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КАФЕДРА МЕДИЧНОЇ ТА БІООРГАНІЧНОЇ ХІМІЇ

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У збірнику представлено тези робіт іноземних студентів І курсу Харківського національного медичного університету.

CONTENTS

Section "NOBEL LAUREATES IN CHEMISTRY"

SIR FREDERICK BANTING

Tusharika Kalia, group1. Scientific adviser: Tishakova Tatyana

Sir Frederick Banting was born in Ontario, Canada in 1891 and has been credited as the co-discoverer of insulin and its therapeutic abilities. In 1923,Banting shared the noble prize for insulin discovery with Scottish biochemist John James Rickard Macleod in the field of medicine. An alma mater of the University of Toronto, Banting was a medical scientist, physician and also a painter. The interesting fact about Banting remains that he is the youngest noble laureate in the field of Medicine and Physiology. About the early years of Banting's life, Banting successfully joined the army in 1915 and was awarded the Military Cross for heroism and finally in 1918, he was awarded the licence to practice medicine, surgery, and midwifery by the Royal College of Physicians of London. Medical research leading to the discovery of insulin-Banting studied about diabetes and that it was caused by the lack of a protein hormone secreted by the Islets of Langerhans of the pancreas. Schafer {founder of endocrinology} had named this putative hormone as "insulin". Insulin was thought to control sugar metabolism and its lack led to increase in blood sugar level which was later excreted with urine. So as a cure for the disease , ground-up pancreas cells were used to produce insulin but attempt was un successful mainly because of the destruction of insulin by the proteolytic enzyme of pancreas. Therefore, the main challenge before scientists was to extract insulin before being destroyed. Banting then studied about experimental closure of the pancreatic duct by ligature or a suture which influenced Banting's thinking. The procedure caused deterioration of the cells of the pancreas that secrete trypsin which breaks down insulin, but it left the islets of Langerhans intact. Banting realized that this procedure would destroy the trypsin-secreting cells but not the insulin. In this way Banting cracked the method to extract insulin and began producing insulin in this manner. Pork and beef would remain the primary commercial sources of insulin until they were replaced by genetically-engineered bacteria like E.coli in the late 20th century.[1]

About insulin: The Insulin is a peptide hormone produced by beta cells of the pancreatic islets which regulates the metabolism of carbohydrates, fats and proteins which we will be discussed later in role of insulin. It is an anabolic hormone, promoting the conversion of small molecules in the blood into large molecules inside the cells.

Molecular aspect of insulin:

Insulin is a peptide hormone comprised of 51 amino acids distributed among two peptide chains, the A and B chains of 21 and 30 amino acid residues respectively. Disulphide bonds of cysteine residues connect the 2 chains. Proinsulin is the original precursor protein of insulin. It is a single-chain polypeptide consisting of proinsulin and signal peptide sequence which is cleaved at its signal peptide, releasing proinsulin. Proinsulin is a single-chain containing insulin's A and B chains in a continuous fashion joined through a segment known as the C domain. Dibasic residues flank the C domain at each end.

Functions performed by insulin:

1)Glucose Metabolism

The homeostasis of glucose metabolism is carried out by 2 signals: insulin-mediated glucose uptake (IMGU) and glucose-stimulated insulin secretion (GSIS). The IMGU cascade allows insulin to increase the uptake of glucose from skeletal muscle and adipose tissue, as well as suppress glucose generation by hepatic cells. insulin allows for glucose entry into skeletal muscle cells for metabolism into glycogen.

2) Glycogen Metabolism

In the liver, insulin effects glycogen metabolism by stimulation of glycogen synthesis and slows down the rate of glycogenolysis (breakdown of glycogen to glucose) as well as gluconeogenesis (synthesis of new glucose using non-carbohydrate precursors)

3) Lipid Metabolism

inhibition of lipolysis (degradation of lipids into free fatty acids) Ultimately, insulin decreases serum free fatty acid levels.

4) Role in Inflammation and Vasodilation

Insulin's actions within endothelial cells and macrophages have an anti-inflammatory effect on the body. Within endothelial cells, insulin stimulates the expression of endothelial nitric oxide synthase which functions to release nitric oxide (NO), which leads to vasodilation [2]

Clinical Significance

There is a group of metabolic diseases in which the body experiences chronic hyperglycaemia arising from insulin imbalance:

Type 1- insulin-dependent, diabetes mellitus is a condition in which the pancreas has low or absent production of insulin.

Type 2, insulin-independent, diabetes mellitus (DM) is a condition in which the body produces insulin, but it is not enough to effectively keep up with the body's glucose metabolic demands. This supply and demand mismatch lead to insulin resistance and abnormal glucose metabolism.

They are characterised by elevated glucose levels in the bloodstream, neuropathy, renal failure, retinopathy, cardiovascular disease, and peripheral vascular disease. [3]

Latest update: However, the latest research suggests that a new type of beta cell might be able restore the normal functionality of the pancreas. [4]

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HAROLD CLAYTON UREY

Adesegun Jacobs Kuye, group 1. Scientific adviser: Tishakova Tetyana

Harold C. Urey, full name Harold Clayton Urey, An American scientist born April 29, 1893. He was awarded the Nobel Prize for Chemistry in 1934 for his discovery of the heavy form of hydrogen known as deuterium [1]. He was also a key figure in the development of the atomic bomb and made essential roles to a widely accepted theory of the origin of the earth, other planets and non-living matter [2].

Urey studied thermodynamics under Gilbert N. Lewis at the University of California. Having obtained his PhD at the age of 30, he was awarded a fellowship by the American-Scandinavian Foundation to study at the Niels Bohr Institute in Copenhagen[2]. Urey became a research associate at Johns Hopkins University in the USA before becoming an associate professor of Chemistry at Columbia University. Three years before being awarded the Nobel prize, he began work with the separation of isotopes that resulted in the discovery of deuterium. [1981, La Jolla, Calif].

During World War II, Urey made use of his evidence on isotope separation to pave way to solve the problem of uranium amelioration(act of enriching uranium). After the war, he became a Professor of chemistry at the Institute for Nuclear Studies, and later in his late year a Ryerson professor of chemistry at the University of Chicago.[3]

Urey died in the first month, January 5th, of 1981, at age of 87 in his home at La Jolla, CA, USA.

Deuterium (or hydrogen-2, symbol D or ^{2}H, also known as heavy hydrogen) is one of two stable isotopes of hydrogen (the other being protium, or H^{1} (hydrogen-1).

The nucleus of deuterium, called a deuteron, contains one proton and one neutron, however the far more common protium has no neutron in the nucleus. Deuterium has a natural abundance in Earth's oceans of about one atom in 6420 of hydrogen. The abundance of deuterium changes slightly in difference types of water.

Citied in his Nobel lecture on the 14th February 1935 titled “Some thermodynamic properties of hydrogen and deuterium’’ Urey Harold questioned if the least atom, hydrogen, had different isotopes, and he shew how he calculated, and they should to be constituted if that were the case. By distilling liquid hydrogen, a hydrogen isotope was extracted in 3 years before that was twice as heavy as regular hydrogen. It was called deuterium (discovery of Heavy Hydrogen) [2] Water that contains deuterium, alleged heavy water, proved to have other chemical properties that contrasted from regular water, and in various ways deuterium became substantial in nuclear technology [3]

Dynamics of Deuterium

Heavy hydrogen is destroyed in the cores of stars faster than it is formed. Other natural processes are thought to create only an infinitesimal molecule of it. It was discovered that almost all deuterium found in nature was produced in the ‘Big Bang’ 13.8 billion years ago, and so the basic or primordial ratio of hydrogen-1 to deuterium (about 26 atoms of deuterium per million hydrogen atoms) has its origin from that time of the Big Bang. This is the ratio found in the gas giant planets, such as Jupiter and other exoplanets [5]

Deuterium occurs in trace amounts naturally as deuterium gas, written $^{2}H_2$ or D_2, but most natural occurrence in the universe is bonded with a typical ^{1}H atom, a gas called hydrogen deuteride (HD or $^{1}H^{2}H$) [3].

How is it produced?

Deuterium is formed for industrial, scientific and military drives, a small fraction of that which is naturally-occurring heavy water is separated out from the heavy water by the Girdler sulfide process, ‘distillation-separation method’ , or other methods of separation technique applicable .

In theory, deuterium for heavy water could be created in a nuclear reactor, but separation from ordinary water is the inexpensive bulk production process- like the kind of processes carried out in India and Canada.

Properties of Deuterium

The physical properties of deuterium compounds can show important kinetic isotope effects which are different from other hydrogen analogs. For example, the deuterium oxide, $^{2}H_2O$, D_2O is more gelatinous in nature than water.

Also, the chemical properties show a suggestively variances in electrochemical bonding. Which can be seen in the length of compounds of heavy hydrogen isotopes when compared to the normal H^1 (hydrogen 1). To this end, Deuterium can replace the normal hydrogen in water molecules to form heavy water. It should be noted that heavy water can be dangerous to human health although slightly because of it less dense property to normal physiological solution of the human body.

Effect on biological systems

Laboratory experiment on animals (mice, rats) and human consumption of heavy water shows a 25%-50% toxicity. However, a higher >90% degree of heavy water is lethal. Experiment on animals especially fishes in heavy water lead to their death. Also, at same degree of toxicity, irreversible impairment of visceral organs is seen in humans when the amount of fresh water consumption is lower compared to heavy water consumption in a given space of time.

