



Recent innovation in chemistry that can change the world

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Abstract:

In the present article we are trying to only highlight and review some landmark research which was done in chemistry that can revolutionize science and technology in recent periods. This research had a greater influence on human development.

Keywords: Overview, Innovation, Nobel Prize, chemistry, technology, sustainability.

Introduction:

Science and technology play an important role in the development of industrial, economic growth of every nation. On the planet earth the natural resources are very limited as per need of growing human population rate, due to over exploitation all the natural resources reach to its extinction stage. Innovation is needed to save these resources and improved technology can support efficient use of natural resources and can save resources. Scientific research and development are concerned with sustainable development. Chemistry is an inseparable part of human life; everything in the world is made up of basic building blocks known as elements. "Chemistry may be involved not only in the initial stages of research but also in intermediate stages and in the evaluation of impact and hence contributing in key ways at every stage of the technological innovation chain". Chemistry has given the world-wide array of new materials, in all fields of technology.

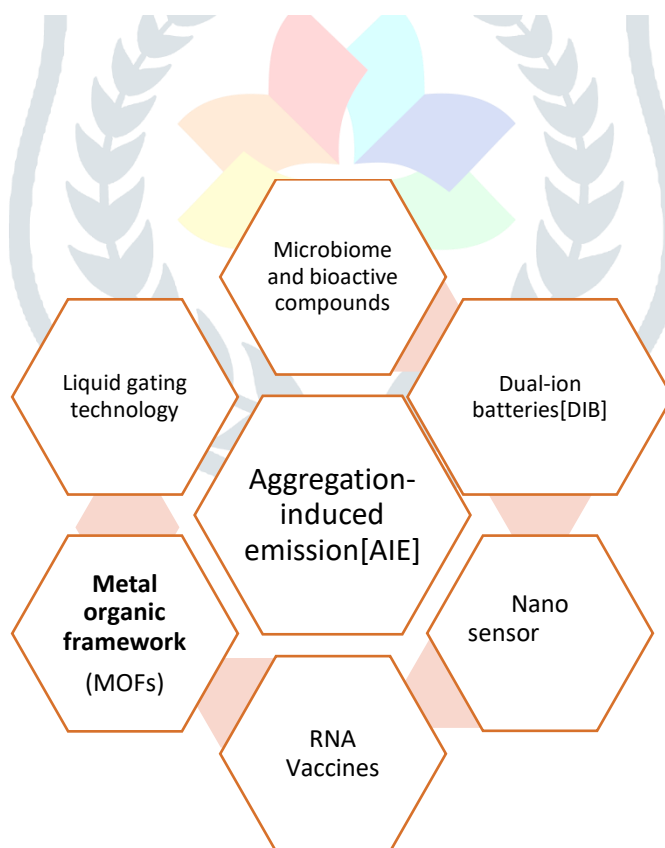
"On the occasion of 100th foundation anniversary of IUPAC and 150th anniversary of Dimitri Mendeleev's first publication on the periodic table of an elements.²The initiative has started by IUPAC since year 2019, to identify and recognize the value of chemistry and chemist and inform to the general public as to how the chemical sciences contribute to the wellbeing of society and the sustainability of planet earth".

Recent Top ten technologies in chemistry, 2019

| | |
|-------------------------------------|---|
| 1. Nanoparticle | 6. Directed evolution of selective enzymes |
| 2. Enantioselective Organocatalytic | 7. Turning plastic to Monomer |
| 3. Flow chemistry | 8 Solid state batteries. |
| 4. Reactive Extrusion | 9.3D-bioprinting |
| 5. Metal organic framework | 10. Reversible deactivation of radical polymerization |

Top technologies in chemistry, 2020

- **AIE**-active materials have been widely exploited for various applications in optoelectronics, sensing, biomedical, and stimuli-responsive systems [1]
- **Metal-organic frameworks (MOFs)** are used as adsorbents and release system for food preservatives. The food quality and lifetime of packaged food can be prolonged up to 9 months. Therefore, food waste can be consequently reduced by MOF-based packaging solutions.[2]



➤ Nano sensor Applications

- To detect various chemicals in gases for pollution monitoring
- For medical diagnostic purposes either as bloodborne sensors or in lab-on-a-chip type devices
- To monitor physical parameters such as temperature, displacement and flow
- As accelerometers in MEMS devices like airbag sensors
- To monitor plant signaling and metabolism to understand plant biology [3]

➤ Advantages of DIBs

- DIBs could make stationary storage batteries free from lithium, nickel, and cobalt.
- A battery using DIB technology is expected to be more economical and sustainable.
- They could be used to support grids for storing a large amount of energy and supply them at higher output.

