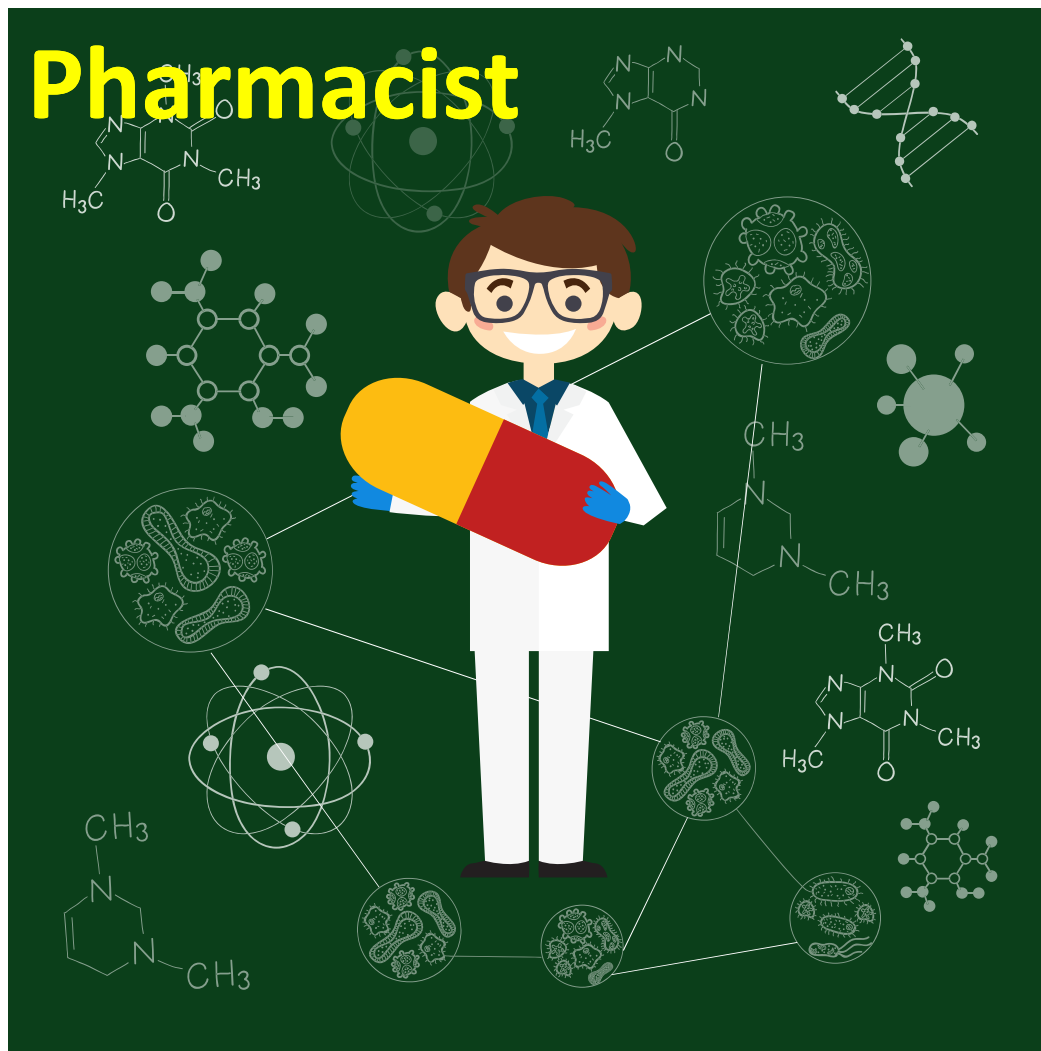


Pharmacist



Department of Pharmacy



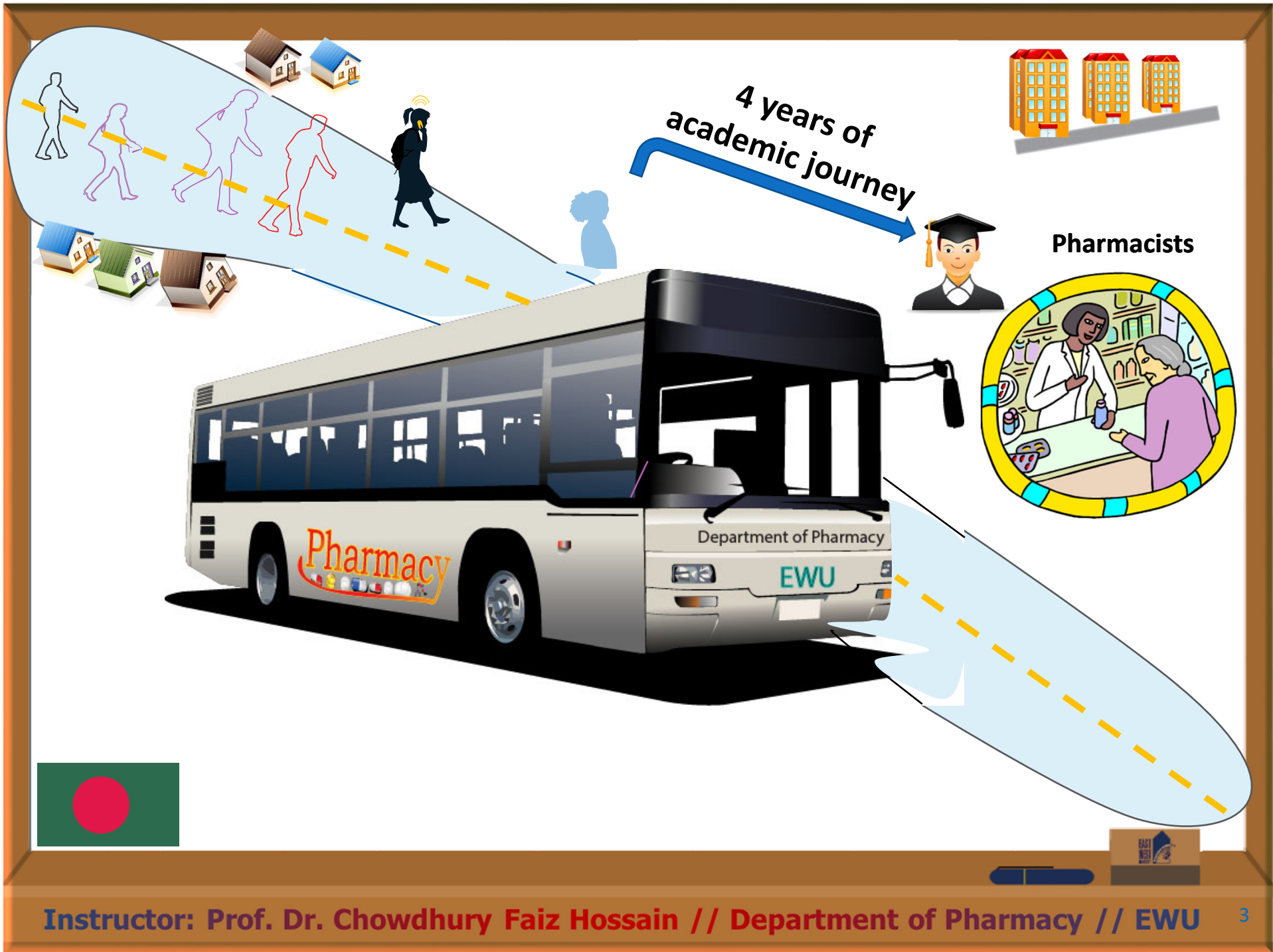
Welcome!!!

Organic Pharmacy

A decorative graphic for the title 'Organic Pharmacy'. The word 'Organic' is in black, and 'Pharmacy' is in large, stylized red and yellow letters. Below the letters are several pills and capsules of different colors and shapes. To the right, there is