

# Unit 3- Lesson 10









Chemistry 0

May 2022, L. Tracey Gao

# Introduction

- Molecules with repeating units are called **polymers**.
- Polymers are found everywhere. Both **naturally** occurring polymers and **man-made** polymers are found in our everyday life.

**Examples of Natural and Synthetic Polymers**

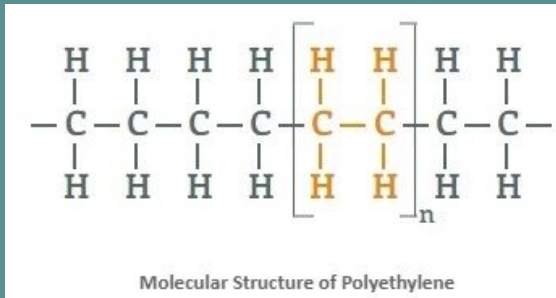
Natural polymers are made by living organisms.	Synthetic polymers are made by chemical reactions in a lab.
 DNA	 Rubber
 Nylon	 Polyester
 Cellulose	 Wool
 Teflon	 Epoxy

sciencenotes.org

# Polymer Structure

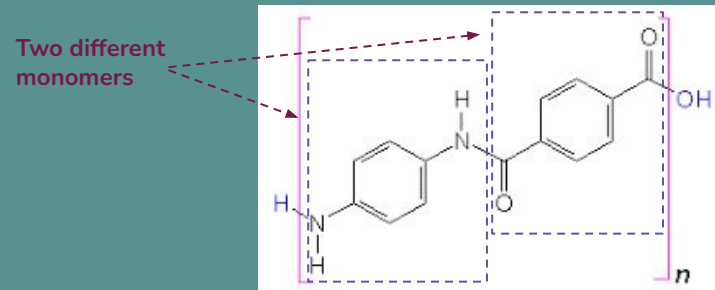
- Monomers
  - The individual units of a polymer are called **monomers**.
  - When the repeating monomer units are all identical, the polymer is called a **homopolymer**. If more than one type of monomer is used, the polymer is called a **copolymer**.

Polyethylene is a **homopolymer** made of ethylene monomers



<https://omnexus.specialchem.com/selection-guide/polyethylene-plastic>

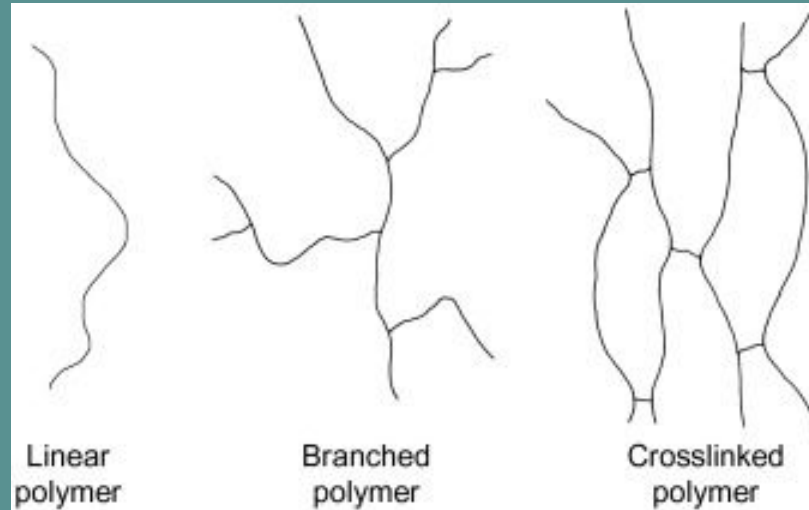
KEVLAR® is a **copolymer** composed of two different monomers.



