The Chemistry of Fats: All fat is *not* created equal!

All fat is *not* created equal!: Outline

- Activity aims and scope
- Introduction
- Let’s talk molecules
- The fats we eat
- Robotics incorporation
- Take home messages

All fat is *not* created equal!: Aims & Scope

- Through the use of robotics, this activity teaches how physical properties of food are related to their chemical structures

- Lesson aims include:
  1. define what is meant by the term “melting point” and how it is related to chemical composition in fats
  2. construct a Lego robot to perform a specific type of measurement
  3. understand the basics of Lego MINDSTORMS Education NXT programming software and be able to implement it using Lego robots
  4. understand how certain properties, such as melting point, can be determined through the measurement of others, such as translucency, of a material

- The main learning goal of the lesson is to provide students with the tools necessary to make educated choices on the fats they eat

Introduction

- The physical properties of all materials are related to chemical structures
  - This includes the materials that we put into our bodies



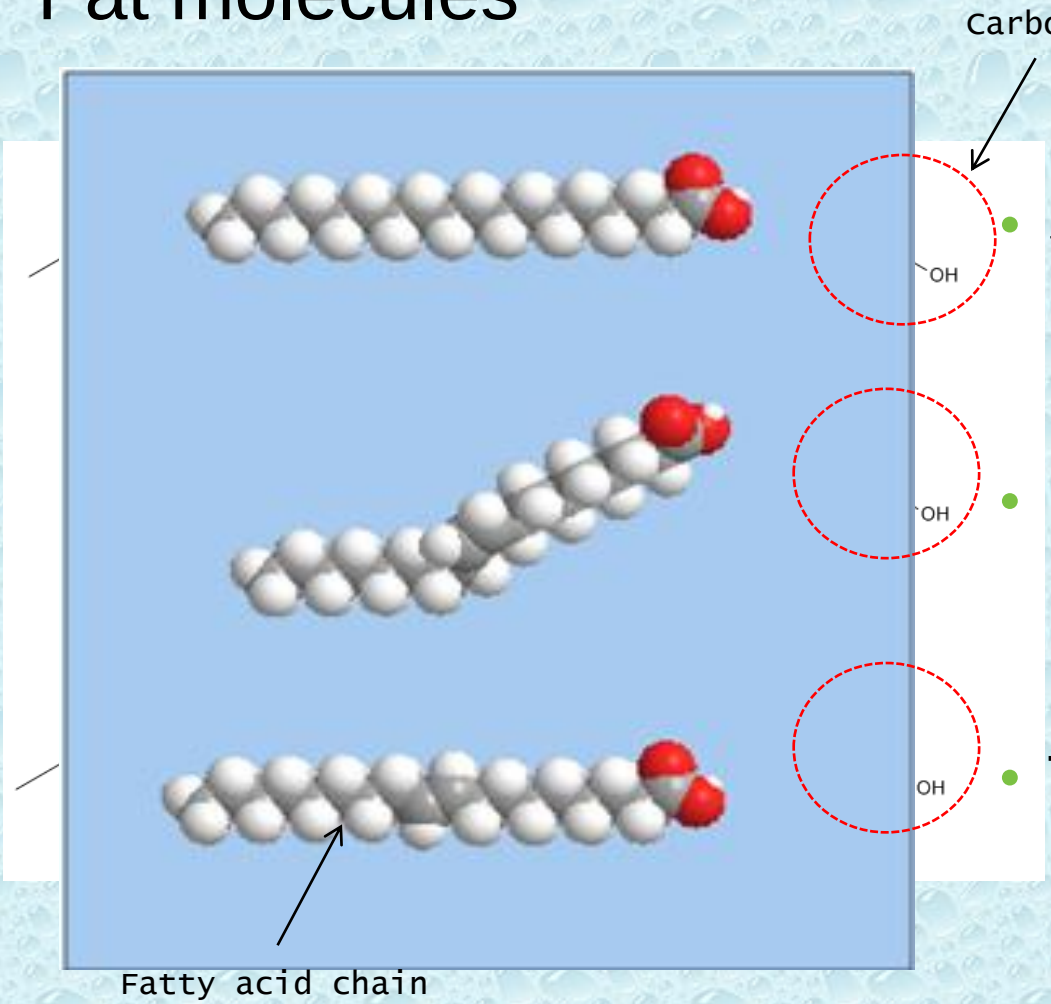

- Foods interact differently with our bodies based on their chemical compositions
- Fats represent one class of foods