➤ RNA Vaccines- found effective during covid-19

- Recent years have witnessed the emergence of liquid gating technologies that employ liquids as structural materials to provide **dynamic gating control**. Such technologies have attracted considerable attention globally owing their antifouling, energy-saving, reversible, and reconfigurable characteristics.

Top technologies in chemistry, 2021

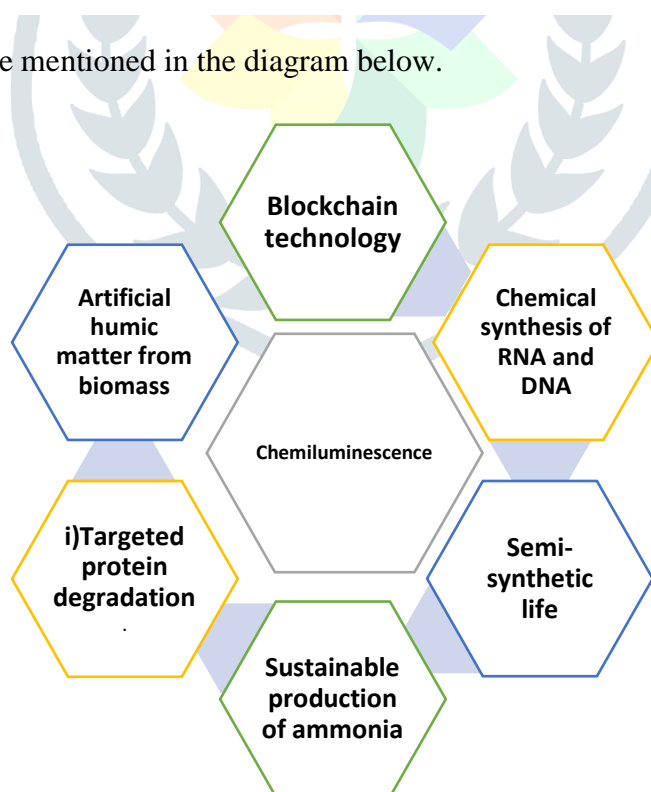
- **Blockchain technology** is an advanced database mechanism that allows transparent information sharing within a business network.

- **Chemiluminescence** helps to measure enzyme, substrate and metabolites, to detect changes of calcium in living cells, to determine oxygen radical.[4]

➤ The most widely adopted technology for sustainable hydrogen production used for ammonia synthesis is water electrolysis coupled with renewable technologies such as wind and solar.[5]

- **Targeted protein degradation** enables investigation of the downstream consequences of protein knockdown and provides an easy-to-use method for target validation.[6]

Some useful technologies are mentioned in the diagram below.



Top ten technologies in chemistry, 2022

| | |
|-----------------------------------|------------------------------------|
| 1. Aerogels, | 6. Nanozymes, |
| 2. Fiber batteries | 7. Rational vaccines with SNA |
| 3. Film-based fluorescent sensors | 8. Sodium-ion batteries. |
| 4. Liquid solar fuel synthesis | 9. Textile displays |
| 5. Nanoparticle mega libraries | 10. VR-enable interactive modeling |

The Nobel Prize winners in the last decade of years.

The Nobel Prize in Chemistry 2022 was awarded jointly to Carolyn R. Bertozzi, Morten Meldal and K. Barry Sharpless "for the development of click chemistry and " Their research is particularly important for the simplification and removal of waste during chemical reactions. They brought chemistry into the era of functionalism and laid the foundations of click chemistry. They share the prize with Carolyn Bertozzi, who took click chemistry to a new dimension and began using it to map cells. Her biorthogonal reactions are now contributing to more targeted cancer treatments, among many other applications.



Source: The Nobel Prize in chemistry 2022-popular information-Noble prize.org

"The Nobel prize in chemistry 2021 was awarded jointly to Benjamin list and David W.C Mac Millan for the development of asymmetric organ catalysis this catalyst is an ingenious tool for building molecule. This research can greatly impact on pharmaceutical field and made chemistry greener. Organic catalyst has stable framework of carbon atoms, to which more active chemical group can attach. These often contain common elements such as oxygen, nitrogen, sulfur or phosphorus. This means that these catalysts are both environmentally friendly and cheap to produce, it can be used to drive multitudes of chemical reactions, using these reactions researchers can construct more efficiently anything from new pharmaceuticals to molecule that can capture light in solar cells.



