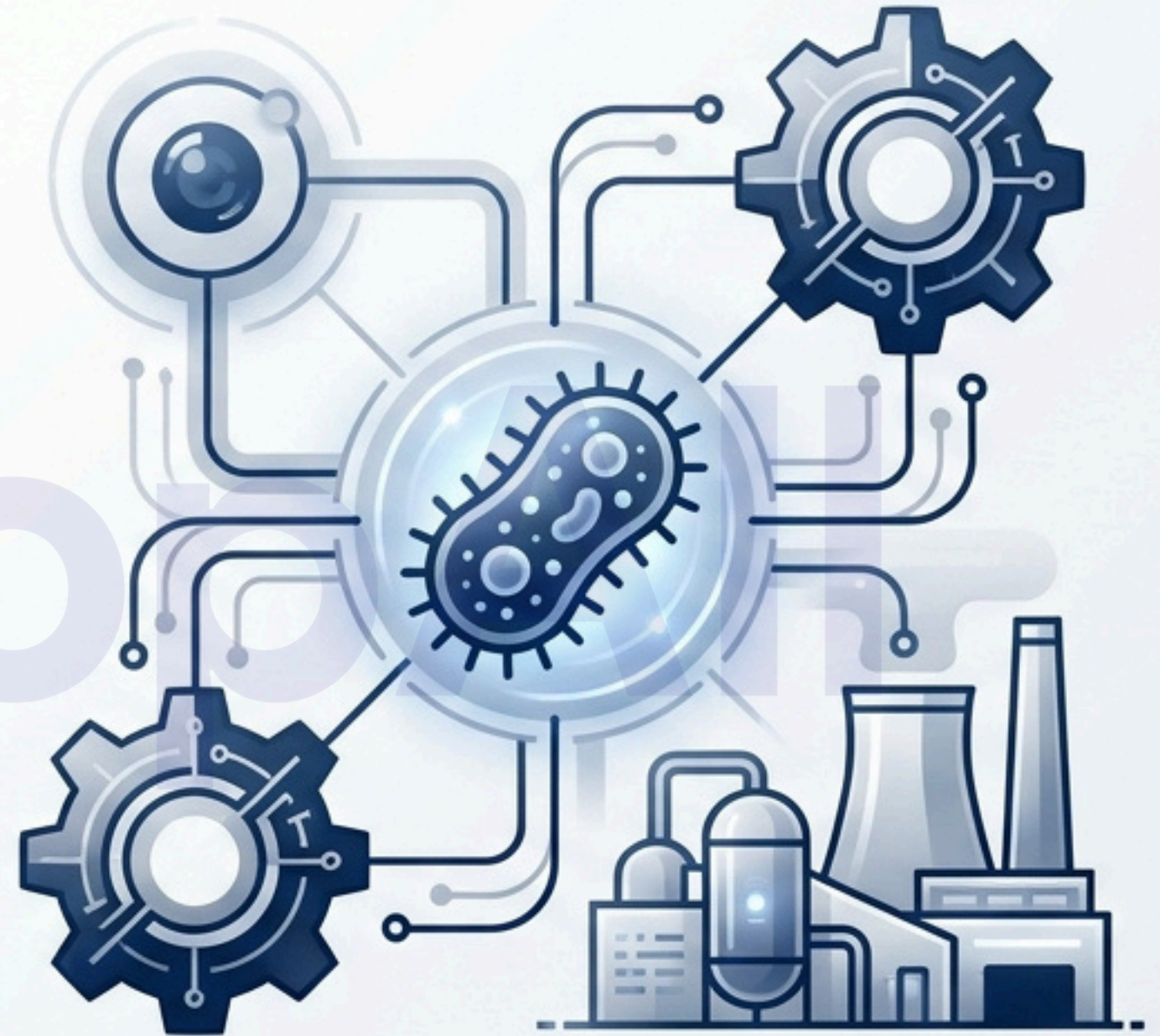


Microbes as Industrial Producers

How biological factories scale from microscopic organisms to massive commercial yields.

[Class 12 Biology]

[Section 8.2]



Scaling Up: From Kitchen to Factory

Household Production



Small inoculum (starter) of organisms like *Lactobacillus* added to milk to produce curd.
Volume is small; environment is uncontrolled.

The Industrial
Shift



Industrial Production



Culturing microbes to synthesize high-value products like beverages and lifesaving antibiotics. Requires massive scale and highly controlled environments to maximize yield.