a chemical structure of a carboxylic acid derivative with a methyl group and an acetoxy group, and a green leaf.

Course: Organic Pharmacy-I (Code: PHRM 103)

Semester: Fall 2020



4 years of academic journey

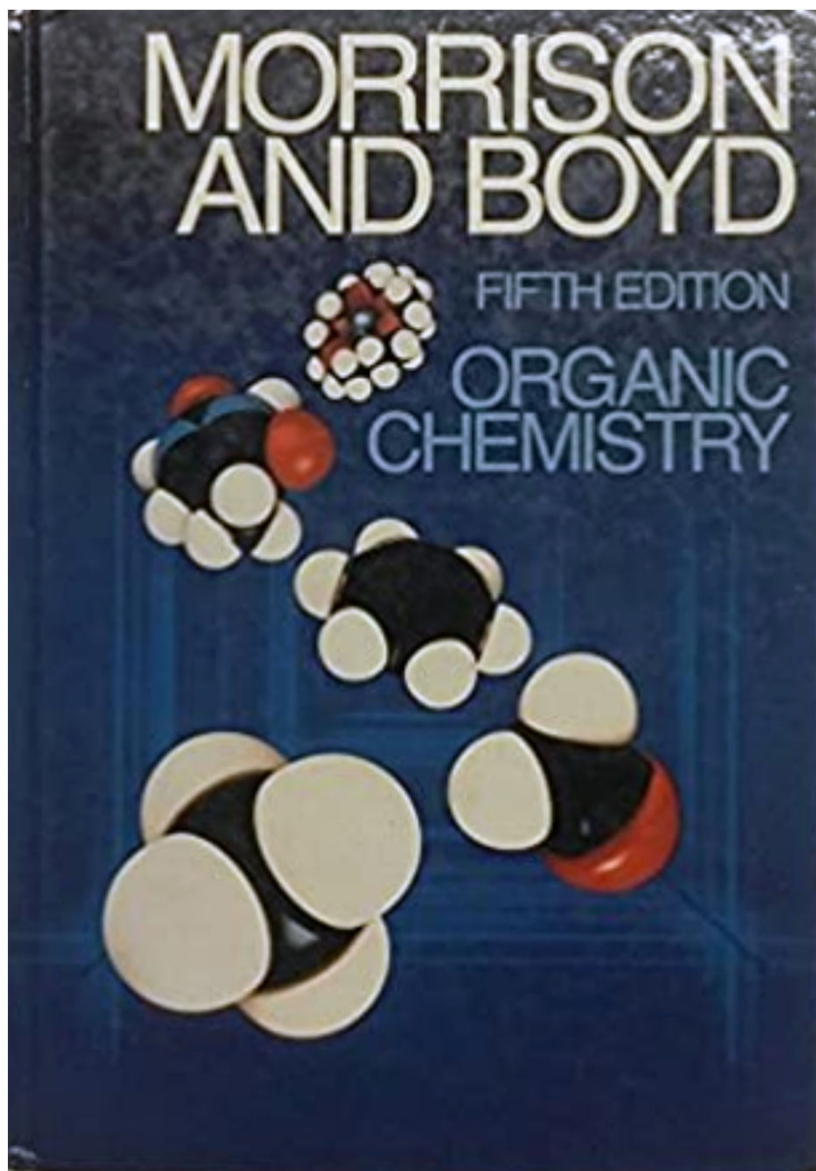
Pharmacists

Pharmacy

Department of Pharmacy

EWU





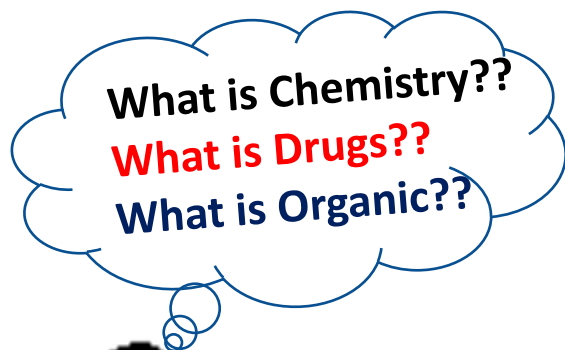
Course: Organic Pharmacy-I

What is Organic Pharmacy?