Application

Deuterium has several commercial and scientific uses as in: Nuclear magnetic resonance, Infrared spectroscopy, Neutron moderator, Neutrino detector and Metabolic rate testing in physiology and biology (whereby deuterium is mixed with $H_2{}^{18}O$ for a common and safe test of mean metabolic rate in humans and animals undergoing their normal activities). Most importantly it uses in the World War 2 Heavy Water Bomb. [6]

In conclusion The discovery of Deuterium has led to other unimageable scientific discovery that has outrightly profuse our imagination. Recently in the August of 2018, scientists publicised the transformation of gaseous deuterium into a liquid metallic form which will help scientist comprehend giant gas planets, like the Jupiter, Saturn and related exoplanets, since such planets are thought to contain a lot of liquid metallic hydrogen, which may be responsible for their detected powerful magnetic fields.[7]

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DISCOVERY OF HEAVY HYDROGEN

Shalom George, group 1. Scientific adviser: Tishakova Tetyana

Hydrogen is an element found in the 1st group of the D.I. Mendeleev periodic table and a nonmetal [1]. Deuterium (which is also known as Heavy hydrogen) was discovered in 1931 by Harold C. Urey; who was an American scientist. Deuterium is essentially an isotope of hydrogen with the double the mass of a normal hydrogen. This is the case since there is an additional proton present in the nucleus of the hydrogen atom; giving it the name “heavy hydrogen [2].” Deuterium’s atomic mass is 2.014 AMU; which reflects his heavier nucleus.

Urey was able to do this by the process of distilling liquid nitrogen; the remaining residue by atomic spectrum. The process of isolating heavy hydrogen is taking water and boiling it with opposite ends interacting with a contact tower. This contact tower is packed with material that can be wetted. The vapor begins to evaporate, leaving liquid that is left behind to be concentrated with the remaining deuterium. The system is not a fully closed system, but has some “breathing room” on the top where there is some ventilation provides that aides the experiment in evaporation and helps to avoid explosions with an increase of pressure [4].

Deuterium’s discovery has been quite instrumental in its various uses as a fusion reactor; with a presence in science, industrial sphere, and the military. One specific example of its use is the ability for deuterium to slow down neurons in nuclear fission

reactors that use heavy water. In the field of biochemistry, there are new and exciting research programs on the effects of deuterium oxide on the human body. These studies are heavily regulated and have patents by major pharmaceutical companies, and corporate giants like Google [5].

It is evident that Urey could not have imagined the impact of his research in coming centuries, across varied industries. And the significance that it would have on the science and medical communities in treating certain volatile pathologies. But he was given one of the most prestigious awards; that still bears significance in the international community today. In 1934 Harold Clayton Urey won the Nobel Peace Prize in recognition of his discovery and research. As the scientific community is engaging in current ground-breaking research with deuterium (or heavy hydrogen); we will continue to see the importance of what Urey did with his perseverance, and hopefully inspire the next generation.

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HEINRICH OTTO WIELAND

Utkarsh Rai, group 3. Scientific adviser: Zavada Oksana

German chemist Heinrich Otto Wieland was born in Pforzheim, in the family of pharmacist Theodor Wieland and Eliza (Blom) Wieland. After receiving primary and secondary education in local schools, he studied chemistry at the universities of Munich, Berlin and Stuttgart. In 1901, he was awarded a doctoral degree at the University of Munich, then he worked here as a lecturer, and in 1909 he became an adjunct professor.

Four years later, Wieland was appointed professor at the Technical University of Munich. During World War I, while on vacation, a scientist from 1917 to 1918 worked for Fritz Haber at the Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry in Berlin, where he took part in Germany's efforts to develop chemical weapons. After the war, he returned to the Technical University of Munich, to his former position, which he held until 1921, after which he worked for three years at the University of Freiburg. From 1924, Wieland was again at the Technical University of Munich, but now as head of the Department of Organic Chemistry and Director of the Bayer Laboratory (named after Adolf He held this post until his retirement in 1950.

In 1927, the scientist was awarded the Nobel Prize in Chemistry "for the study of bile acids and the structure of many similar substances." In his opening remarks on behalf of the Royal Swedish Academy of Sciences, X. G. Söderbaum stressed the importance of Wiland's solution of the problem, which Söderbaum called, "without a doubt, the most complex organic chemistry ever encountered." Noting that "Wiland was able to get saturated acid from bile, which can be considered as an initial substance for the production of bile acids," Söderbaum compared it with similar discoveries made by Windaus: "When Windaus ... from cholesterol, this clearly indicated a close relationship between cholesterol and bile acids. "von Bayer).

Among the many scientific societies in which he was a member are: the Royal Society of London, the American National Academy of Sciences. American Academy of Arts and Sciences, chemical societies of London, Romania, Japan.

JACOBUS HENDRICUS VAN'T HOFF

Zura Zuhair, group 3. Scientific adviser: Zavada Oksana

Jacobus Hendricus Van't Hoff was born in Rotterdam. His father Jacob Hendrik Vant-Hoff was a doctor and wanted his son to get a good education. From the Netherlands he journeyed to Germany and then to Paris for further study, finishing his doctorate at the University of Utrecht in 1874.

The first Nobel laureate in the field of chemistry was the Dutch chemist Vant-Hoff. He is the founder of stereochemistry, introduced the concept of the spatial structure of chemicals, and he also developed a theory of the speed of chemical reactions and formulated the foundations of chemical kinetics. He received the Nobel Prize for his discovery of the laws of chemical dynamics and osmotic pressure. The wording of the

Nobel Committee: «in recognition of the extraordinary services he has rendered by the discovery of the laws of chemical dynamics and osmotic pressure in solutions».

In 1874, in the Utrecht University, van't Hoff defended his doctoral thesis on the study of certain organic acids, and became a doctor of mathematics and natural philosophy. In 1874, a few months before the thesis was defended, Van't Hoff published a paper on the title An Attempt to Extend to Space the Present Structural Chemical Formulae. With an Observation on the Relation Between Optical Activity and the Chemical Constituents of Organic Compounds"). In this work, the scientist refuted the existence of two-dimensional molecules and suggested that the optical activity of organic compounds is associated with an asymmetric molecular structure, with the carbon atom in the center of the tetrahedron, and in its four corners are atoms or groups of atoms that differ from each other. Vant-Hoff used physical and chemical research methods in chemistry. A thorough mathematical preparation helped a scientist study the rate of reactions and conditions affecting chemical equilibrium.

He died of pulmonary tuberculosis on March 1, 1911 in Germany, in Steglitz (now part of Berlin).

MULLIS CAREY

Suraj Kuamar Singh, group 3. Scientific adviser: Zavada Oksana

Mullis Cary (b. December 28, 1944), American biochemist. He developed a polymerase chain reaction method (obtaining an unlimited number of copies of DNA using DNA polymerase enzyme), which is widely used in molecular biology and medicine. Nobel Prize (1993, together with M. Smith).

Education degree-Bachelor of science from the Georgia institute of technology in 1966. -Ph.d Degree in Biochemistry from the University of California, Berkeley in 1972 and after that Lectured in Biochemistry there until 1973.

In the spring of 1983, Friday night, Kari Mallis, a 39-year-old synthetic chemist from the then little-known California biotech firm Cetus, was sent home from work. Along the way, he reflected on how to improve the accuracy of identifying point mutations in genomic DNA using the recently proposed method of oligomeric restriction. The essence of the method consisted in the enzymatic elongation of the oligonucleotide, deposited on the DNA region adjacent to the mutation region. If deoxynucleotides (“building blocks” of which DNA is built) are not added to the reaction all at once, but one at a time, then

oligonucleotide elongation will occur only when the added deoxynucleotide is complementary to the mutation site.

In 1993, Mallis received the Nobel Prize "for his contribution to the development of DNA-based chemistry methods for the invention of the polymerase chain reaction method." After receiving the Nobel Prize, he left the production, and science, and settled in California on the ocean, where he is engaged in windsurfing and (in his spare time) private scientific advice. In his summary on the occasion of the Nobel lecture, Mallis said that "since 1993 he has been a writer."

He wrote and published in 1998 the autobiography of the No-Veil Dance in the Field of Reason.

In 2016, he signed a letter calling for Greenpeace, the United Nations and governments around the world to stop fighting genetically modified organisms.

OTTO HAHN

Asit Jena, group 4. Scientific adviser: Kalinenko Olha

INTRODUCTION:

Otto Hahn a German chemist and a revolutionary personality in feild of radiochemistry.He was refered as the FATHER OF NUCLEAR CHEMISTRY and he got 1944 nobel prize in chemistry for his discovery of nuclear fission.

BIRTH:

He took birth on 8th march 1879 at Frankfurt ,Germany and was youngest son of Heinririch Han and Charlote Hahn.

EARLY LIFE:

From his childhood he had a special interest on chemistry and aimed to became an industrial chemist.

EDUCATION:

He completed his school education from Klinger Obrrealschule in Frankfurt and got a degree.

Then he studied at university of Marburg and Munisch taking physics and chemistry as his subject.

In 1901 he received his doctorate degree from university of Marburg on organic chemistry for writing a thesis on *BROMINE DERIVATIVES OF ISOEUGENOL.*

RESEARCH:

INITIAL STEP TOWARDS DISCOVERY:

Being inquisitive towards chemistry he started working in radio chemistry under Sir Williom Ramsay at university college London in 1904.

During his research with radium salt he discovered Radiothorium[an isotope of thorium $Th_{228.}$

It was his first contribution to the world of radiochemistry.

His discovery was presented before the comette of Royal socity and new radio active element was published in their procceding.

3 DISCOVERIES AT A TIME:

In 1905 through Ramsay he started working with Ernest Rutherford's team in MC Gill university ,Montreal,Canada.

During the course of his research he discovered two elements Thorium-C [now $_{212}$ Po] and Radioactinium [$_{227}$ Th] and explored about α-rays of radiothorium.

DISCOVERY OF MESOTHORIUM:

In 1906 he returned germany and team up with Emilfisher and started his lab work in fisher's workshop.

There he found Mesothorium,mesothorium-2,ionium [Mother substance of radium]

In the late time mesotorium was used in radiation treatment and hence he entered the field of radiotherapy in oncology.

In 1914 he was nominated for nobel prize for his discovery.

PRODUCTION OF POISONOUS GAS;CONTRIBUTION TO WORLD WAR-1:

Being a member of scientific team in Berlin he was given task to produce poisonous gas and make them use in weapons during world war-1.

Then he successfully produced mustard gas ana chlorine gas but couldnot be properly used in weapons.