<http://www.chm.bris.ac.uk/motm/kevlar/kevlarh.htm>

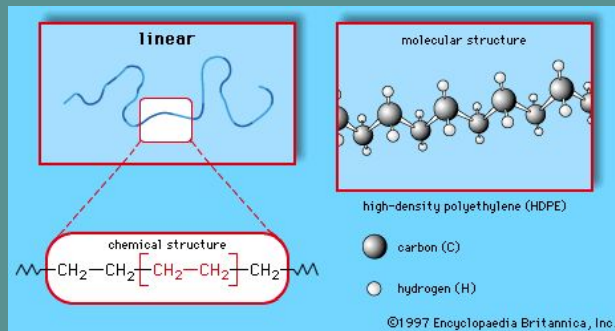
# Polymer Structure

- Linear Polymer
- Branched Polymer
- Crosslinked Polymer



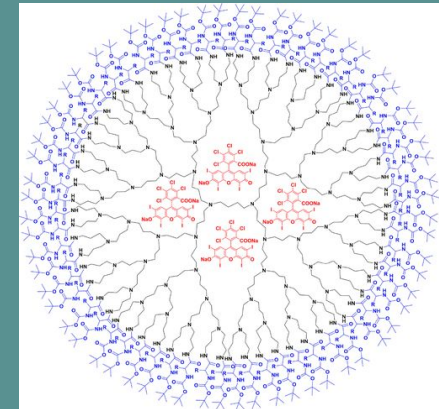
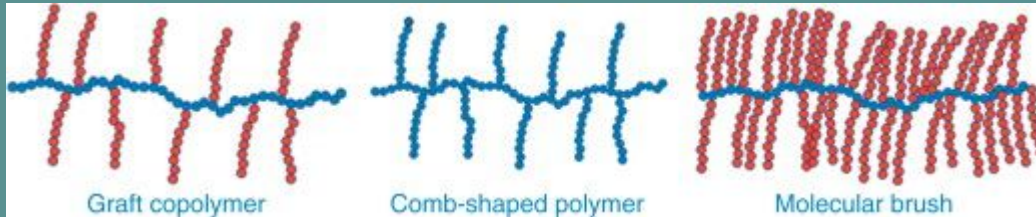
# Polymer Structure

- **Linear:** In a linear polymer every monomer unit is connected to the next monomer unit, one after another, end to end. It vary in length and can have several thousand monomer units linked together. However, it does not stay as a stretched out chain, but instead roll up into a **random coil**.



# Polymer Structure

- **Branched:** Polymers with branches at irregular intervals along the polymer chain are called branched polymers. They can be slightly branched, or highly branched. **Dendrimers** are extensively branched polymers that grow with a constantly increasing number of branches.

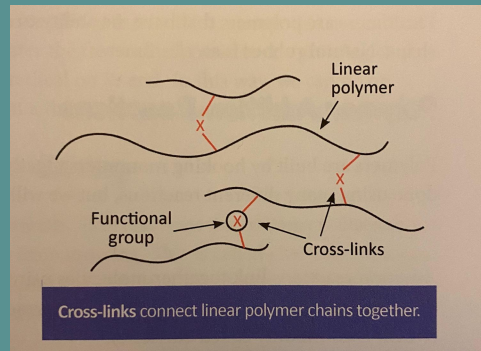


<https://www.sciencedirect.com/topics/materials-science/branched-polymer#:~:text=Branched%20polymers%20are%20defined%20as,%2C%20and%20comb%2Dshaped%20polymers.>

<https://pubs.acs.org/doi/10.1021/acs.macromol.0c00286>

# Polymer Structure

- **Crosslinked:** Polymer molecules can also be connected to each other through cross-links. A cross link is a covalent bond between any two polymer chains. Cross-linking occurs primarily through double bonds of functional groups on the monomers such as -OH groups and carbonyl groups.





## Summary

- A polymer is a molecule of “many units” each of which is a monomer.
- Polymers can contain one type of monomer, or can be composed of two or more different monomer units.
- Polymers can be linear or branched or contain cross-links.