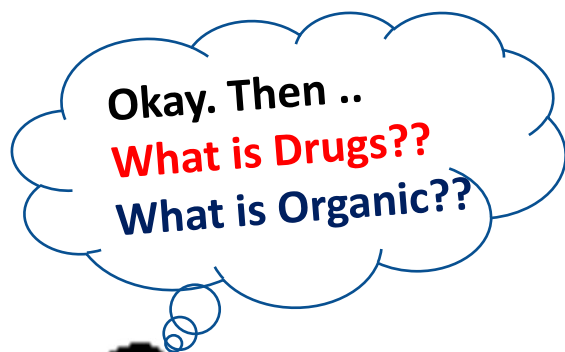
Course: Organic Pharmacy-I

Organic Pharmacy deals with the **Chemistry of Organic Drugs**



Organic Drugs are Organic Compounds

Organic Pharmacy deals with the **Chemistry of Organic Drugs**



Chemistry is the science of the

- composition
- structure
- properties and
- reactions

of the **atomic and molecular** systems of **matter** .

Organic Pharmacy deals with the **Chemistry of Organic Drugs**

Okay. Then give some examples??
What is Organic??

Drugs are biologically active molecules used to **prevent or alleviate illness.**



Introduction to Some Famous Organic Drugs (Structures, Sources and Uses)

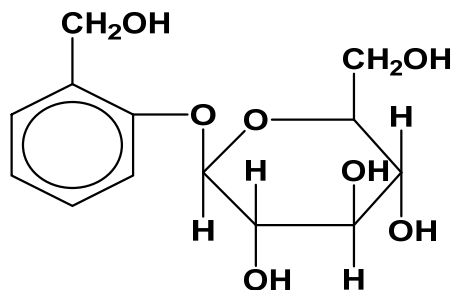


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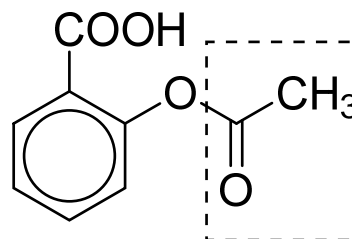
White Willow (*Salix alba*)

Ancient civilizations used willow tree extracts to treat **pain** and **inflammation**.



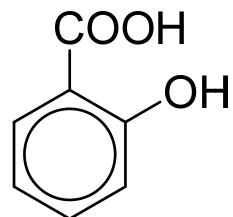


salicine



acetyl group

aspirine
(acetyl salicylic acid)

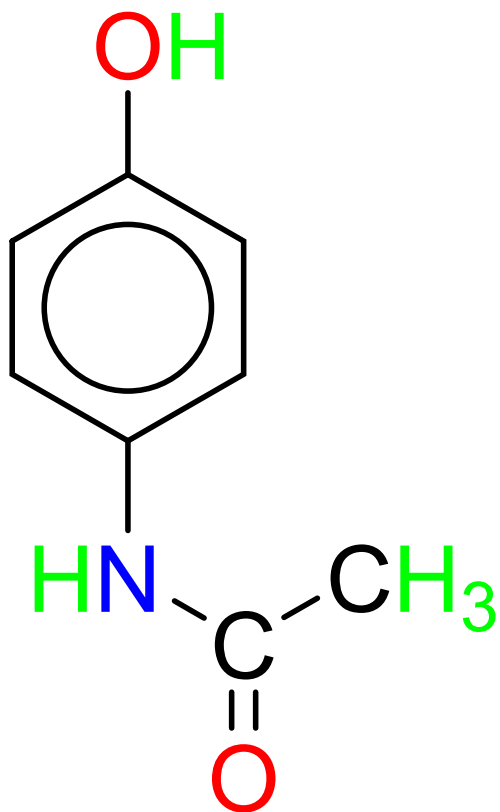


salicylic acid

In 1899, **Bayer** marketed it as
Aspirin

More than 100 years later, acetylsalicylic acid is still the best-known NSAID drug.