DISCOVERY OF Pa:

In 1916 he returned to Berlin and team up with Meither and isolated protoactinium[isotope of $_{91}$p]

For it both were nominated for nobelprize in chemistry in 1920.

DISCOVERY OF NUCLEAR ISOMERISM:

In 1921 Hahn disovered uranium Z[later identified $_{234}$pa] which was the 1st recorded example of nuclear isomerism and again nominated for nobel prize.

APPLIED RADIOCHEMISTRY:

In 1920 using his own emanation method he gave the ideas of applied radiochemistry.which in later time had a great influence on nulear chemist in different corner of world.

DISCOVERY OF NUCLEAR FISSION:

In 1934 Hahn became keenly interested in the work of Italian physicist enricofermi,

1-who found that when a heavier nuclei[uranium]was bombarded by neutrons.several large radioactive fragments were formed.

Hahn ,Meitner and strassmann together started.

2-working on Fermi's theory but it was very difficult and then meithre went away.

In mid of 1938 Hahn and starssmann continued the research on it.

3-By the end of they got the experiment proof that of the product from uranium was a radioactive form of much lighter element barium,indicating that uranium [heavy nucleai]had split in two ligher atoms.

4-In 1939 Hahn represented it to his colligue meither,along with her nephew Robert Frisch.,who named it as nuclear fission.

5-Equation was:

$$^{235}_{92}u + ^{1}_{0}n \Longrightarrow {}_{56}Ba + {}_{36}kr + einigen$$

This discovery initiated a new era.

6-in the field of nuclearphysics and radio chemistry.

Finally in 15th Nov.1945 he was awarded the 1944 nobel prize in chemistry by Royal Swedish Academy of science.

7- For his discovery of fission of heavy atomic nuclei.

8- later in world war-2 idea of fission was emploited to produce nuclear reactors and weapons.

Through out his whole research life he had discovered 25 element and explored the existance of about 100 isotopes.

In his life time he became the elected president of max plank society for advancement of science. HONOURS:

1-Nobel prize is chemistry (1944)

2-Enrico Fermi award (1966)

These two award his life time achievement award.

Apart from he got many more medals and prizes like;

1.Emil fischer medal(1919)

2.Cannizzaro Prize(1939)

3.Copernicus Prize(1941)

4.maxplanck medal(1949)

5.Paracelsus medal(1952)

6.Faraday lecture ship prize(1958)

7.Hugo Grotius Medal(1958)

8.Legion d' HOnneur(1959)

DEATH:

He was died at the age of 89 on 28 july 1968

Otto Hahn's achievements are known universally and hold a special place in the history of science.

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GEORGE DE HEVESY

Kamsiyochukwu Okey Anozie, group 7. Scientific adviser: Kozub Svetlana

George Charles De Hevesy was born on August 1st, 1885 in Budapest, Austria-Hungary (presently Hungary). He graduated from Piarista Catholic Grammar School in 1903. He then went on to study at the University of Budapest for a year and moved to Berlin Technical High School, West-Germany (now Germany) for some months. Due to the cold climate of the region at that time, he contracted pneumonia and had to move to the University of Freiburg. He remained there and studied till he graduated from there with a Doctoral degree in Physics in 1908.

In 1911, Hevesy travelled to Manchester, England to study at Ernest Rutherford's laboratory at the University of Manchester. There, he studied Rutherford's efforts in discovering the atomic nucleus. He also researched on the solubility of radioactive substances in water, how to determine the charge power of radioactive ions by their diffusion rates in solutions and how to separate radium D (which was lead-210) emission from lead. Although the latter did not work out well as planned, he was to achieve a great feat in the history of Chemistry for it was also at Manchester that the revolutionary discovery of radioactive tracers took place and it all started with the trick played on Hevesy by his landlady. Hevesy suspected that his landlady was serving him each day with the recycled leftovers from the previous day's meal. Although she denied the fact, Hevesy went further on to investigate and find out the truth. He sprinkled a minute amount of radioactive material on the food he was served one day. The next day, he brought an electroscope (which was like a radioactive-detecting device) from his lab and tested it on the food he was served. The electroscope picked up the presence of a radioactive

substance in the food which proved that the landlady was indeed serving him with leftovers.

Hevesy began studies on radioactive tracers and their application in studying the metabolic processes of biological systems. He became the first scientist to use a radioactive isotope to study a biological process in animals and plants. He demonstrated how lead absorbed from the soil was distributed to different plant parts by dipping the plant into a solution of a radioactive isotope of lead (particularly lead-212).

In 1922, George together with Dirk Coster used X-ray emission spectroscopy on an ore of Zirconium mineral to discover an element with an atomic number of 72. They named this element "Hafnium" and later published their findings in 1923.

George later used other radioactive isotopes like Deuterium in water (called "Heavy water") to determine the period of time a single water molecule would have to stay in the human body before it was excreted and radioactive Phosphorus (specifically Phosphorus-32) to find out the various physiological processes occurring the body by tracing the pathways of the radioactive substance in the body.

George was awarded the 1943 Nobel Prize in Chemistry for his research work on the use of radioactive isotopes as tracers in the study of biological and chemical processes [1].

Today, his researches are widely applied in medicine and chemistry. Doctors in the field of Nuclear Medicine can administer radioactive tracers to patients intravenously, orally, through inhalation or even through ingestion to find out the pathway of the infection and the source (or root cause) of the disease. Tracers like radioactive Iodine-131 is administered to patients with disease of the thyroid gland so that the doctors can diagnose both hyperthyroidism or hypothyroidism, Gold-198 is used in the diagnosis of liver diseases.

Special devices to trace down the path of these radioactive substances in the human body namely Single Photon Emission Computed Tomography scan (SPECT scan) or Positron Emission Tomography scan (PET scan). These devices track the radiotracers moving in the body to clearly detect various disorders in the bones, organs and tissues. As a matter of fact, theses specially-manufactured cameras have been known as a good diagnostic method for diseases like Parkinson's disease in the brain, Alzheimer's disease, et cetera [2].

In Chemistry, the steps of a complex chemical reaction can now be easily followed by scientists with the use of radioactive tracers. Scientists integrate radioactive atoms into reactant molecules and track the pathways of the atoms by following their radioactivity.

An example is the use of Carbon-14(a radioactive isotope of Carbon) in ascertaining the steps involved in photosynthesis in plants [3].

These are just few of the amazing applications of radiotracers in medicine and chemistry. All these began just with the encounter of Hevesy with his landlady's leftovers.

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JOHN B. FENN

Ahmed Mostafa Khairy, group 8. Scientific adviser: Syrovaya Anna

John B. Fenn was born June 15, 1917 in America. He graduated from college and received a bachelor's degree in 1973. He then entered Yale University, where he received his Ph.D. He was married to his supervisor. They had three children.

In Alabama John B. Fenn worked at the Monsanto Chemical Company after graduation.

In 1960 Fenn worked on steam analysis and vacuum systems. His main idea was to replace heavy argon with lighter helium. According to the pressure in the gas flow, light molecules move faster by moving heavy molecules along the line of observation. Because of this, the speed of particles and the force of impact increase.

In 1967 Fen went to a university at Yale and did research in the field of spectrometry. He proposed using organic samples to create a jet instead of "heavy" molecules. John B. Fenn improved the method of mass spectrometry, which identifies molecules according to the acceleration rate in an electric field. It is used in biology to identify molecules in a matter of seconds, accelerating the research of new drugs.

John B. Fenn also developed electro spray ionization, which turned out to be a fairly universal technique, and was used in the development of pharmaceuticals and the analysis of food products for the presence of harmful substances.

In 2002 John B. Fenn received the Nobel Prize in Chemistry for developing methods for the identification and analysis of proteins and other biological molecules. He

deciphered the genetic code and examined the gene sequences. This was a breakthrough in science.

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FRITZ PREGL

Mayowa Michelle Akintimehin, group 9. Scientific adviser: Syrovaya Anna

Fritz Pregl received the 1923 Nobel prize in Chemistry for his advances in the microanalysis of organic materials. Although Fritz did not distinguish himself with original theories but rather built on the work of others, the advances he made were terrific, opening up a whole new field of Chemical study with his innovative improvements in the exactness of his instrumentation.

Fritz Pregl, an Austrian Chemist, doctor, and inventor was born in Laibach, Austria (now Ljubljana in the Republic of Slovenia) on September 3, 1869 to Raimund Pregl, the treasurer of a bank in Krain, who died when Pregl was young, and Friderike Schlacker, who moved him to Graz in 1880 where he got admission into the University of Graz [1]. He studied Medicine, specializing in ophthalmology while still working as a laboratory assistant to Alexander Rollett. After his graduation, the University of Graz appointed him as an assistant lecturer in Physiology and Histology before naming him as a university lecturer in 1899. During this time, Pregl acquired a thorough knowledge and understanding of all the branches of Chemistry under the guidance of Professor Skraup. [2]

In 1904, Pregl went to Germany. During his stay there, he studied Chemistry with Wilhem Ostwald in Leipzig, and Emil Fischer in Berlin. On his return to Graz in 1905, Pregl worked as an assistant at the medical and Chemical laboratory under K.B Hofmann. He was later appointed as forensic chemist for Graz circuit in 1907 [1] . At that time he started investigating the components of albuminous bodies and the analysis of bile acids. Unfortunately, his investigation was limited due to lack of enough starting materials and this compelled him to look for other methods which required smaller amounts when making quantitative analysis of elements in a compounds. [3]

In 1910, Pregl worked as a lecturer at the university of Innsbruck until 1913, when he was recalled to the university of Graz as a full professor, and later appointed Dean of the Medical faculty for the year 1916, in 1920, the university appointed him Vice Chancellor. Pregl’s work had been concentrated on the fields of Physiology and

Physiological Chemistry initially, he later turned to the study of compositions of chemical compounds and particularly investigated on bile acids.