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Key Highlights

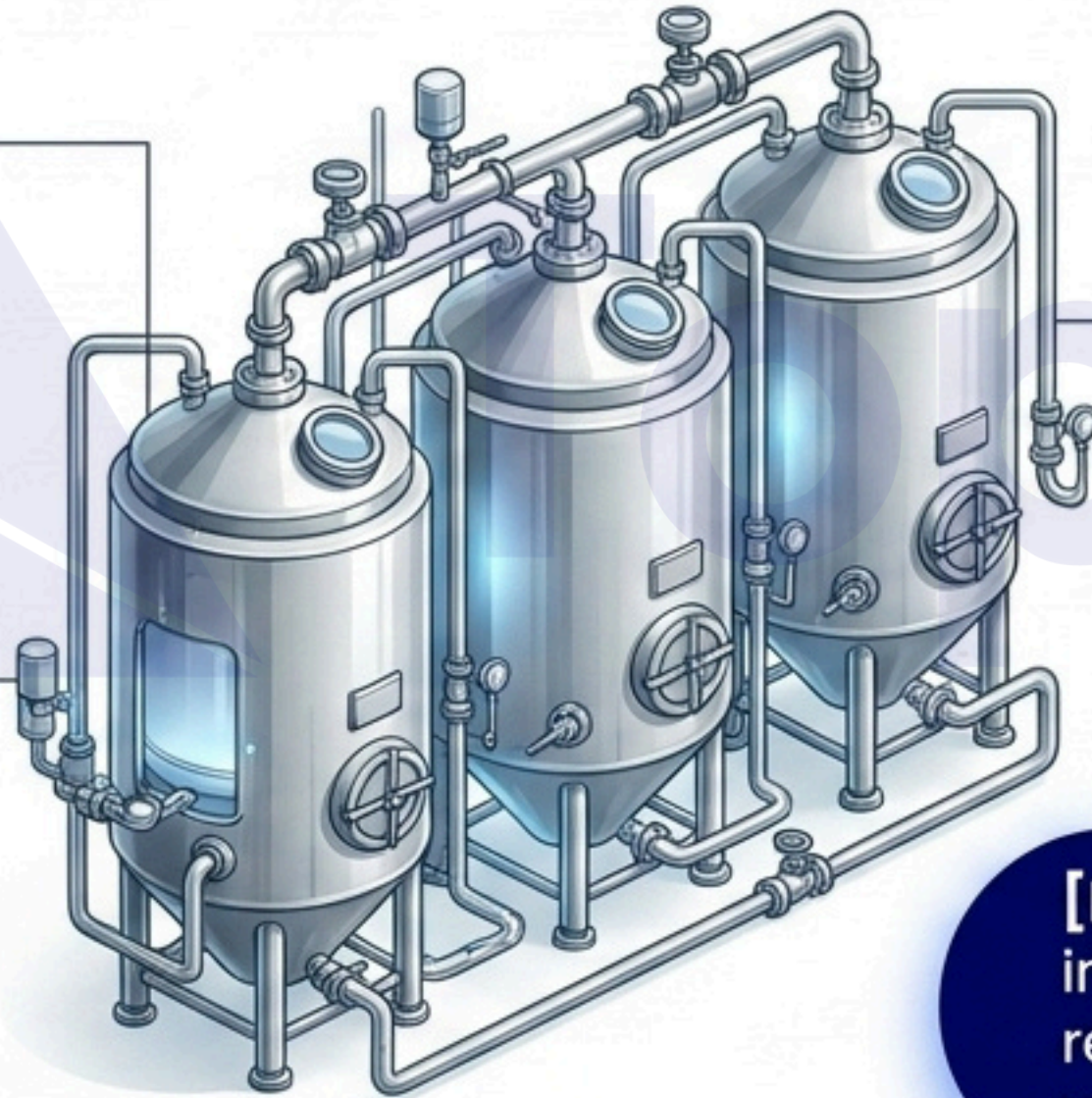
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The Biological Engine: The Fermentor

Scale

Massive industrial vessels holding thousands of liters.