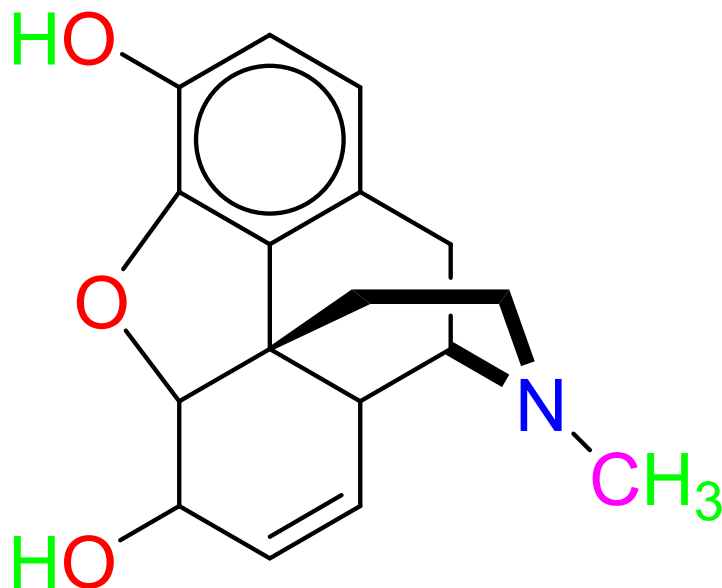
Paracetamol : analgesic and antipyretic



- ❑ First synthesized in 1888 by Bayer
- ❑ never tested for medicinal properties.
- ❑ Clinically evaluated In 1893
- ❑ mistakenly believed that it produced sever adverse effects
- ❑ the compound was ignored for half a century.
- ❑ It was reinvestigated and found to be analgesic and antipyretic and relatively safe.
- ❑ In 1950, the first paracetamol product, Triagesic, was marketed (it a combination of paracetamol, aspirin and caffeine)

Morphine

An opioid analgesic



Morpheus is the God of dreams and sleep in **Greek mythology**. A drug is named after His name and that is **Morphine**

Because it (morphine) has divine power of producing sleep and relieves human agony by removing severe pain.

Poppy tree

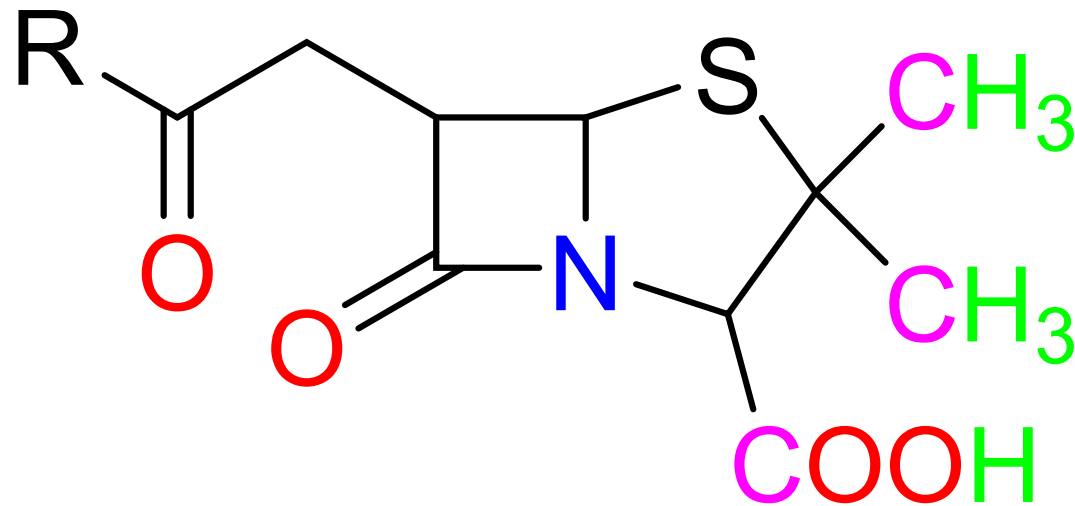


Papever somniferum



Penicillin : An antibiotic

An **antibiotic** is an agent that either kills or inhibits the growth of **microorganisms**.



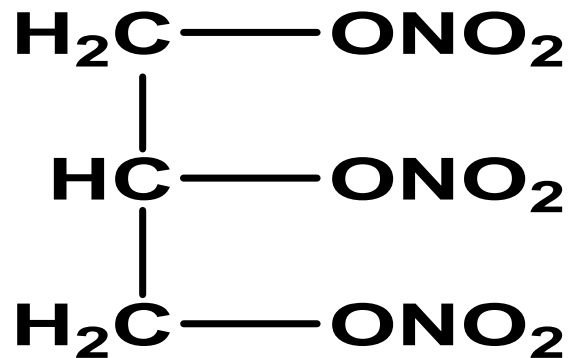
- ❑ Alexander Fleming discovered this drug in 1928 from a fungus, *Penicillium notatum*.
- ❑ It has been used to treat diseases caused by bacteria since 1942.



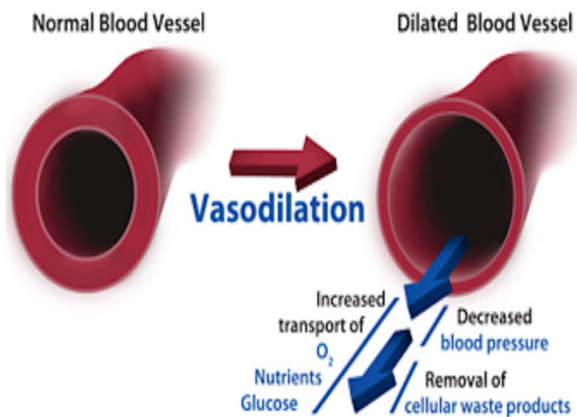
Alexander Fleming (1928)



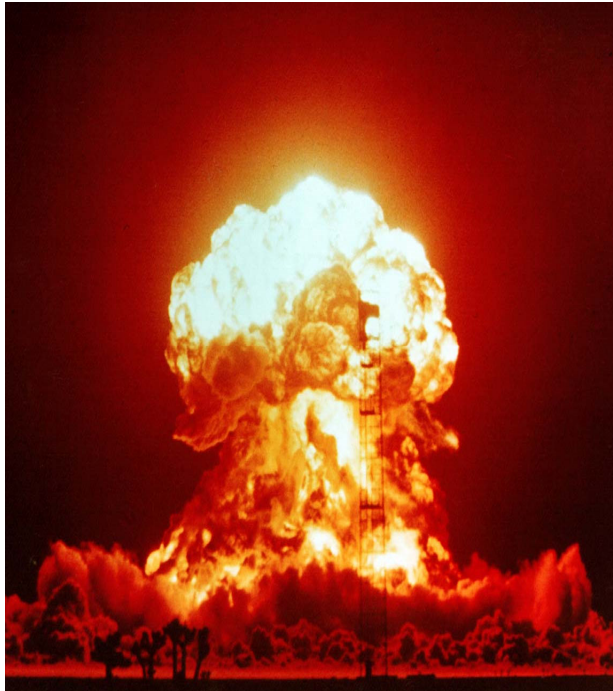
Nitroglycerin is used to treat **angina pectoris**



Angina pectoris is type of chest pain due to not enough blood flow to the heart.