In 1912, by using his own method of micro analysis, Pregl was able to make measurements of Carbon, Nitrogen, Hydrogen, Sulphur, and Halogens using only 5-13 mg of starting materials, and the results were as accurate as those obtained by macro-analysis. He later perfected his work in a way that as little as 3-5 mg of materials were adequate to carry out the analysis. Pregl also developed a sensitive microbalance, invented micromethods for determining the functional groups of organic compounds. [4]

Pregl's work was first recognized by the Lieben prize for Chemistry from Imperial Academy of Science in Vienna (1914), an honorary doctorate in Philosophy from the University of Gottingen (1920); in 1921, he was elected corresponding member by the Academy of Sciences in Vienna. The greatest and most unexpected honor was the award of the Nobel prize for Chemistry by the Swedish Academy of Sciences in 1923. The chairman of the Nobel committee at the time, O. Hammarsteen, pointed out that Pregl was award the prize for modifying and improving already existing methods. Following this event, chemists from all over the world came to the Medico-Chemical Institute in Graz to study Pregl's techniques of quantitative organic microanalysis under his guidance.

Pregl was a bachelor throughout his life. He died of Pneumonia at the age of 61 at Graz on December 13, 1930. Shortly before he died, he put a considerable amount of money at the disposal of the Vienna Academy of Sciences for the promotion of micro-chemical research and to establish the Fritz Pregl prize which is now awarded every year to Austrian Scientists.[5]

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CARL BOSCH AND FRIEDRICH BERGIUS

Olaofe Precious A., group 9. Scientific Adviser: Syrovaya Anna

The Nobel Prize an international recognition award bestowed to frontiers in academic, cultural, or scientific advances diversified in six categories (chemistry

included). The prizes have been awarded since 1901, and in 1931 was shared by two scientists in recognition of their contributions to the invention and development of chemical high-pressure methods. The two scientists: Carl Bosch and Friedrich Karl Rudolf Bergius, are German chemists who worked independently on high pressure methods. The discoveries of both Chemists are still employed in modern industrial and theoretical chemistry, and are relevant for easy manufacture of certain chemical compounds.

Carl Bosch [1874-1940] was a German chemist and metallurgist. He studied metallurgy at the Technical University of Berlin before moving to the University of Leipzig where he decided on a career in Chemistry.[1] Upon graduation, Bosch worked for BASF (Badische Anilin- und Sodafabrik). It was the biggest chemical and dye firm in Germany at the time and it gave Bosch the right platform needed to explore. There he took part in the development of the then new industry of synthetic indigo and he explored the high-pressure synthesis of ammonia developed by Fritz Haber.[2]

In 1908, Badische Anilin-und Sodafabrik offered Bosch an opportunity to develop an industrial production and artificial fixation of ammonia using high pressure synthesis. Bosch had to renovate the original Haber process with addition, removal and substitution of several catalysts, apparatuses and procedures. Also, Bosch substituted osmium, uranium catalysts with iron catalyst with additives.[1] Bosch made procedures ecofriendly. Apart from the Nobel prize, Bosch earned Liebig Medal of German Chemists association in 1919.

Friedrich Bergius [1884-1949] was born in Goldschmieden near Breslau, Silesia to a chemical factory owner. While schooling in Breslau, Bergius helped his father out in his factory where he developed interest in technical processes and chemistry.[3] He gained practical knowledge of large metallurgical plant at tender years. After this, in 1903, Bergius began studying at the University of Breslau. [3] In the University of Leipzig he obtained his doctorate degree with a thesis on absolute sulfuric acid as a solvent. Bergius lectured on metallurgy at the Technische Hochschule in Hannover in 1911.

In 1913, Bergius developed techniques for high-pressure and high-temperature chemistry of carbon-containing substrates. This process s involved the production of liquid hydrocarbons used as synthetic fuels. In 1927 Bergius completed his works on liquefaction process and patented his work. It was taken by big companies like I. G. Fabernindustrie (a subdivision of BASF). [3]

The work on coal liquefaction was just a first part of Bergius' work, he soon began work on hydrolysis of cellulose to sugar.

Both Carl Bosch and Friedrich Bergius placed their names in the book of chemistry's greatest achievements by having their innovated processes named after them (Haber-Bosch process and Bergius process respectively). Here are some of the uses of the Haber-Bosch processes:

- production of fertilizers, synthetic nitrate and industrial gasoline
- production of synthetic fuel, methanol and ammonia
- fixation of artificial nitrogen

The development of these two processes is a real open door to many more developments in chemistry, and for the general comfort of mankind.

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PAUL BERG

Godson Akamihe, group 10. Scientific adviser: Kalinenko Olha

Paul Berg was born on the 30th of June 1926 in the city of New York USA. He grew up in Brooklyn where his passion for Science started with his teacher urging students to participate in science projects and also, he's reading of scientific books such as Paul De Kruif's *Microbe Hunters (1926)* and Sinclair Lewis's *Arrowsmith (1925).* He graduated from Abraham Lincoln High school in 1943 at the age of 16 and in 1948, received a B.S in Biochemistry at Pennsylvania State University during the time of WW2. He had his doctorate in Biochemistry from Case Western Reserve University in 1952.[1]

After completing his graduate studies, he spent two years as a postdoctoral fellow at American Cancer Society, working in Copenhagen at the Institute of Cytophysiology, Denmark. After he was done in Denmark, he moved to Washington school of medicine and spent time there as a Cancer Research Scholar with the department of Microbiology where he became a leader in decrypting the biosynthesis of proteins on the bases of codes which are carried on deoxyribonucleic acid (DNA) and also ribonucleic acid (DNA). He worked with Professor Kornberg and was a professor there from 1955 to 1959.

He then moved to Stanford university and thought biochemistry for close 41 years and served as the director of the Beckman Center for molecular and genetic medicine from 1985 to 2000.[2]

RESEARCH ON GENE SPLICING AND RECOMBINANT DNA

After he joined the department of Stanford University in 1959, Paul Berg's interest in Genetics of Microbes increased so much so that he took a leave to study them at the Laboratory of a renowned scientist known as *Renato Dulbecco*. At the Renato Dulbecco laboratory, he learned systems of animal-cell culture. Dulbecco had already been able to prove that particular viruses create a cancerous state in an infected cell by taking control of the expression of genetic information of the cell for their own reproduction. Now the question on the mind of all scientist at that time including Paul Berg, was if foreign genes could be inserted into a virus thereby making it a vector or means of transmission of genes into new cells.

The idea of recombinant DNA developed from a string of improvement in biochemistry, most especially were discoveries of new enzymes such as the restriction enzymes *EcoRI* that are able to cut DNA at definite points. Another was the enzyme ligase that form covalent bonds which stipulate a kind of chemical soldering or fusing that could restore DNA after a foreign gene was spliced into it.

Berg's 1971 landmark experiment of gene-splicing involved splicing a bit of the DNA of the bacterial virus known as the I or lampda Bacteriophage into the DNA of the much-studied *simian virus SV40* whose natural host is the monkey. The DNA of the two viruses takes the structure of a closed loop. Berg used his own cut and splice method to create sticky ends of the DNA of both viruses. The restriction enzymes where primarily used to open the circular units of DNA of the bacteriophage and simian virus and where added into the ends of the molecules by the terminal transferase enzyme. When similar varieties of DNA where incubated together, the ends would anneal naturally. Finally, DNA ligase would be added to seal the plasmid.

The Recombinant DNA was not immediately introduced into another organism by Paul Berg due to the public disagreement over the potential dangers of such experimentation. The main worry was that a recombinant DNA containing a dreaded gene-such as genes that code for the development of cancerous tumors, could escape from the Lab in some common bacteria and spread far and wide infecting hundreds of people[3][4]

MEDICAL BENEFITS OF RECOMBINANT DNA

Though rDNA has a wide range of advantages, numerous questions on consumer concern have also been raised. But it was revealed from a thorough analysis that such

consumer concerns where due to the lack of sufficient knowledge about the science involved in the utilization of the advantages of rDNA. Below, we shall evaluate concerns and benefits of rDNA with regards to medicine

The biotechnology of rDNA takes us nearer to the realism of the idea of commercial manufacturing in plants of edible vaccine and therapeutics for avoiding and treating animal and human diseases. The potentials of the biotechnology of rDNA consist of a wide variety of compounds contrasting from vaccine antigens for hepatitis-B, Norwalk viruses or bacteria to vaccines against cancer and diabetes. Also, genetically-modified strains of probiotic microorganisms are also potential mediums for successful transfer of vaccines and digestive aids such as lactase through the small intestine and stomach. Vaccines of rDNA are very economical, appropriate to distribute and simple and safe to administer. The first successful clinical trial was reported by scientist in 1998 when an edible vaccine was used against a pathogenic strain of Escherichia coli.[5]

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SEX HORMONES

Faith Kahimbi Samwele, group 10. Scientific adviser Kalinenko Olha

BIOGRAPHY

Adolf Fredrick Johann Butenandt was a German biochemist, who was born on March 24 1903 in Bremerhaven-Lehe Germany and he died on 18 January 1995 in Munich at the age of 91.He was awarded the 1939 Nobel Prize for Chemistry 1939 together with Leopold Ruzicka for his work on sex hormones. He only accepted his price in 1949

because the Nazi government forced him to refuse the award.He received his PhD in 1927 and finished his studies at the universities of Marburg and Göttingen . [1]

He later taught at the university of Göttingen the institute of Danzing.In the beginning of 1936 Adolf Butenandt became a director of the Kaiser Wilhelm Institute for biochemistry in Berlin, in 1945 when the institute had moved to Tubingen, he became a professor at the University of Tübingen.He again became a professor at the University of Munich in 1956 when the institute relocated to Munich.From the year 1960 to 1972 he served as the president of Max Planck Society for the Advancement of Science.[1]

HIS RESEARCH

This came to an understanding of several hormones, their role in human sexuality and reproduction was paved due to his work in isolating and synthezing hormones, this also made the development of birth control pills possible. [2]

Dr Adolf Butenandt worked with the urine of pregnant women,he succeded in isolating estrone, which is the hormone that determines sexual development in females in pure crystalline form. Two years he worked with another chemist and he isolated androsterone which is known as a male hormone, he made it possible by obtainining 15 milligrams of crystalline substance from 3960 gallons of male urine. By isolating the hormones, he also revealed the molecular structure of hormones. [2]

After chemical purification, he made a discovery that the male hormone was not just similar in structure to the female hormone but he also discovered that they were both similar to steroids. A demonstration was done by Dr .Ruzicka that it was possible for cholesterol to be transformed to the male hormone androsterone. [2]

Dr. Butenandt and Dr .Ruzicka, due the foundation of their work were able to synthesize testorsterone, which is the hormone that stimulates masculine features. Using extracts from ovaries of a sow, Dr.Butenandt a second female hormone known as progesterone. [2]

A research on cancer, viruses and insecticides was later conducted by Dr.Butenandt.His work on insects together with Erich Hecker, led to his discovery on the first crystallized pheromone, which is a sexual substance of the silk worm found in bombykol. His discoveries about the structure sex hormones paved the way for the development of birth control pills and led to the manufacture of steroids like cortisone. [2]

APPLICATION IN MEDICINE

The various sex hormones that were discovered by Adolf Butenandt are used in medicine world widely for various reasons. The women hormone was made in order to prevent ovulation in women which prevents them for from becoming pregnant; this is known as the birth control pill.

