What plant grows the most abundantly on Earth?
Algae: Tiny Plants with Big Energy Potential
Learning Objectives for Today

• What are similarities and differences between biofuels and fossil fuels?
• What are algae? What can biological engineers make out of algae?
• Why is breaking the algal cell wall important for biological engineers?
Biofuels

Chemicals from plants that we can use for energy

What is another source of chemical energy?

How are oil, coal and natural gas different than biofuels?
Biological engineers

People who apply their knowledge about living things to solve problems

Biological engineers work with farmers, doctors and scientists

Describe a problem that biological engineers might be able to help you with...
Algae are Super Plants

Algae are one type of teeny tiny plant that you can find growing in lakes, ponds and swimming pools.
<table>
<thead>
<tr>
<th>Algae</th>
<th>Very small plants</th>
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<tr>
<td></td>
<td>Live in water in many places around the world</td>
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<td>They grow fast</td>
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Algae grow “like weeds”

The types of algae that many engineers use grow twice their size in a day! That’s fast.

Compared to human growth, it would be like:

- On Monday, you weigh 50 pounds
- By Tuesday, you weigh 100 pounds.
- How much would you weigh on Wednesday?
- By Friday, you would weigh 800 pounds!

*From where does the alga growth come?*
Plants Photosynthesize

Photo = light
Synthesize = to make, usually a chemical
Why do biological engineers use algae for biofuels?

Algae grow very fast

Algae grow in many places around the world

People do not usually eat algae

We can make biofuel from three parts of algal cells
3 Parts of Algae We Make into Fuel

- Oil
- Cell wall (made of sugar)
- Starch (made of sugar)
Algae

Very small plants
Live in water in many places around the world
They grow fast
People don’t usually eat algae
Composed of oil, starch and cell walls
Cell Wall Analogy
Cell wall

A structure made of sugar that surrounds and protects a cell.

Cell wall sugars can be used to make more biofuel.
Review

• Why are algae good for biofuels?
  – Algae grow very fast
  – Via photosynthesis, algae make sugars and oils
  – Humans do not think algae are tasty, so we can use these oils and sugars to make fuel

• What parts of algae can be made into biofuels?
  – 3 components of algal cells can be made into fuel: **oils, starch** and the **cell wall**.
• Why do we want to know about the sugars of the cell wall?
  – Knowing what types of sugar “LEGO pieces” make up algal cell walls helps us learn how to take them apart without using energy-intensive methods like smashing or melting
  – If we know what sugar “LEGO pieces” we have, we can recycle them into new chemicals
How do people grow algae for biofuels?
Raceway ponds

A way to grow large quantities of algae

Farmers use raceway ponds
Photobioreactor

A way to grow small to large amounts of algae
Engineers and farmers use photobioreactors
<table>
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<th>Petri dishes</th>
<th>A way to grow small amounts of algae</th>
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<td>Engineers use petri dishes for experiments</td>
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