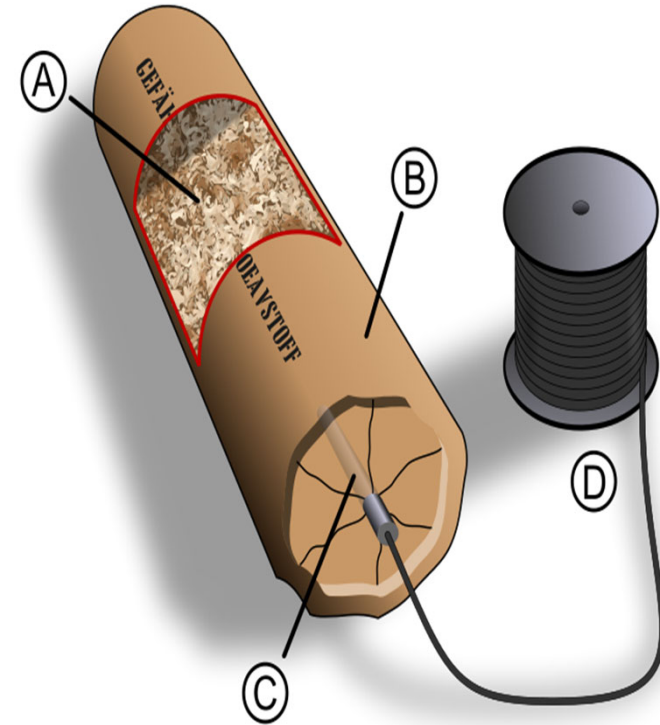
Nitroglycerin



Nitroglycerin is explosive liquid



Alfred Nobel

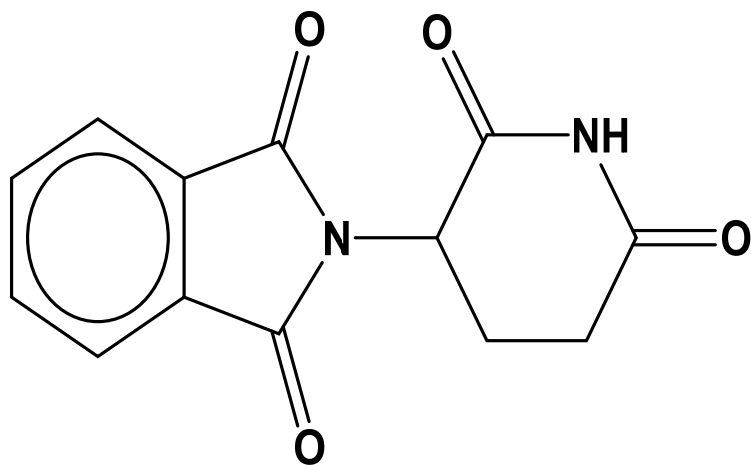


Dynamite

Thalidomide

A drug for the treatment of

- certain **cancers** (multiple myeloma) and
- **leprosy**.



Thalidomide

It made a tragic human history.



Thalidomide was launched in 1957 proclaiming as a "**wonder drug**" for morning sickness of pregnant women.

Later it was found that thalidomide has serious side effect.

It is teratogenic (A teratogen is an agent that can disturb the development of the embryo or fetus.).

Thalidomide led to the death of approximately 2,000 children and **serious birth defects** in more than 10,000 children



Introduction to Organic Compounds and Chemistry



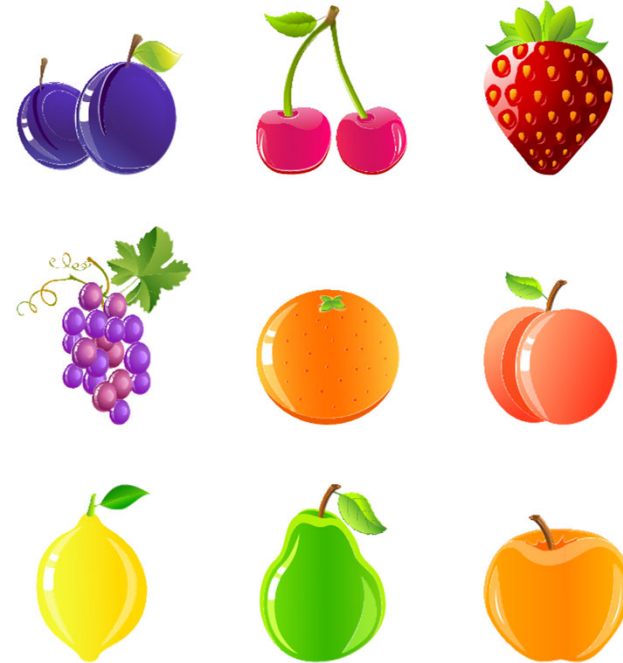
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Organic Pharmacy deals with the
Chemistry of Organic Drugs

What is Organic??