Estrone hormone as discovered by Adolf is an oestrogen hormone that is isolated from pregnancy urine, human placenta, palm kernel hormone and other substances that are synthetically produced. It is produced by the ovaries and fatty tissues and it was mainly used to treat menopause symptoms [3]

Estrone has been marketed in vaginal and intramuscular formation. It was used in the treatment of hypoestrogenism usually hot flashes and atrophic vaginitis, in women who are in menopause. Endometrial hyperplasia occurs if taken in high dosage. This hormone however is no longer marketed and no longer available and in use. This hormone has shown several effects when taken, a few mentioned below. [4]

Effects of estone hormones:

1.Vaginal dryness

2.Mood changes

3.It increased libido in women

4.It increased sensitivity and pigmentation of the nipple, as well as nipple erection.

5.Reproductive tract changes which included increased growth, thickness and differentiation of the endometrium

6.Increased mucous discharge from the cervix

By isolating hormones, Adolf also made a discovery about birth control pills, which is used by women to prevent preganacy.It was first tested on pigs then later a group of woman in Mexico, but it had various side effects and it was taken orally. The pill contains small amounts of oestrogen and progestine, which inhibit the body cyclical hormone to prevent pregnancy. [4]

Adrosterone was another hormone which he discovered, which was a male hormone, it is used in the body to produce testosterone and oestrogen it is also known as a steroid hormone and it is taken orally. It usually used to [5]:

1. Enhance athletic performance
2. Keep red blood cells healthy
3. Enhance recovery and growth from exercise
4. Increase sexual desire and performance

This pill is not recommended because it comes with several side effects such as [4]:

1. Reduced sperm production
2. Shrucken testicles
3. Breast development
4. Change in behaviour
5. Heart diseases etc

This pill may also be consumed by women but it also comes with effects because women will start developing muscular traits and features such as [4]:

1. Deepening of voice

2, Facial hair

3. Acne and male pattern baldness

4. Abnormal menstrual cycle and depression

In overall in both man and woman this pill is not recommended because it causes breast and prostate cancer and is poisonous to the liver. [5]

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THE NOBEL PRIZE IN CHEMISTRY 2009

Mashaal Khan, group 11. Scientific adviser: Kozub Svetlana

In 2009, three laureates, Thomas A. Steitz, Venkatraman Ramakrishnan and Ada E. Yonath were awarded with the Nobel Prize for plotting the cell's most convoluted organelle, the ribosome at an atomic level.

Messenger RNA is formed in the nucleus after transcription of DNA. mRNA then undergoes translation in the cytoplasm where the ribosomeś main function lies, which is to process the genetic information carried by the mRNA and produces the specific protein accordingly.

Ribosomes are present in cells of all organisms which makes it the ideal target for drugs, mainly antibiotics. Antibiotics work by invading the bacterial ribosomes and ceasing protein production, with the ribosomes of humans left unharmed. The three laureates have, therefore, allowed more insight to continue research and advancement of new drugs.

Ada Yonath, the Israeli biochemist and crystallographer, was met with skeptics who questioned her vision which was to determine the place of each atom in the ribosome. She confined ribosomes from hot springs which had a harsh environment. She crystallized the ribosomes and used x-ray crystallography to make a pattern which would be used to find

the places of hundreds of thousands of atoms in the ribosome. It took 25,000 tries before successfully crystallizing the ribosome. It is because the crystals need to be perfect and produce a precise pattern every time. She tried many methods, such as freezing the crystals in liquid nitrogen to stabilize it and using robust micro-organism to crystallize ribosomes. Ada Yonath soon got closer to her goal and more researchers joined her conquest, among which were Venkatraman Ramakrishnan and Thomas Steitz.

A peculiarity of the ribosome is that mishaps are rare during protein synthesis. A consequence of a translation error would be the protein losing its function or have an entirely different role which could be really dangerous. Venkatraman Ramakrishnan, the American-British structural biologist, studied 30S ribosomes and their crystal structures which helped understand the precision of the ribosome. He used neutron scattering to discover the structure of a subunit of a chromosome. He also discovered that nucleotides in the 30s ribosome calculate the distance between the mRNA codon and the tRNA anticodon. A faulty distance would cause the tRNA to fall from the ribosome. Ribosome measures the distance twice and hence, double-checks that everything is in order. Thus, the chances of an error is 1 every 100,000 amino acids.

The ribosome prompts the formation of peptide bonds between the amino acids. Acquiring the image of each step of the chemical reaction is hard because it happens at an atomic level at really high speeds. Thomas Steitz, the American biochemist, has made ribosomes into crystals which emphasize the molecules assisting the peptide bond formation. He also used x-ray crystallography. Thomas, along with other researchers mapped, using hundreds of thousands of atoms, the structure of ribosomes.

People have developed countless antibiotics that assist in blocking the function of the ribosome in bacteria. However, bacteria are developing resistance against these antibiotics exponentially. Therefore, a solution needs to be sought. The laureates have displayed how different antibiotics attach to the ribosome. Some hinder translation, others block formation of peptide bonds and so on. This research has opened up doors to form newer and stronger drugs to restrict bacterial infestation.

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PETER AGRE

Alaa Sarieddine, group 12. Scientific adviser: Tishakova Tatyana

Peter Agre (born January 30, 1949, Northfield, Minnesota, U.S.) is an American physician and molecular biologist. Agre shared the 2003 Nobel Prize in Chemistry for his discovery of aquaporins water channels (1).

Water is the major constituent of human cells and is concerned in all physiological and biochemical processes in an organism. Where it's involved in temperature regulation, has an essential role in toxin removal and its hydrogen bonding links makes it an ideal organic solvent etc. Water moves in and out of cells and in the extracellular medium, it allows the passage of solute into various cells. This water exchange between extra- and intracellular mediums occurs through the cell membrane by simple diffusion. However, some tissues require fast water flow, such as kidneys. Where diffusion is helped by membrane water channels (aquaporins) (2).

Aquaporins, also known as AQPs, are integral membrane channel proteins that serve in water transfer, in some cases, other small solutes across the membrane. They are preserved in bacteria, plants, and animals. Aquaporins are differentially expressed in many fluid transporting tissues in the body (3) where there are 13 members of the aquaporin family in human (4).

According to their permeability, mammalian aquaporins are branched into three groups: 1) water-selective permeable aquaporins (AQPs 1, 2, 4, 5, 6, and 8); 2) GLPs permeable to water, glycerol, urea, and other solutes (AQPs 3, 7, 9, and 10); 3) subcellular aquaporins (AQP11 and AQP12). AQP0 can be found in human lens, where the lens in is followed by momentous volume alterations, which needs rapid water flow. AQP0 also has a role in microcirculation of the local eye. Even though, its water permeability is low with respect to other aquaporins where it is about 40 times lower than that of AQP1. AQP1 is found in RBC, brain, lungs, and kidney proximal tubules. AQP2 is mainly expressed in the kidney, and also found in the endolymphatic sac of human ear. Furthermore, AQP2 is the only of its family members whose function is regulated. AQP3 has been expressed in an expanded variety of body organs; for example, respiratory system, digestive system, urinary system, kidneys, skin, and eyes. AQP4 is found in the brain astrocytes. Regarding AQP5, it is mainly expressed in the alveolar epithelium, trachea, and upper bronchus. Where AQP5 has an important role in water homeostasis maintenance in the lungs. This protein was also found in secretary cells such as lacrimal and salivary glands. AQP6 is located in intracellular vesicles of the renal epithelial cells, collecting duct cells. As for AQP7, it is mainly found in the adipose tissue, heart, testis, skeletal muscle, and kidneys.

AQP8 has been identified in various body organs; for example: the liver, pancreas, kidneys, stomach, testes, salivary gland, jejunum, placenta, lung, duodenum, and trachea. Regarding AQP9, it has been found in leukocytes, liver, testis, ovary, and brain. AQP10 is expressed in the small intestine (2). AQP11 is localized in the vicinity of lipids in human's adipocytes, and it is permeable for water and glycerol (5). AQP12 is located in the pancreatic acinar cells (6).

AQPs forms channels of molecular masses between 28 and 30-kDa. They exist as four identical copies of a monomer aquaporin and work together as a tetramer. Each monomer is composed of 6 helices (1, 2, 3, 4, 5, and 6) linked by 5 loops (A, B, C, and E) respectively, and 2 short helices (HB and HE). Helices 2 and 3 are linked by loop B with a half helix HB between the helices, and helices 5 and 6 are linked by loop E, with HE in between. These positions of helices make the AQP divided into two similar tandem repeats (halves). On the Inside, on each half, there's a highly conserved motif that is always found in aquaporins, the NPA motif (asparagine-proline-alanine sequences). In addition, his-180 and cys-189 amino acids are found on each tandem repeat as well. These two amino acids are out of a group of four called the aromatic/arginine selectivity filter. The other two are phe-56 and arg-195. This filter is found in all aquaporin but with different isoforms, where numbers of those amino acids might be different in every aquaporin type. And Gly-188 is also found in the backbone of the aquaporin besides Cys-189 (7).

