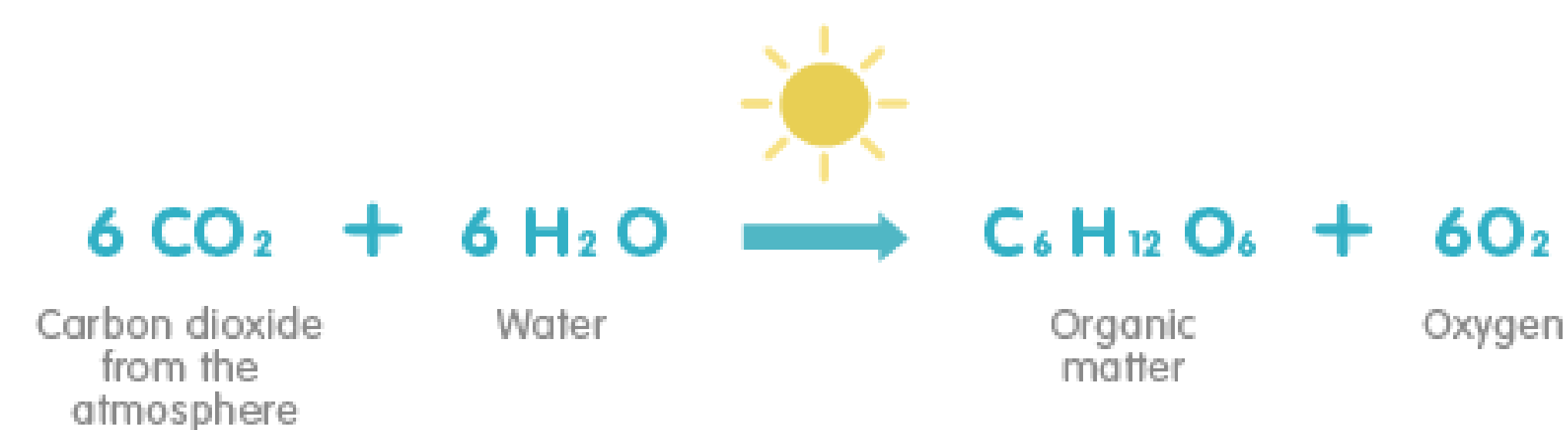


### Glucose

- Place of Birth:** First organisms
- Family:** Carbohydrates, monosaccharide
- Lifespan:** Depends on many factors, usually converted to more compact forms (starch, cellulose)
- Parents:** CO<sub>2</sub>, H<sub>2</sub>O and sunlight...yep, it was (and still is) a love triangle...
- Siblings:** L-Glucose (black sheep of the family)
- Children:** Starch, cellulose
- Job:** Feeding the world, and making it drunk...
- Special Interests:** Making vitamin C, brewing alcohol
- What do its friends say about it?** We cannot live without it! (Plants and Algae)
- Favourite song:** The Archies : "Sugar, sugar! Oh, honey, honey"

### Synthesis

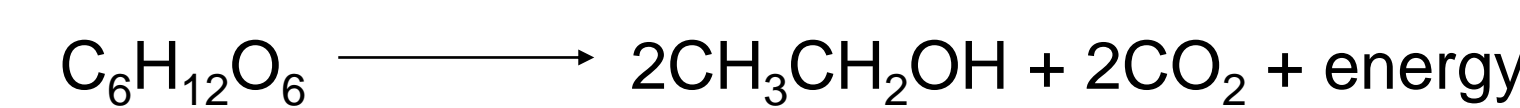
#### Photosynthesis



**Gluconeogenesis** - complex process of making sugars (important sources of energy, in particular for brain) in our bodies.