Organic Pharmacy deals with the Chemistry of Organic Drugs



can leave on fruits
can't leave on rocks

Two kinds of materials present in this world

Jöns Jakob Berzelius (1807)

Organic

- Compounds derived from living organisms
- contain an unmeasurable **vital force**

Inorganic

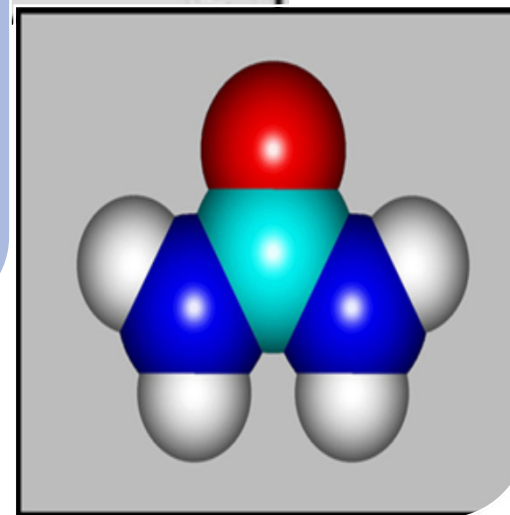
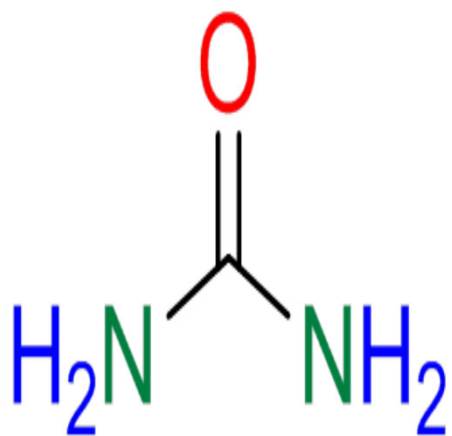
- Compounds derived from minerals
- those lacking that vital force

Because scientists could not create life in the laboratory, they **could not create compounds with a vital force** (organic compound).

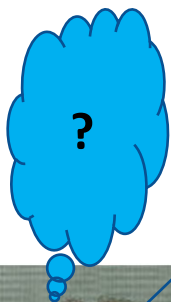




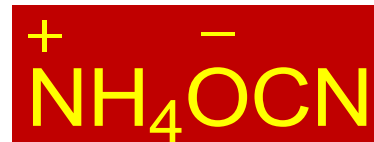
1800s



Friedrich Wöhler Research in 1828



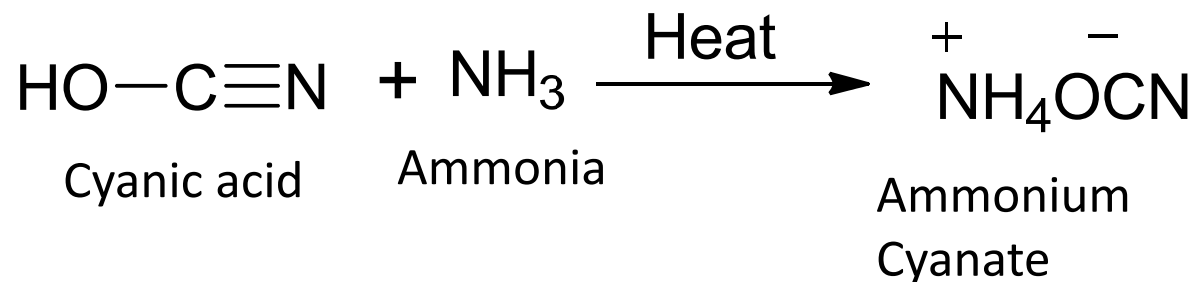
I need to synthesize
Ammonium Cyanate.



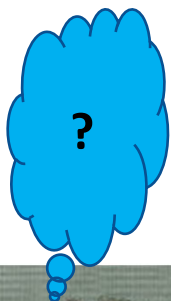
Logical approach ?



Friedrich Wöhler



Friedrich Wöhler Research in 1828

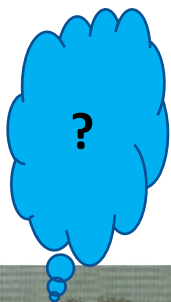


Friedrich Wöhler

I did not get Ammonium Cyanate !!



Friedrich Wöhler Research in 1828



Friedrich Wöhler

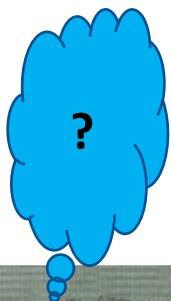
- Wöhler got a familiar but unexpected compound. And he recognized the compound as **urea**.

So there must some re-arrangement occurred in the reaction.

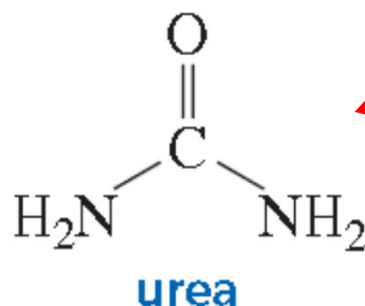
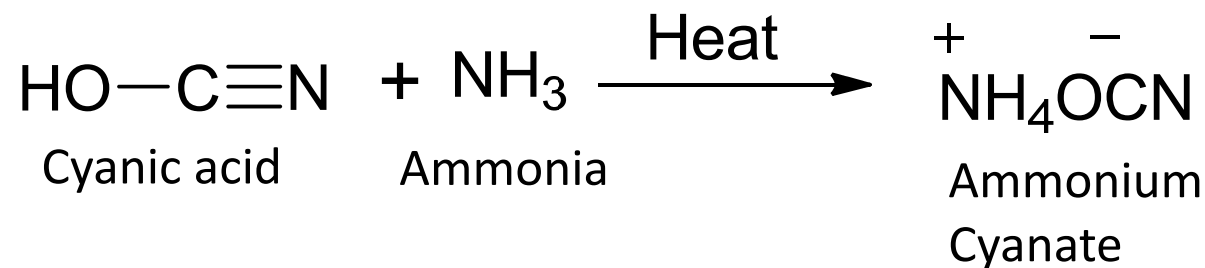
But **urea is known organic compound !!**