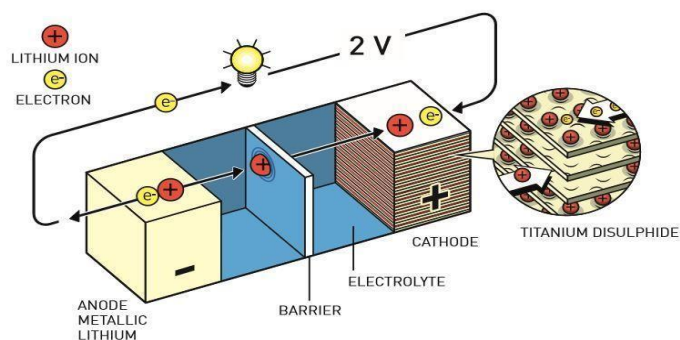
Source: The Nobel Prize in chemistry 2021-popular information-Noble prize.org

“The Royal Swedish academy of science declared the Nobel Prize of 2020 in chemistry to the scientist Emmanuelle Charpentier of France and Jennifer A Doudna of the U. S for the development of CRISPAR-Cas9 DNA snipping “scissors” a method for genome editing, (rewriting the code of life). This technique can used to change the DNA of animals, plants and microorganism with extremely high precision. This technology can revolutionarily impact on the life sciences, and contributing to new cancer therapies and may make the dream of curing inherited diseases”.



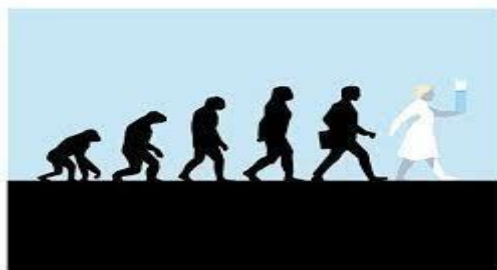
Source: Press release: The Nobel prize in chemistry 2020 Nobelprize.org

“The Nobel prize in chemistry 2019 was awarded John B. Goodenough, the university of Texas at Austin, USA, M. Stanley Whittingham Binghamton University, State University of New York, USA and Akira Yoshino of Asahi Kasei Corporation, Tokyo, Japan Meijo University, Nagoya, Japan “for the development of lithium-ion batteries”⁶“Lithium-ion batteries are used globally to power the portable electronics that we use to communicate, work, study, listen to music and search for knowledge. Lithium-ion batteries have also enabled the development of long-range electric cars and the storage of energy from renewable sources, such as solar and wind power”.



Source: The Nobel Prize in chemistry 2019 popular information Noble prize .org

“The Nobel prize in chemistry 2018 was divided, one half awarded to Frances H. Arnold “for the directed evolution of enzymes”, the other half jointly to George Smith and sir Gregory P. Winter” for the phage display of peptides and antibodies. “For the way they have taken control of evolution and used it for the greatest benefit to humankind. Enzymes developed through direct evolution are now used to produce biofuels and pharmaceuticals, among other things. Antibodies evolved using a method called phage display can combat autoimmune diseases and, in some cases, cure metastatic cancer”.



Source: The Nobel Prize in chemistry 2018-Popular Information-Noble prize.org

“The Nobel prize in chemistry 2017 was awarded to Jacques Dubochet, Joachim frank and Richard Henderson for the development of cryo-electron microscopy, which both simplifies and improves the imaging of biomolecules. This method has moved biochemistry into a new era.”

“The Nobel Prize in chemistry 2016 was awarded to Jean-Pierre Sauvage, Sir J. Fraser Stoddart and Bernard L. Feringa for their design and production of molecular machines. They have developed molecules with controllable movements, which can perform a task when energy is added”.

“Thomas Lindahal, Paul Modrich and Aziz Sancar was awarded the Nobel prize in 2015 for having mapped, at molecular level, how cell repair damage DNA and safeguard the genetic information. Their work has provided fundamental knowledge of how a living cell functions and is, for instance, used for the development of new cancer treatments”.

“The Nobel Prize in chemistry 2014 was awarded jointly to Eric Betzig, Stefan W Hell and William E. Moerner “for development of super-resolved fluorescence microscopy. This research overcomes the limitation of optical microscopy”.

“The Nobel Prize in chemistry 2013 was awarded jointly to Martin Carplus, Michael Levitt and Arieh Warshel” for the development of multiscale models for complex chemical systems. “This research laid the foundation for the powerful programs that are used to understand and predict chemical processes. Computer models mirroring real life have become crucial for most advances made in chemistry today.”

“The Nobel Prize in chemistry 2012 was awarded jointly to Robert J.Lefkowitz and Brian K.Kolbika for a groundbreaking discovery that revealed the inner workings of an important family of G-protein-coupled receptors.

Conclusion:

All the above-described research in chemistry has greater importance in the development and it can help humans to solve a number of existing problems in all the fields of science, technology and innovations. Hence from above observation of research in chemistry it is concluded that the research in Chemistry has a greater influence on human life that can change the world. Research in chemistry can help in the achievement of the Millennium development goals and sustainable development goals worldwide. Science and technology are an inseparable part of human life.

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