#### Interesting side effects - Alcoholic Fermentation

- sugars are converted into cellular energy with ethanol and CO<sub>2</sub> produced as metabolic waste



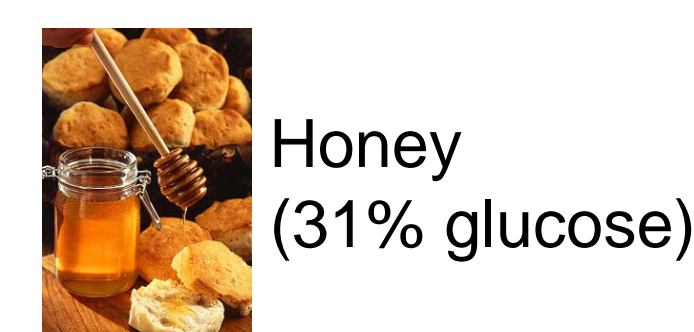
Alcoholic fermentation occurs in the production of alcoholic beverages and ethanol fuel but also in the rising of the bread dough.

### Uses and Significance:

#### As an energy source:

- Glucose is an ubiquitous fuel in biology
- Energy can be produced from glucose by either aerobic respiration, anaerobic respiration, or fermentation
- Glucose is a primary source of energy for the brain, and hence its availability influences psychological processes. When glucose is low, psychological processes requiring mental effort (e.g., self-control, decision-making) are impaired. Normal blood level 70-140 mg.

Commercially produced *via* enzymatic hydrolysis of starch



Honey (31% glucose)



Raisins (10% glucose)



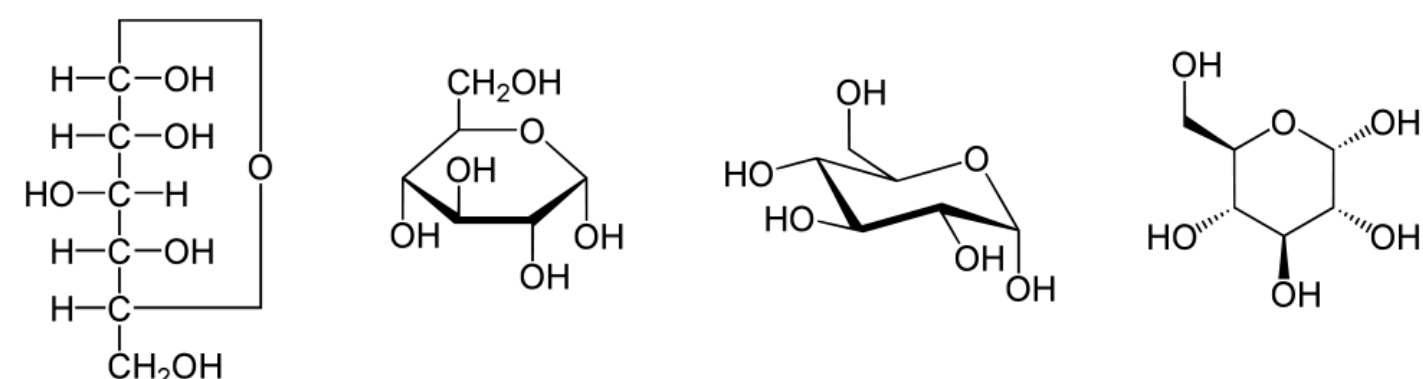
Rice (up to 80% starch glucose polymer)

### How did it change the world?

Glucose has been there from the very beginning and it is likely that we would not be able to be and think without the energy which it supplies. But, the understanding of its structure and function was also a key to understanding organic chemistry and metabolism, which in turn shed more light on deadly diabetes. Glucose also gave us bread, alcohol and biofuels. Lots of magic held in this simple molecule.