Friedrich Wöhler Research in 1828



Friedrich Wöhler



← re-arrangement

"I must tell Berzelius that –
**I can make urea without the use of kidneys,
either man or dog !!!**

Friedrich Wöhler Research in 1828

History Made

This is the first time
an “**organic**” compound
had been made by a **human**
without the aid of any kind
of **vital force**.

After this accidental discovery, it had become clear that organic compounds did **not have to come** from **living organisms**, but could be made in the laboratory by human.



Berzelius definition of Organic Compound was no more valid after this discovery.

So, what will be the new definition of Organic compound ??



New Definition of Organic Compound

Organic compounds are the compounds of carbon.

But for historical reasons, a few types of carbon-containing compounds, such as carbides (CaC_2), carbonates, simple oxides of carbon (such as CO and CO_2), and cyanides (NaCN) are considered as **inorganic**.

Although it is become clear that organic compounds (**i.e. compounds of carbon**) do not have to come from living sources but could be made in the laboratory, the term "**inorganic**" and "**organic**" has been retained to this day.



New Definition of Organic Compound


- ✓ Despite the demise of vitalism in science, the word “organic” is still used today by some people to mean “**coming from living organisms**” as in the terms “**organic vitamins**” and “**organic fertilizers**.”
- ✓ The commonly used term “**organic food**” means that the food was grown without the use of **synthetic fertilizers** and **pesticides**.
- ✓ In science today, the study of compounds from living organisms is called **natural products chemistry**.



What carbon so special?

Why is an **entire branch of chemistry** devoted to the study of **carbon-containing compounds?**

Organic chemistry



What carbon so special?

Because: -

Carbon atoms can form strong bonds to **other carbon atoms** to form **rings** and **chains** of carbon atoms, and carbon atoms can also **form strong bonds** to elements such as **hydrogen, nitrogen, oxygen**, and **sulfur**.

Because of **these bond-forming properties**, carbon can be the basis for the **huge diversity of compounds necessary for the emergence of living organisms**.



What carbon so special?

huge diversity of carbon compounds –

- All of the molecules that make life possible **contain carbon** (proteins, lipids, carbohydrates)
- The chemical reactions that take place in living systems **are organic reactions.**



What carbon so special?

huge diversity of carbon compounds –

- Most of the compounds found in nature—those we **rely on for food, medicine, clothing** are **organic** (rice, morphine, cotton, silk etc.)
- Chemists have **synthesized millions of organic compounds** never found in nature (e.g. **synthetic fabrics, plastics, synthetic rubber, medicines**)



What carbon so special?

Due to huge diversity of carbon compounds, an entire branch of chemistry devoted to the study of carbon-containing compounds i.e. **Organic Chemistry and Organic Pharmacy**

Therefore, Carbon is special among all other elements of periodic table

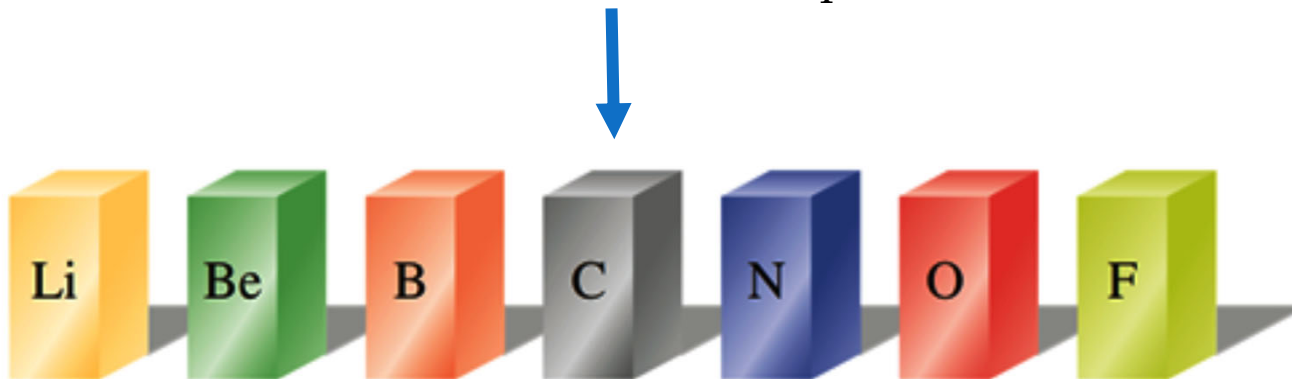
What makes carbon SO special?

The answer lies in -
carbon's position in the periodic table



What carbon so special?

Carbon is in the center of the periodic lane



Elements in the 2nd lane (row) of their neighborhood (periodic table)

The atoms to the left of carbon have a tendency to **give up** electrons, whereas the atoms to the right have a tendency to **accept** electrons. Because carbon is in the middle, it **neither readily gives up nor readily accepts** electrons. Instead, it shares electrons.

But why?

Carbon can share electrons with several different kinds of atoms, and it can also share electrons with other carbon atoms.

