# 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:
  - define what is meant by the term "melting point" and how it is related to chemical composition in fats
  - construct a Lego robot to perform a specific type of measurement
  - understand the basics of Lego MINDSTORMS Education NXT programming software and be able to implement it using Lego robots
  - 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

![](_page_5_Figure_0.jpeg)

### 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

![](_page_6_Figure_5.jpeg)

#### Pantry samples

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1	PLITTED		Total Ea
58	BUTTER		IULAI FA
	Nutrition Facts		Satur
	Serving Size 1 (195) (14g) Servings Per Container about 32		Trans
-	Amount Per Serving		Polyu
5-	Calories 100 Calories from Fat 100		Mono
6	% Daily Value*		Choloct
	Total Fat 11g 17%		cholest
	Saturated Fat 7g 35%		Sodium
a. 1	Trans Fat Og		Total O.
12	Cholesterol 30mg 10%		Total Ga
	Sadium 90ma		Protein
	Total Cashabudada On	100	The second second
-	Total carbonyurate 0g 0%		Vitamin
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7.0	Manufacture a new	-	vitamin C cald
	Vitamin A 8%	100	*Percent Deit

<b>Nutrition Facts</b>	Serv
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Amount Per Serving	Calo
Calories 120 Calories from Fat 120	1
% Daily Value*	Total
Total Fat 14g 22%	Sat
Saturated Fat 2g 10%	Tra
Trans Fat Og	Chole
Polyunsaturated Fat 8g	Sodi
Monounsaturated Fat 4g	Total
Cholesterol Omg 0%	Deste
Sodium Omg 0%	Prote
Total Carbohydrate Og 0%	No
Protein Og	
Vitamin E 10%	23.0
Not a significant source of dietary fiber, sugars, vitamin A, vitamin C, calcium, and interview.	
*Percent Daily Values are based on a 2,000 calorie diet.	STORE

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Nutrition Facts arving size: 15 ml (1TBSP) arvings per container: about 67	
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dium 0 mg 0%	Ľ.
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Not a significant source of cholesterol, dietary fiber, sugar, vitamin A, vitamin C, calcium and iron. * Percent daily values are based	1
on a 2,000 calorie diet.	0
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Nutrition Fac Serving Size 1 Tbsp (14g) Servings Per Container about	cts ut 32				
Amount Per Serving	Amount Per Serving				
Calories 70 Calories fro	m Fat 70				
% Daily	Value*				
Total Fat 8g	12%				
Saturated Fat 1.5g	8%				
Trans Fat 1.5g Polyunsaturated Fat 2.5g					
					Monounsaturated Fat 2g
Cholesterol Omg	0%				
Sodium 125mg	5%				
Total Carbohydrate Og	0%				
Protein Og					
Vitamin A 6% (30% as Beta Car	rotene)				
Not a significant source of Dietary Fi Sugars, Vitamin C, Calcium and Iron.	ber,				
*Percent Daily Values are based on a 2,000	calorie diet.				

Percentage (%)	Butter	Corn oil	Olive oil	Margarine
Saturated fat	64 %	14 %	14 %	19 %
Mana poly composit	tio 36n%weig	$_{sht}$ 29% mono	of fat weight	( <u>g</u> ) <u>25</u> %100000
unsaturated fat		57 % poly <sup>toto</sup>	ul fat weight	( <i>g )</i> 31 % poly
Trans fat	-	-	-	19%

# Robot design

![](_page_8_Picture_1.jpeg)

Side view

Front view

# Programming the robot

![](_page_9_Figure_1.jpeg)

#### 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

![](_page_10_Picture_5.jpeg)

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

# Thank you!