### History:

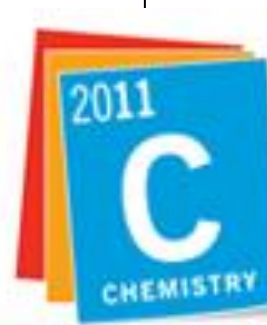
- 1100:** first reference to "grape sugar" in Moorish writings
- 1747:** **Andreas Marggraf** isolated glucose from raisins
- 1811:** **Constantin Kirchhoff** produced sugar syrup from isolated glucose
- 1838:** French chemist **Jean Baptiste Andre Dumas** named glucose after Greek "glycos" meaning sweet
- 1891-1894:** **Emil Fischer** studied glucose and also established stereochemical configuration of all known sugars and correctly predicted isomers



Understanding glucose was key to understanding organic chemistry - Nobel prize awarded to

**Emil Fischer in 1902** for his work on sugars

- 1971:** first commercial blood glucose-meter - Ames Reflectance Meter designed by **Anton Hubert Clemens**.



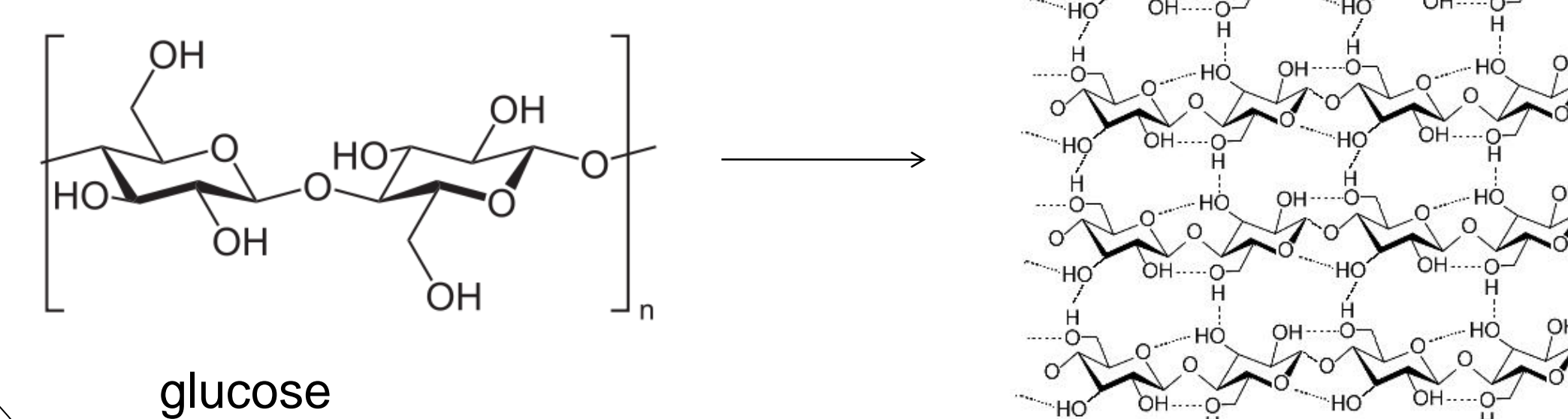
International Year of  
**CHEMISTRY**  
2011

### Cellulose

- Nickname:** Cellulose "the most common organic compound on Earth" Polysaccharide
- Place of Birth:** Algae, Green Plants, some bacteria
- Family:** Polysaccharide
- Parents:** D- Glucose - single mother
- Siblings:** chitin- half brother
- Children:** wood (40-50% cellulose), cotton (90% cellulose)
- Job:** Structural component of the primary cell wall of green plants
- Special Interests:** Papermaking, Clothes design
- What do its friends say about it?** It makes us stronger ( plants)
- Favourite celebrities:** Woody Allen, James Woods, Woodrow Wilson
- Favourite song:** Cotton fields ( The Beach Boys)

### Structure and properties

**Cellulose** is an organic compound with the formula (C<sub>6</sub>H<sub>10</sub>O<sub>5</sub>)<sub>n</sub>. It consists of several hundred to over ten thousand β(1→4) linked D-glucose units.