Periodic Table

Understanding the importance of the Table

Answer of the question, “what makes carbon so special?”, is given based on the **position of that element** in the periodic table

That means position in the periodic table

- very important
- dictates the behavior of an element

“How position of an element controls its behavior in chemical reactions”?

It is the electron number in the outer shell of an element which dictates the behavior of an element to form compounds

Note: This universe has uncountable number of compounds, but all are formed from these 92 elements.

+ Although there are 118 elements that have been discovered to date, but the naturally available number of elements is considered to be 92.



Periodic Table

Recall periodic table

In 1869, Russian **Dmitri Mendeleev** devises the periodic table of **elements**.

The periodic table is tabular arrangement of the neighbourhood of all elements where the elements are grouped by **rows (periodic lanes)** or **columns (periodic houses, family or group)**.



Periodic Table

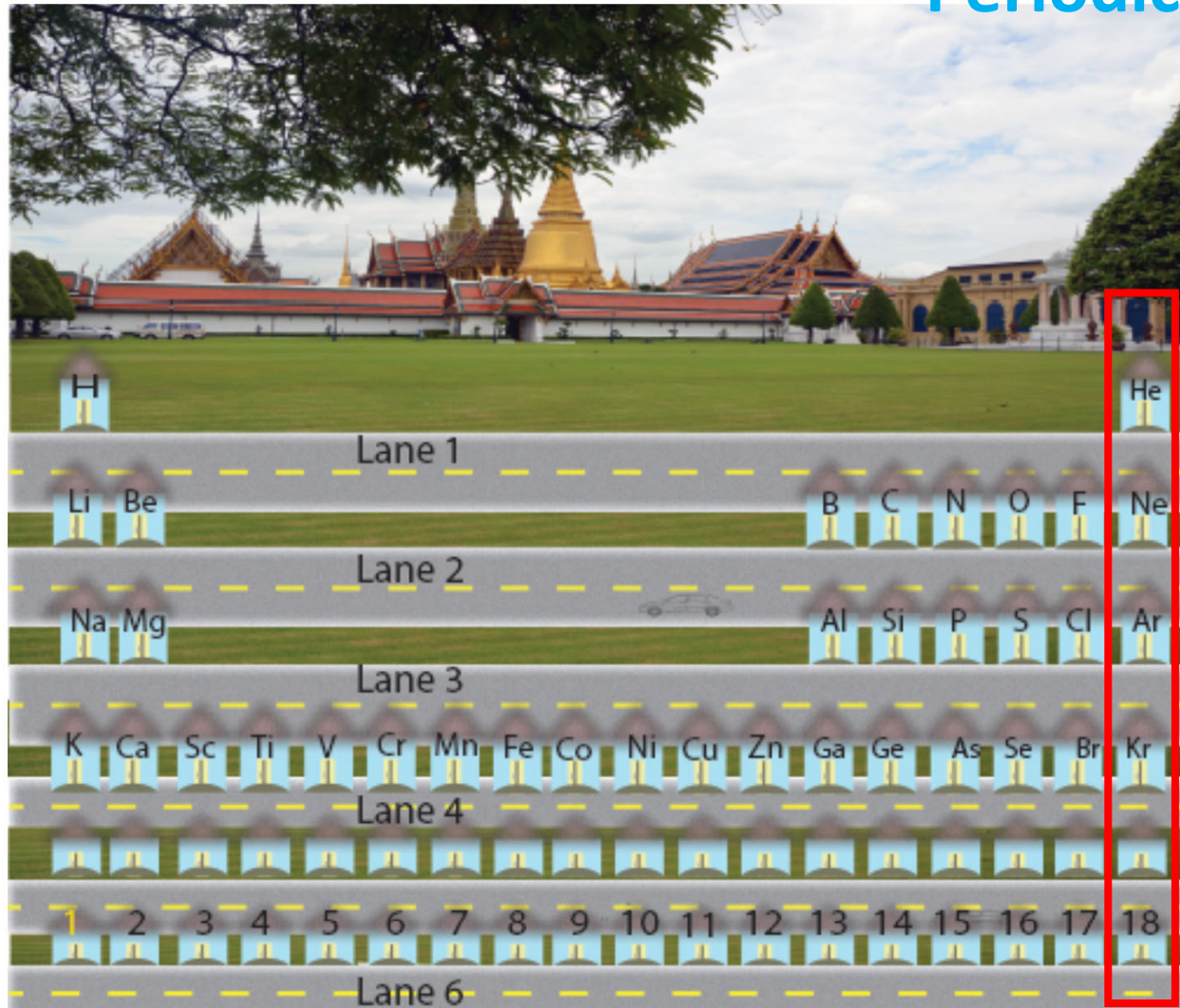
Naming of raw (periodic lane) or column (periodic houses, family or group) of periodic table by different nomenclature system.

Group/ House# →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Period/ Lane# ↓	Alkali metal	Alkaline earth metal											Boron group	Carbon group	Pnictoge n	Chalcoge n	Halogen	Noble gas	
CAS:	IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII B			IB	II B	IIIA	IVA	VA	VIA	VIIA	VIIIA	
old IUPAC:	IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIII			IB	II B	IIIB	IVB	VB	VIB	VII B	0	
1	H																		He
2	Li	Be											B	C	N	O	F		Ne
3															P	S	Cl		
4																		Br	
5																		I	
6																			

Important elements that are found in organic drugs are shown in shaded color.



Periodic Neighborhood



Elements of these houses (#18 or VIIIA) seem to be rich and happy, and possessing outstanding qualities of **inertness**. So, They are called as **Noble** elements.

But why?

It is necessary to study **atomic structure** and **electron configuration** of atoms of the elements