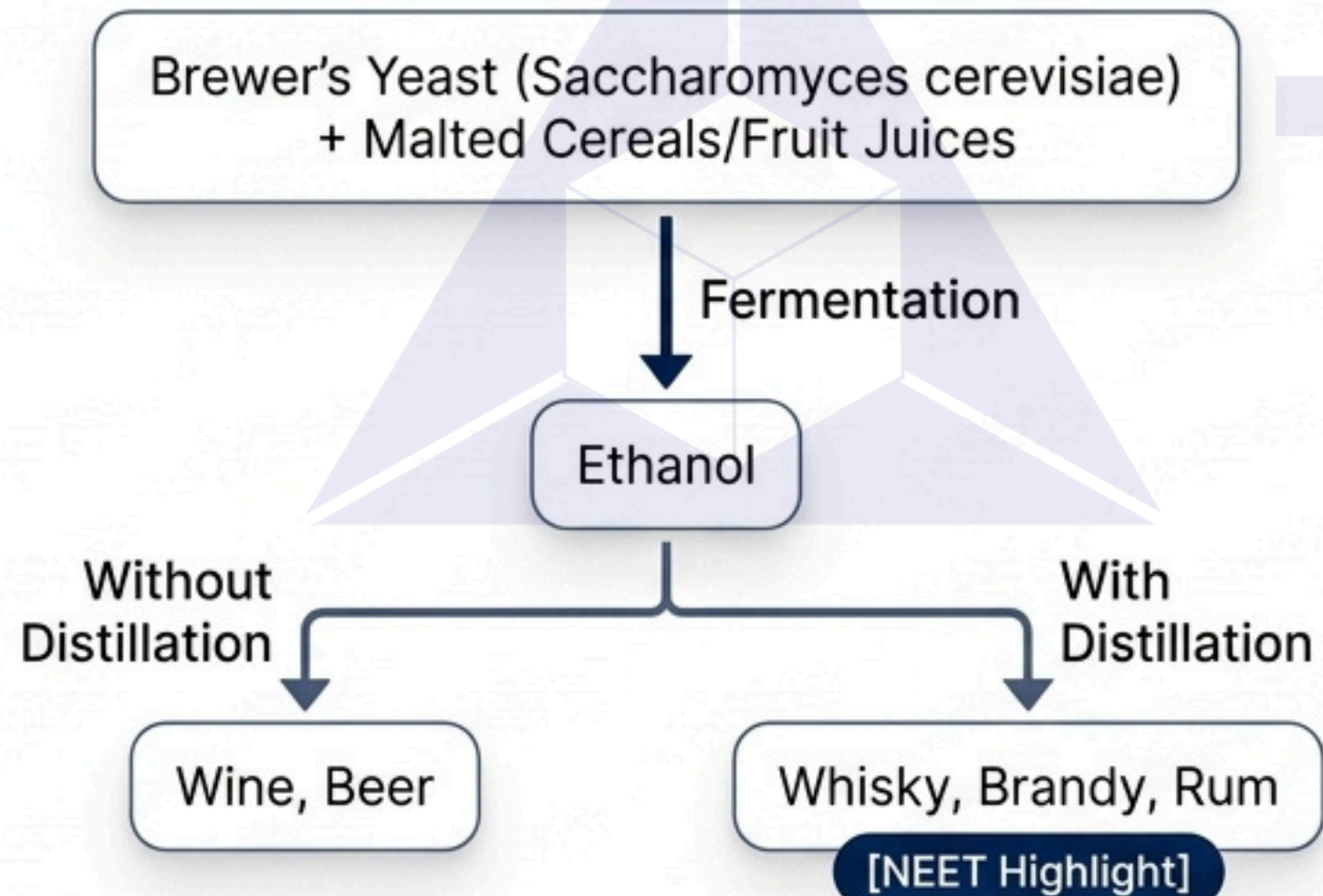
Function

Provides a highly controlled environment (temperature, pH, oxygen) for optimal microbial growth.

[Exam Takeaway] Large-scale industrial production specifically requires growing microbes in large vessels called **Fermentors**.

Primary Products: Beverages & Antibiotics

Fermented Beverages



Antibiotics ('Pro-Life' for humans)

1928 (Chance Discovery)

- Alexander Fleming observes *Penicillium notatum* mould inhibiting *Staphylococci* bacteria.

Later (Full Potential)

- Ernest Chain & Howard Florey develop it into an effective drug.

1945 (Recognition)

- Fleming, Chain, and Florey awarded the Nobel Prize. Extensive use in WWII.

High-Yield Matrix: Microbe to Molecule

[NEET High-Yield: **Direct Match Qs**]

Microbe Name	Classification	Product	Industrial / Medical Application
<i>Aspergillus niger</i>	Fungus	Citric Acid	-
<i>Acetobacter aceti</i>	Bacterium	Acetic Acid	-
<i>Clostridium butylicum</i>	Bacterium	Butyric Acid	-
<i>Lactobacillus</i>	Bacterium	Lactic Acid	-
<i>Streptococcus</i> (modified)	Bacterium	Streptokinase	'Clot buster' for myocardial infarction.
Various Microbes	-	Lipases & Pectinases/Proteases	Stain removal (laundry) & Clarifying bottled juices.
<i>Trichoderma polysporum</i>	Fungus	Cyclosporin A	Immunosuppressive agent for organ transplants.
<i>Monascus purpureus</i>	Yeast	Statins	Blood-cholesterol lowering (Competitive inhibition).



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