This AQP1 structure maintain a uniquely selective mechanism for free permeation by H_2O through a channel without other parts passing through it. Hypothetically, protons could cross a channel by temporarily collaborating with successive hydrogen-bonded water molecules in a single-life chain. Therefore, AQP1 has two main features that prevent the composition of connected chain hydrogen-bonded water particles. The first obstruction to proton passage is situated 8 Å above the middle of the phospholipid bilayer, where the side chains of Arg-195, Phe-56, and His-180 are aligned. The backbone carbonyl atoms of Gly-188 and Cys-189 also line at this level of the channel. Where diameter of the pathway at this barrier is 2.8 Å which is nearly equal to the van der Waals diameter of a water molecule. The constriction Arg-195 bears a strong positive charge that is capable of disruption of all hydrogen bonds between water molecule by repulsion. The diameter of the pore is restricted by Hist-180 with a partial positive charge at neutral pH. The second barrier is the powerful dipole, composed by the two small helices (HB and HE) containing the motif NPA in the hemipore loops that fit at the center of AQP1. Mainly, these partial charges and Asn residues reorganize water molecules moving through the channel. By this reorientation of a water molecule, hydrogen-bonding interaction between it and those

beneath and above it, gets disrupted. Thus, eliminating the chance of proton conductance (8).

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Section "NANOTECHNOLOGY IN CHEMISTRY, MEDICINE AND PHARMACY"

NANOTECNOLOGY IN MEDICINE, CHEMISTRY AND PHYSICS

Michael Stephen, group 13. Scientific adviser: Levashova Olha

This has helped in the revolution of the way we detect and treat damage to the human body and disease in future.

Its application has helped in drug delivery in the body cells by introducing the drug directly to the affected cells and it has helped reduce damage to cells in the body.

The use of nanotech has also helped in diagnostic techniques to detect disease in the body e.g. carbon nanotubes (chip like) use in detection of cancer in the human blood stream, gold nanorods is also used in the diagnostics of kidney to know if affected, this is helpful in the dictation because it gets attracted the protein generated by a damaged kidney.

Nano technology has help min diverse way nin our lives today,it has also made an impact in the treatment of

- Antibacterial treatment
- Wound treatment
- Cell repair mechanism.

In chemistry nanotechnology is being referred to as the Nano chemistry which is the combination of chemistry and nanoscience.

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NANOTECHNOLOGY DEVELOPMENT IN ALZHEIMER'S DISEASE

Logina Salam, group 18. Scientific adviser: Lukianova Larysa

Despite the fact that measuring with one billionth of a meter and introducing solutions at molecular and atomic levels in the 70s seemed as a very futuristic idea, nanotechnology has irreversibly revolutionized the sectors of chemistry, pharmacy and medicine since then, all the way from successful drug delivery processes to nano-sized robots.

Today, owing to the chemical, electrical, physical and magnetic properties of the nanoparticles, which are usually 0.1-100 nm, nanotechnology has found its way in many disciplinarians and has been a promising field with one of its most popular applications in the field of neurology, which brings us to Alzheimer's disease, the basic form of dementia. Alzheimer has long been mistakenly thought of as an inevitable side effect of the aging process with very little medical advancement to cure it completely or even lessen its symptoms. Although it possesses one of the highest incidence rates of modern diseases, affecting over 35 million people worldwide, almost as high as cancer rates, and 1 in every 2 people over the age of 85, there has been essentially no progress made in terms of

finding a cure over the past few years that differ from what was known since its discovery decades ago.

The neuroscience of Alzheimer's disease is now understood as the malfunctioning of the synapses' functions between two neurons. The brain possesses hundreds of trillions of these synapses, which are tiny gaps between two neurons, that are involved in the processes of communication, speech, recognition, memory and many cognitive abilities. The brain makes sense of our thoughts and experiences by creating patterns of the signals passing in these synapses over time and uses many neurotransmitters in the process to help communicate between neuron cells. These synapses are basically the starting points at the molecular level and are considered to be the points where the problem cascades all the way before the patient can even become symptomatic. It is still not fully understood what causes Alzheimer's disease manifestations but generally scientists believe that genetic, environmental and lifestyle factors can affect it being early-onset or late-onset. At the beginning age of 40 or older, the amyloid-β protein released by the neurons into the synapses faces some kind of malfunctioning. Either a lot of this protein is released or not enough is broken down after it completes its function. This accumulation stimulates astrocyte or microglia cells, which clear the cellular debris and metabolize this protein, causing these cells over time to then become hyper-activated due to the increasing accumulation of amyloid-β protein in the synapse and eventually can also start metabolizing the synapses themselves, thus, starting micro-inflammations at these points. This can create lapses in memory. In addition to the hyper-phosphorylation of the transport protein 'Tau' in the neurons that leads to the formation of tangles as it starts to twist around itself, formation of sticky plaques resulting from the accumulation of the amyloid-β protein are also observed. Eventually, most cognitive abilities of an Alzheimer's patient are gradually lost.

Early diagnosis of the disease is unfortunately considered as a luxury as the accumulation of this protein can take from 10-15 years, which can occur before any symptoms can appear, where, by then, any intervention at that point is almost fruitless. Thus, with the help of nanotechnology, scientist hope to plan and design highly specific nanospheres or particles, that have high affinity for the amyloid-β protein provided that it shall cause no lesions with high resolution, made of iron oxide with special magnetic properties and are covered with antibodies and thus can target the plaques in the brain. It has already been tried on diseased mice, that later showed an improvement in short memory and a surprising decrease in the number of plaques and tangles in their brains. These nanoparticles can also deliver new drugs into the brain and surpass the blood brain barrier. Other approaches include the newly discovered blood tests that can help diagnose

Alzheimer's disease and liposomes, circular lipid bilayer nanomolecules, are also being considered as they are biocompatible, less toxic and are only 50-200 nm. Ultrasensitive nanotags for Alzheimer's diagnosis have also been developed in order to be able to distinguish amyloid-β1-40 protein from amyloid-β1-42.

If we hope to live in a world where everyone can dream of being able to live to be 85 or older and still be able to take care of themselves and remember their experiences, then a medical breakthrough in Alzheimer's diseases ought to be soon discovered. Nanotechnology has not only improved our lifestyles, but it can also contribute to saving millions of lives.

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BIOMEDICAL APPLICATIONS OF GOLD NANOPARTICLES

Vinissa, group 22. Scientific adviser: Zavada Oksana

Since ancient times, people used various metals for medical, cosmetic purposes. A significant role was given to precious metals. One of them is gold. In ancient Egypt, China, he was endowed with divine qualities. All of us, the familiar metal - gold - is transformed in the nanoworld. Today, nano-gold in medicine is used to control and prevent an extensive list of diseases.

In Egypt, it was believed that the metal prolongs youth, prevents aging. There are references that Cleopatra used it in the fight against aging. In China, it was believed that gold is a universal remedy for many ailments and contributes to longevity. In ancient times, the metal was crushed by the physical method. Powder used by various methods: Used in food; Added to bathing water; Applied to the body, etc. About gold solution for drinking is mentioned in the books, dated by the first century BC. What is this product, and what is its health benefit?

Colloidal gold is a solution of nanoparticles in demineralized water. In simple terms, the precious solution includes the smallest particles of metal and water. There are no salts in the solution. The metal particles are characterized by the same charge, therefore they repel each other, thus ensuring a constant movement and uniform distribution of nanoparticles. Golden water is used to fight and treat many ailments: diseases of the musculoskeletal system, heart, respiratory system, gastrointestinal tract, liver. It is recommended for epilepsy, depression, infertility, impotence, hysteria and others.

The use of metal nanoparticles in traditional medicine began not so long ago. Nano-gold is used to treat various diseases:Diagnosis, treatment of malignant tumors. An innovative method of treatment is to deliver solar nanoparticles in combination with infrared radiation into the tumor tissue. In this case, cancerous tissues die. It should be noted that healthy cells are not damaged, which is caused by the atrophy of the blood vessels of the cancerous tissue.

CARBON NANOTUBES FOR MEDICAL APPLICATIONS

Vikas Puree, group 22. Scientific Adviser: Zavada Oksana

Nanomaterials - materials containing structural elements, the sizes of which in one of measurements do not exceed 100 nm. Upon transition to the ultrafine state of the substance acquired melt qualitatively new properties. In the last decade, the most popular type of nanomaterial The materials are carbon nanotubes that attract the attention of personal scientific directions. The development of fundamental and applied concepts of coal native nanotubes in the coming years can lead to radical changes in materials science, electronics, biology, medicine and ecology.

Carbon nanotubes open up new opportunities for biological and medical applications: visualization of molecular, cellular and tissue structures; creating biosensors and electrodes on their basis; target delivery of various substances; photovoltaic and photothermal therapy The most promising feature of carbon nanotubes in the context of

biomedical applications is their ability to penetrate various tissues of the body and carry large doses of agents, providing therapeutic and diagnostic effects. In addition, the function The carbonized carbon nanotubes are biodegradable. Thanks to these advantages, nanotubes are a promising basis for systems for the targeted delivery of various substances.Another important trend in the use of carbon nanotubes in medicine and biology is the visualization of objects on the molecular, cellular, and tissue levels. Contrasting materials associated with carbon nanotubes improve visual-cell division, which allows to identify new patterns of development of the pathological process. Due to the uncertainty about the issue of biocompatibility and cytotoxicity of carbon nanotubes, the possibility of their practical application is slowed down.

Before introducing carbon nanotubes in Practical health care should consider all possible consequences of their use. The high pace of studying properties and the development of new nano-structures based on carbon nanotubes in the near future will lead to new successes associated with the application and developing new parameters that will determine their properties and effects.

CYCLODEXTRINS

Abhishek Swain, group 22. Scientific adviser: Zavada Oksana

One of the topical issues of modern medicine and pharmacy is the creation of medical forms of vector (targeted, directed) delivery.