  - Fat molecules are a very *efficient* way to store energy

Dietary fats

- There are 4 groups of different fats which are divided based on their chemistry
  1. Saturated fat: animal sources, including meat and dairy products. Raises cholesterol levels and increases risk of heart disease
  2. Monounsaturated fat: found in a variety of natural foods and oils. Can improve cholesterol levels and decrease risk of heart disease
  3. Polyunsaturated fat: found mostly in plant-based foods and oils.
     - Omega-3 fatty acids: beneficial to the heart
  4. Trans fat: found in processed vegetable oils. Made during partial hydrogenation of unsaturated fats, associated with health risks

- Humans need certain *essential fatty acids* for growth, eg/ linoleic acid
- Many Americans consume **6-8** times the required amount of dietary fat

Fat molecules



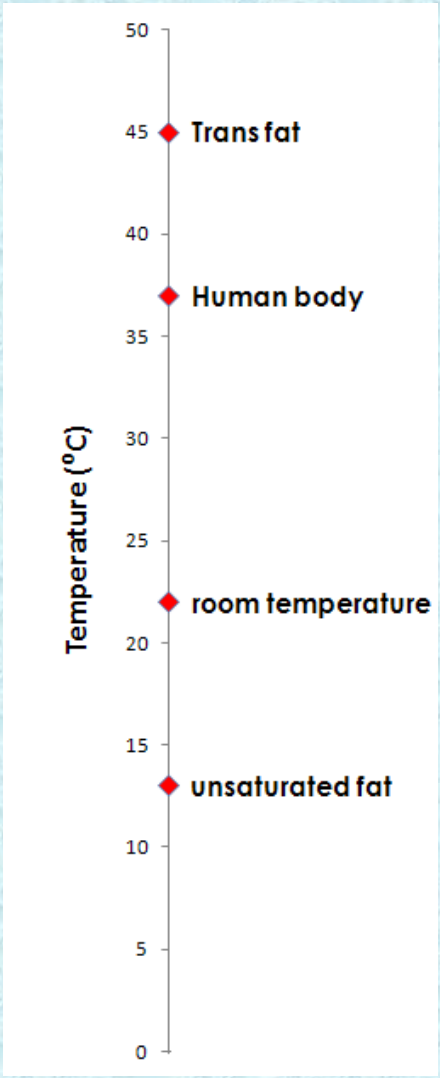
- Saturated fat
- Monounsaturated fat
- Trans fat

Fat compounds

- Foods high in saturated and trans fat → **solids** at room temperature
- Foods high in mono/poly unsaturated fats → **liquids** at room temperature

- Physical properties, such as translucency and melting point, can be explained by *molecular packing*

- Using a robot with sensors capable of measuring translucency and melting point, various fat samples will be studied to gather data based on their physical properties

