actively studied during the 1950s, 1960s, and 1970s