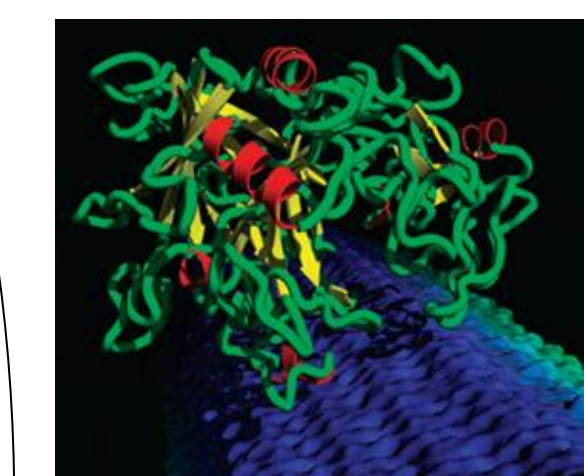


glucose

cellulose

Decomposes on heating, but does not melt, insoluble in water, dissolves in ammoniacal copper hydroxide solution (Schweizer's reagent).

Special enzymes are used for cellulose digestion/ decomposition - **Cellulases**



Cellulases break non covalent bonds in crystalline cellulose, hydrolyse cellulose fibres in smaller sugars and then ultimately in glucose.

### History:

- 4500 BC:** China and South East Asia- use of hemp to make rope and cordage
- 4000 BC:** Use of cellulose based materials for the fabrication of garments
- 3000 BC:** Egypt, India: first reports on spinning cotton
- 1837-1842:** French agricultural chemist **Anselme Payen** isolated fibrous substance from different plants, determined that it is a carbohydrate composed of glucose residues and isomeric to starch ( 44,4% C, 6,2 %H)
- 1839:** French Academy of Science named new carbohydrate Cellulose (*cellule* (French for cells) + *glucose*)
- 1855:** **Alexander Parkes** made celluloid from cellulose derivative (nitrocellulose) and camphor
- 1884:** **Paul Vieille** made smokeless gunpowder called Poudre B from nitrocellulose
- 1950ties:** Modern insulation materials based on cellulose (fire retardants such as boric acid added to prevent combustion)



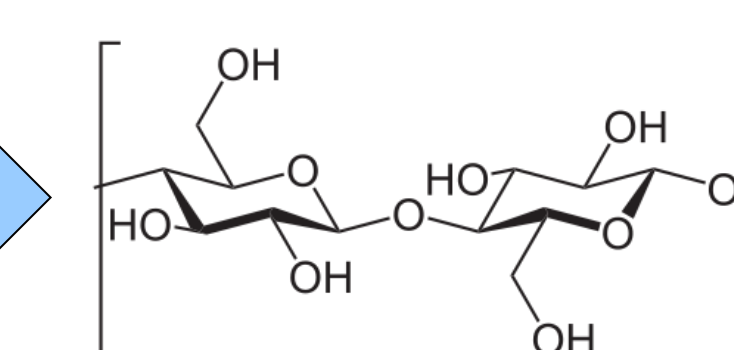
Anselme Payen

### Production and uses

- Pure cellulose obtained by successive treatment of cotton, wool, flax or paper with dilute alkali, hydrochloric or hydrofluoric acid.
- Used to make paper, rayon, cellophane, textile, biofuel, as tickener and stabilizer in processed food, and as stationary phase in thin layer chromatography.



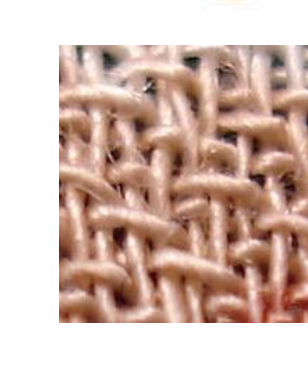
Cotton



Cellulose



Paper



Rayon



Cellophane

### How did it change the world?

Cellulose is the most common organic molecule on earth and it is not surprising that it has found so many uses in daily life. It keeps us warm (isolating material and clothing), increases and transfers knowledge (paper, books), it gave us movies and photographs, it eased the characterisation of chemical reactions (thin layer chromatography) and it is lately explored as a powerful biofuel. The future might bring more uses, but even if does not - cellulose has already deserved its place in the hall of molecular fame.