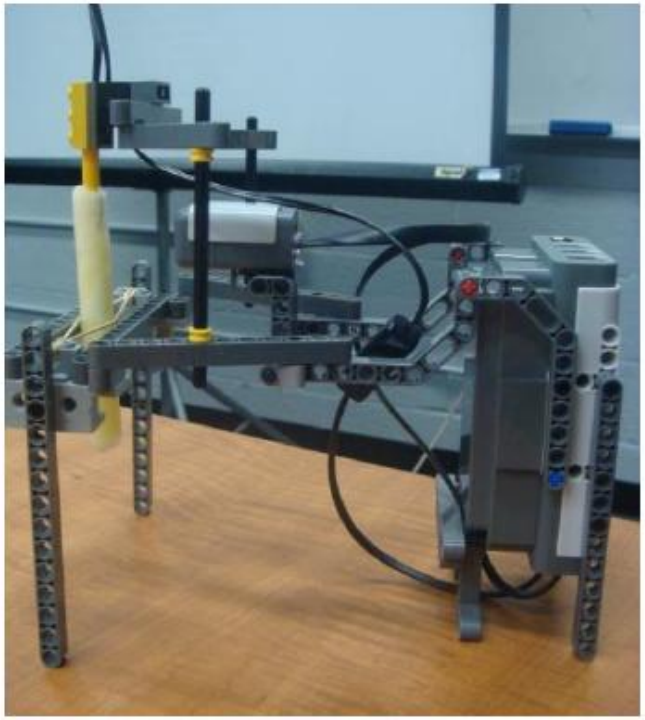


Pantry samples

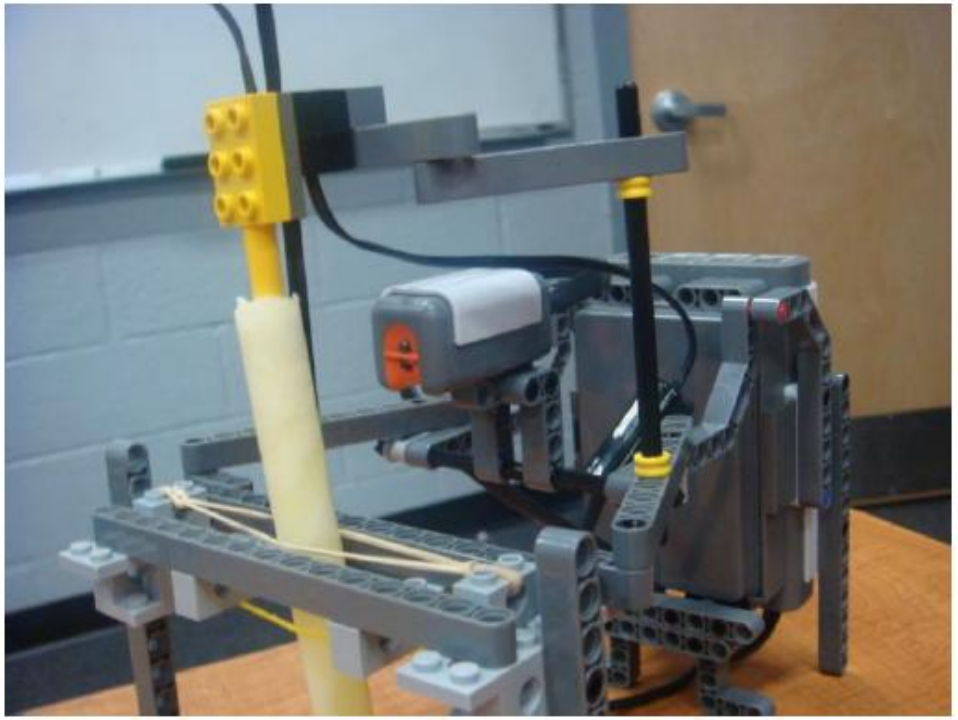
Percentage (%)	Butter	Corn oil	Olive oil	Margarine
Saturated fat	64 %	14 %	14 %	19 %
Mono/poly unsaturated fat	36 %	29 % mono 57 % poly	86 %	25 % mono 31 % poly
Trans fat	-	-	-	19%

$$percent\ composition\ (weight\ \%) = \frac{type\ of\ fat\ weight\ (g)}{total\ fat\ weight\ (g)} \times 100$$