Prospective structures for the creation of containers for dosage forms for the delivery of the active substance are macromolecules of cyclodextrins.

Cyclodextrins (CD, CD) - molecules of natural origin - were discovered in 1891 by Villiers A. in the study of metabolic products of Bacillus amylobacter, and received the first name "pulp". In 1903, F. Schardinger reported receiving two distinct crystalline products similar to cellulose, which he called α- and β-dextrins.

In nature, CSDs are formed during starch degradation under the action of cycloglycosyltransferase, produced by various bacteria among which Bacillusmacerans and B. circulans appear main producers.

Cyclodextrins are ring molecules, but due to the lack of free rotation at the level of connections between glucopyrano. In hot fragments, they are in the form of non-cylinder dra and truncated cone.

The cavity of the CD is covered with hydrogen atoms, giving it hydrophobic properties, whereas outside surface is hydrophilic, thanks OH-

groups. In an aqueous solution, water molecules in the cavity of the CD may be replaced by apolar molecules or apolar fragments of molecules leading to reversible education complex"Guest host". This property allows the use of cyclodextrins in pharmacy to create drugs for targeted delivery, thereby increasing the solubility of poorly soluble molecules.

Cyclodextrins, known for over 100 years, found their active use only in after decades. Their ability to shape inclusion complexes with increased solubility, stability, bioavailability and other guest molecule properties made it necessary to revise the possibility of using previously unoccupied compounds and expanding the range of application of already known drugs funds.

APPLICATIONS OF LIPOSOMES

Pragyana Patra, group 22. Scientific adviser: Zavada Oksana

Current direction of modern medicine - the use of new effective drugs with minimal side effects for the treatment of diseases of different etiological nature of various organs and systems. These principles are satisfied by liposomal forms of drugs. Therefore, the use of liposomal forms of drugs is a very urgent problem.

In 1964, the American scientist Alex Bengham first received and described liposomes.

In the 1980s, the peak of research in liposome structures. Patented basic methods of obtaining various phospholipid vesicles.

Published over 670 patent documents resulting from the study of liposomes Leaders in this area are Japan, the USA, Germany, France, Great Britain and Switzerland.

Liposomes are closed spherical vesicles that consist of phospholipid binaries surrounding the central aqueous cavity and self-assembled at the phase transition due to the amphiphilic structure of lipids.

Advantages: absence of an allergic reaction; increase in therapeutic effect; protection of the drug from degradation; presence in liposomes antioxidant properties; ability to protect the body from the toxic effect of the medicinal drugs; prolong the action introduced in the body of the medicinal product; change the pharmacokinetics medicines.

Liposomal drugs have a greater ability to penetrate the skin and hair, compared with traditional external dosage forms such as ointments and gels, and therefore they are more accessible to living target cells.

It was established that liposomes make more intensive processes of interaction of active substances with the skin in the course of therapeutic external therapy, which leads to an increase in the therapeutic efficacy of medicinal substances. A large number of advantages of liposomal forms of use of medicinal products makes it possible to widely apply them in oncology, cardiology, gastroenterology, pulmonology.

Section "MODERN POLYMERS IN MEDICINE AND CHEMISTRY"

ROLE OF LIPIDS IN CHEMISTRY

Esther Oluwatobi Babalola, group 26. Scientific adviser: Kalinenko Olha

Lipids are organic compounds that are fatty acids or their derivatives and are insoluble in water but are soluble in organic solvents e.g. natural oils, wax, steroids etc. They dissolve in alcohol and not in water; they contain carbon, hydrogen and oxygen but have far less oxygen proportionally than carbohydrates. Origin [Greek] lipos(fat) [French] lipide ---- lipid (early 20th Century) [1].

STRUCTURE:

Biological fatty acids, members of the class of components known as carboxylic acids, are composed of a hydrocarbon chain with one terminal carboxyl group (COOH) . The fragment of a carboxylic acid not including the hydroxyl (OH) group is called an acyl group. Under physiological conditions in water, this acidic group usually has lost a hydrogen ion (H+) to form a negatively charged number of carbon atoms because the biosynthetic path way common to all organisms involves chemically linking two-carbon units together [although relatively small amounts of odd-number fatty acid do occurring some organisms]. Although the molecule as a whole is water- insoluble by virtue of its hydrophobic hydrocarbon chain, the negatively charged carboxylate is hydrophilic. This common form for biological lipids one that contains well- separated hydrophobic and hydrophilic parts is called amphipathic.{3}

They are important living cells together with carbohydrates and protein lipids are the main constituents of plant and animal cell.

TYPES

We have 4 types of lipid group;

1. Triglycerides
2. Phospholipids [membrane lipids]
3. Steroids

4. Wax

TRIGYLCERIDES:

This is a group of lipids a category that includes fats and oil they are composed of a single molecule of glycerol bound to three fatty acids. Glycerol is a three carbon alcohol with three OH group that serve as binding sites.in most cells they are stored as triglycerides are stored in concentration from droplets or globules.

PHOSPHOLIPIDS [MEMBRANE LIPIDS]:

Phospholipids is a class of lipids that serve as major structural components of cell membrane, although phospholipids are similar to triglycerides in containing glycerol and fatty acids, Phospholipids contain only fatty acids attached to glycerol binding site holds a phosphate group. The structure of lipids bilayer helps the membrane in functioning such as selective permeability and fluid nature.

STERIODS:

These are complex commonly found in cell membrane animal hormones. The best known of these is the sterol called cholesterol.

WAX:

Waxes are esters formed between a long chain alcohol and saturated fatty acids. This material is typically pliable and soft when warm but hard and water resistant when cold e.g. paraffin.

Lipids 'like and water' is a saying based on minimal interaction of lipid with water. Although this saying is for isoprene-based lipids and bulky fatty acids lipids such as waxes and triglycerides, it is not for all lipids e.g. it does not apply to substances composed of fatty acids or diacylgycerides.

Fatty acids and diacyglycerides are often are often amphipathic; that is , the carboxylic acid "head" is hydrophilic and the hydrocarbon "tail" is hydrophilic. When a fatty acid or triglyceride substance is placed in water, structures that maximize the interaction of the hydrophilic heads with water and minimize the interactions of hydrophilic tails with water are formed. At low lipids concentrations a monolayer is formed, with hydrophilic heads associating with water molecules and hydrophilic tails "pointing" straight into the air [2].

In conclusion: lipids are essential component of human physiology at the molecular level [3, 4].

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NUCLEIC ACID IN MEDICINE AND CHEMISTRY

Maris Osagbemworue Osagie, group 26. Scientific adviser: Kalinenko Olha

Nucleic acid is an organic compound that is made up of genetic materials in living [3] organism.

WHAT IS NUCLEIC ACID? [1]

A nucleic acid is a complex organic compound found in living organisms responsible for transfer of genetic materials from one generation to the next. Nucleic cells are contained with nitrogen and phosphorus as well as carbon, hydrogen, and oxygen in addition, therefore making it an unusual compound.

STRUCTURE AND TYPES OF NUCLEIC ACID [1]

Nucleic acids are polymers. They are very large molecules that consist of much smaller units, monomers, which are repeated many times over again. The monomers of nucleic acid are known as nucleotides. The structure of nucleic acid is made up a phosphorus, sugar and nitrogenous base. While the phosphorus remains the same, there are two types of sugar: deoxyribose (without oxygen) and ribose sugar and five different type nitrogenous bases: adenine, cytosine, guanine, uracil and thymine.

Nuclear acid with deoxyribose sugar is DNA and one with ribose sugar is RNA. Both molecules not only differ with the sugar they contain but with the nitrogenous bases they contain (RNA has uracil while DNA contains thymine.), physical structure and the roles they play in living organism.

NUCLEIC ACID ON CHEMISTRY AND MEDICINE [2] and [3]

Both DNA and RNA can serve purposes beyond transfer and storage of genetic material. They display catalytic activities, binding and respond to chemical stimuli. Chemical modification of DNA molecules is promising for design of biosensors to detect structural changes in the nucleic acid. Nucleic acid switches are useful for control of nucleic acid by external stimuli as DNA switches are regulated by light, radiation and magnetic fields.

Certain RNAs perform catalysis. Catalytic RNAs called ribozymes can be made to specifically cleave and splice target RNAs. Also through the use of in vitro evolution techniques, DNA-based enzymes have been obtained that cleave to target RNAs.

Double stranded DNAs have been employed to squelch the activities of a variety of transcription factors .The use of combinatorial libraries of nucleic acids and in vitro

selection methods allow nucleic acid based ligands to be developed as specific, antagonists to virtually target any proteins.

Nucleic acids labelling market is driven by rising genomic and enzymology research, improvements in disease diagnostics, increasing health care expenditure and growing governments initiatives and investments in molecular biology.

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POLYPROPYLENE

Johanna Rejoice Mvula, group 27. Scientific adviser: Kalinenko Olha

Polypropylene also called (P.P or polypropene) is a polymer which softens when it's heated and hardens again when it is cooled. It is semi-crystalline which simply means that it is partially composed of crystals. Polypropylene is composed of a monomer called Propylene. P.P has two main types namely; Homopolymers and Copolymers in which copolymer is subdivided into Block and Random Copolymers. Polypropylene like other polymers goes through a process called Polymerization. It is a process where monomers are joined together in a chemical reaction which later forms complex 3D polymer chains.

History of Polypropylene

In 1951, Chemist J.Paul Hogan and Robert L.Bank who were employed by an American oil company called Philips Petroleum were one of the first chemists to polymerize propylene when they were attempting to convert propylene into gasoline. [5]They were awarded the Perkin Medal Award in 1989. Three (3) years later in March 1954 chemists Giulio Natta and Karl Ziegler polymerized propylene into a crystalline isotactic, and were awarded the Noble prize in 1963.

The chemical formula for Polypropylene's is (C_3H_6).

Properties for Polypropylene

Chemical Resistance

Polypropylene is resistant to acids which are diluted and concentrated and to organic solvents such as ketones, alcohol etc.

