Introduction to Bioprocess Engineering SQBI2513

Microorganism: Biologists and engineers think differently

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Learning outcomes

By the end of this lesson, you should be able to:

1. Recall the types of kingdom for living organism.
2. Identify the special properties of prokaryotes which bioprocess engineers are interested in.
3. State how scientists and engineers think about microorganism.

Taxonomy (2 min discussion)

- Taxonomy of living things = classification

Criteria (description)	Examples
Morphology	Shape, color, appearance
Energy and nutritional requirements	
growth and product-release rates	
method of reproduction	
means of motion	
Genetically	

Some Properties of prokaryotes

- **Two category: bacteria and archaea.**
- **Examples of prokaryotes are:_____**
- **Cell size is smaller than eukaryotes.**
- **Cells have broad tolerance limits.**
- **The metabolic processes is complex.**
- **They have no membrane enclosed compartments.**
- **Cells are lack of nucleus.**
- **All prokaryotes have a nucleoid, a plasma membrane, and a cytoplasm.**
  The plasma membrane is a phospolipid bilayer that encloses the cell.

Disclaim

- This is not a microbiology course.
- The information on microbiology is not comprehensive.

Brainstorming

- Wait a minute,….this is bioprocess class, not a microbiology class.
- Is the prokaryotes properties important to bioprocess engineers?
- If “YES”, Why? Knowledge use for what?
- If “NO”, What would the engineers like to know?

"Wh" questions

The biologist asks:

What…is this cell?

Why…it has a cell wall?

Where…it was found?

How…to grow it?

Who….did that job?

When…will the cell die?

The engineer ask:

What…is the usage?

Why…not we make money from it?

Where…I can get it free without paying?

How…to sell it?

Who….to sell it?

When…I can sell it?

Some special properties of prokaryotes bioprocess engineers are interested

Criteria (description)	Reasons
Fast growing	
Require simpler medium	
Consist industrial applicable enzymes	
Thermophiles/thermozymes	
Others?	
Others?	

How about eukaryota?

- Examples of eukaryotic cells are:
  - Fungi
  - Algae
  - Yeast

- Can you name a few applications of these cells?

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Examples of established bioprocess industrials

Food industries	**Value added industries**	**Pharma industries**
-Probiotics -Wine etc -Fermented food i.e cheese -Others?	-Oligosaccharides -Vitamins (e.g B) -Chemicals e.g citric acid	-Antibiotics -Antibody -Insulin -H-serum albumin -EPO -CHO -Others

Examples of established bioprocess industrials

Waste treatment

-Solid waste

- Domestic waste
- Factory waste

Recent emerging bioprocess industrials (examples)

- Microalgae
- Empty fruit bunch
- Biogas (biobutanol, etc)
- Construction disposed woods
- Bioplastic
- Healthcare e.g collagen
- Alternative to conventional oligosaccharides

Recent emerging bioprocess industrials (examples)

- Better Than Corn? Algae Set to Beat Out Other Biofuel Feedstocks
- (adapted from Worldwatch Institute) Alana Herro – October 8, 2007

- 1 acre corn produce: 1600L ethanol.
- 1 acre soybeans produce: 265L biodiesel.
- 1 acre algae produce 19,000L biodiesel.

Animal/mammalian cell lines

- Therapeutic proteins are normally produced in mammalian cells such as cells from hamster and mouse.
- Mammalian cells are normally growth on attached surface but attempts were already done to make them able to grow in suspension.

5 min discussion-
Some issues using mammalian cell line

Concern	Reasoning
Why use mammalian cell line and not prokaryotes/eukaryotes cell lines?	
Cost of using mammalian cell lines?	
Problems of using mammalian cell lines?	

Home work

- Tuesday 3 min Quiz:
- Reading material:
  - Wikipedia: keyword “Glycosylation”
  - Wikipedia: keyword “cell culture”