Robot design

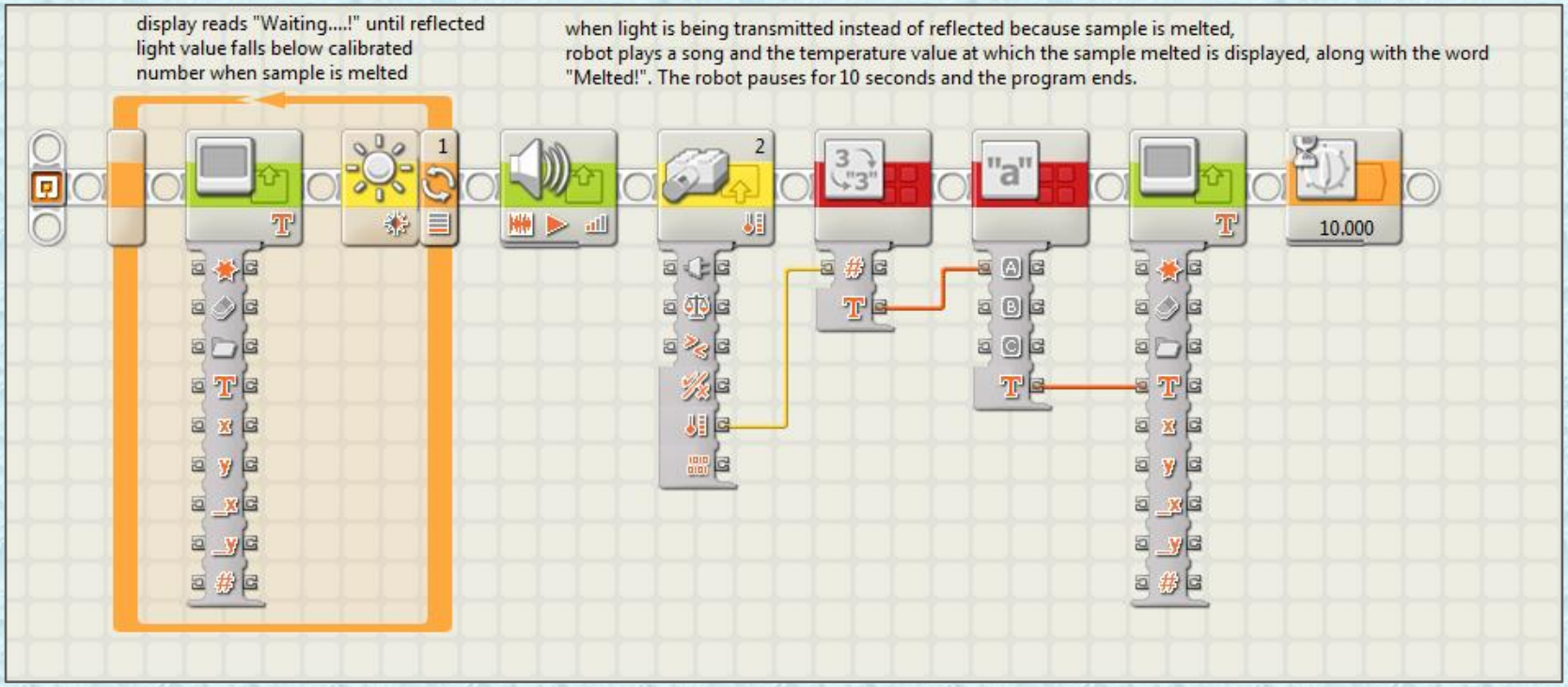


- Side view



- Front view

Programming the robot



Take home messages

- We will understand which types of fats to watch out for in our diets
  - Equip with knowledge to analyze and scrutinize nutrition fact labels
- Robots are employed to perform measurements that can provide us with useful data
- Understand that physical properties of materials are directly related to their chemical structures

- **Stay healthy, happy and curious of the world around us!**

Thank you!