1. Transmissivity

Polypropylene has a natural opaque color which can be altered to be transparent. It makes it an excellent choice for transferring light.

2. Insulation

Polypropylene is a fairly good electrical conductor. It becomes easily statically charged and an anti-static agents can be added to reduce its static effect.

3. Fatigue resistance

Polypropylene has the ability to counteract wearing and weakening of materials. Its physical properties allow it to withstand bending, torsion, flexing cold and hot temperatures and still retain its shape.

4. Thermal properties

Polypropylene melting point occurs in a range of 160°c to 166°c (320°f to 331°f). In temperatures below 0°c, polypropylene becomes brittle. [6]

There are a few more examples of Polypropylene's properties such as being lightweight, good weldability, resistance to moisture absorption hence its hydrophobic properties. [7]

Due to Polypropylene's properties, it is widely used in a broad variety of industries.

Application of polypropylene

Automotive

Where the use of injection molding or a different type of molding are used for automotive parts e.g. Battery cases, bumpers, door and interior trims and many more. [4]

Clothing

P.P usually uses Non-woven fabrics e.g. rope and twine which are both strong and moisture resistant. [4] Polypropylene is also used for sanitary products, diapers where they alter the hydrophobic state into hydrophilic which allows these products to absorb liquids. Polypropylene can also be used for both cold and hot weather clothes [6]

Industrial

Polypropylene sheet form is produced and used in packaging, pipes formation, chemical tanks and also storage containers or boxes. These sheets could also be converted into synthetic paper where daily used products such as membership cards, phone cards etc. contain this synthetic paper. [1]

In the medical field, polypropylene has plenty of benefits and uses.

Disposable syringes being one of many following Petri dishes, Intravenous bottles, and medical equipment casings like MRI casing. Medical Grade Polypropylene is used more often due to its multi-purpose, easy sterilization, safer by being shatter proof, non-permeable which also makes it safer to transport biohazardous materials, it improves life

especially in amputees where the injection molding method [2] is used to create lightweight, hypo-allergenic personalized prosthetics for patients. [3]

Polypropylene too has cons. They are prone to Ultra Violet degradation and oxidation as well. They are highly flammable and have a minimal high temperature use, possibly due to its high thermal augmentation coefficiency. Fortunately, half, if not all these disadvantages have solutions to prevent disintegration of this polymer.

Is Polypropylene safe?

The Food and Drug Administration (FDA) started approving polypropylene in 2013 as "food-safe".[8] Other organizations such as Environmental Working Group (EWG) classify P.P as low to moderate hazardous.[6] Having the approval from these organizations and knowing the properties of P.P it could be concluded that it could be safe for use.

Resin Identification Code (RIC)

RIC is a specific set of different symbols which can be found on plastic products to help recognize the resin used to produce the plastic. Polypropylene has been assigned the number "5". This number seen on plastic products helps people in recycling plants to easily identify the material and sort it accordingly or curious people wanting to find out more about the material. [6]

In conclusion, the incorporation of Polypropylene specifically in the medical field gives people in this field of work an easier and secure way to handle P.P without the threat of exposure to dangerous toxins. It appears to be more beneficial despite it having disadvantages. In this particular case the pros outweigh the cons. Being eco-friendly, inexpensive and recyclable acts as a bonus for the environment in the long run.

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USE OF POLYMER IN MEDICINE

Isha Sharma, group 32. Scientific adviser: Zavada Oksana

Widespread use in medicine of polymeric materials is determined by their high consumer properties, lower cost compared to products made from metals and their alloys and the ability to be easily processed if they are used as disposable products.

Prospects for the use of polymers in medical practice are unlimited. High-temperature resistant polymers produce single-use syringes, systems for blood transfusion, cardiopulmonary bypass and artificial kidney, spatulas, applicators.

The beginning of the use of polymeric materials in medicine should be considered the year 1788, when, during surgery, A. M. Shumlyansky resorted to rubber. Then in 1895 celluloid was used to close bone defects after surgery on the skull. In 1939, the joint efforts of dentists and chemists (I. I. Revzin, G. S. Petrov, I. M. Ezrielev, and others) led to the creation of the AKP-7 polymer for the manufacture of maxillary and dental prostheses. Soon, a series of plastics from acrylic resins appeared to be suitable for ocular prostheses and reconstructive operations in maxillofacial surgery. In 1943, S. D. Fedorov for the first time made a patch of polymethyl methacrylate to close the defect of the skull.

Polymers such as polyethylene, polyvinyl chloride, polyamides, silicone, polypropylene, are used to create non-adherent dressings. The principle of their design lies in the fact that the surface of the cellulosic or synthetic material facing the wound is covered with a thin film of a hydrophobic polymer, and so that the dressing agent does not lose sorption activity, the film is usually perforated. To increase the rate of absorption of the exudate with a sorbent, it has been proposed to coat the perforated film with

surfactants. There is a group of adherent, but atraumatic sorption coatings based on natural and synthetic polymers. Bandages of this type do not need to be removed and remain in the wound until they are completely resorbed.

The use of polymers in medicine, a booming and promising industry.

POLYETHYLENE IN MEDICINE

Srayans Jain, group 32. Scientific advicer: Zavada Oksana

Polymeric materials that are in contact with biological media of a living organism can be dissolved in these media without changing the molecular weight or undergo biodegradation by the following main mechanisms: hydrolysis with the formation of macromolecular fragments and monomer products; catalytic hydrolysis under the influence of enzymes phagocytic destruction (protective cellular reaction of the body to a foreign body).

For medical purposes, it is a polikmerni materiali zaaltehnichnogo priznachennya, and takozhi specialinali polimerni materiali mednogo priznachennya. W Perche vigotovlyayut budivelne th sanitarno-tehnichne ustatkuvannya likuvalnih SET, Utensils, items for doglyadu patsiєntami, detali riznih priladiv, doslidnitskoї th likuvalnoї Aparatura, instrumentiv, utensils for analitichnih laboratoriy in minutes. Zastosuuvannya polimernyh materialiv zamist otdelitsiny materialiv (metal_v, skla) obmovovy їkh vyrahnyh tehnologichnymi power, a complex of psycho-mechanical characteristics, it is possible pererobki in virobi mass vzhitku one-time zasosuvanan. Krim zaaltehnichnyh, before the tsikh polymernogo materiliv predatryavlyayutsya datatkovi sanitarno-giginnichni vimogi - the smallest vidilennya in navkolishnє sredovishche gazopodibnyh products_, scho is not peresischu GDK; neroschineny in myuchy roschinakh; it is possible to sterilize with desiccated rosins, gases, UV-coatings, Mr-viprominyuvannyam.

Polyethylene is the most advanced material in the manufacture of prostheses at the moment. More than 200 thousand operations on the replacement of joints using polyethylene are carried out annually. The service life of polyethylene prostheses - 10-15 years. One thread of polyethylene (fiber) can withstand a load of several kilograms. That is why this material is almost indispensable now in spinal and maxillofacial surgery.

The cost of polyethylene prostheses is still high. But the more massive will be the process of production of these prostheses, the less will be their cost.

NYLON

Avishkar Tomar, group 32. Scientific advicer: Zavada Oksana

Modern chemical industry is an inexhaustible source of high-tech developments used in all branches of human activity. The most promising in this regard, the field of medicine. Here chemical innovations are most sought after. And the fact that today is successfully used in medicine, once created for use in a completely different field. For example, Nylon.

Nylon was first produced in 1935 by the American chemist Wallace Hume Carothers. He headed the laboratory of DuPont, also known as the "Hall of Pure Science" (Puruty Hall), the development of synthesis techniques took a scientist 12 years, he also developed a technique for the synthesis of polyester, neoprene.

The word "nylon" is considered artificially created. According to one version, the name forms the first letters in the names of the cities of London and New York. The idea is: (N) ew- (Y) ork and (Lon) don form the word nylon. There is also an opinion that the name is an abbreviation of the New York Lab of Organic Nitrocompounds or the author's word created by DuPont.

Actually, in medicine, polyamide monofilament, similar in properties to polypropylene yarn, is used as a suture material. Polyamide monofilament consists of a single solid fiber, it is smooth, characterized by high elasticity and durability, resistance to abrasion; used in suture surgery, but not recommended for long periods (biodegradation occurs within 2-5 years).

Nylon finds its application in modern medicine: latex gloves, bandages and tubes, for such applications as self-tightening stitches, implantable medical devices and artificial joints.

One of the new uses of nylon is its use to replace metal frames in biomedical engineering. Polymer structures have several advantages, one of which is their transparency for magnetic resonance imaging (MRI).

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POLYMERS IN TISSUE ENGINEERING

Sheryl Nikita Ebanezer, group 33. Scientific adviser: Kalinenko Olha

Tissue engineering is a type of regenerative medicine that requires cells, scaffolds (which provide the right environment to support the cells), and suitable bio-chemical and physico-chemical factors (which aid in improvement or replacement of biological tissues). For cells, stem cells obtained from the patient themselves is most ideal.

The materials used for scaffolds are polymers which can be natural or synthetic, or biodegradable or permanent. Natural materials include proteins such as collagen and synthetic materials mostly include polyesters. It is important for the scaffolds to have properties of good biocompatibility, biodegradability, mechanical properties etc. Synthetic polymers can be produced much easily and have better mechanical properties in comparison to natural polymers and hence are more commonly used.

Some main examples of these are:

1. Polycaprolactone (PCL), Polylactic acid (PLA), Polyglycolic acid (PGA) and Polylactic-co-glycolic acid (PLGA)

– Semi-crystalline aliphatic polyesters.
– High organic-solvent solubility.
– Biodegradable polyester with a low melting point of around 60 °C and a glass transition temperature of about -60°C.
– Used for formation of tissue regeneration support structures.
– Due to relatively long degradation profile they are suitable for use in tissues with longer regeneration processes.
– They are polyhydroxy acids. Hydrolysis of the ester bonds in the chain causes break down of PLA, PGA and PLGA to their monomeric units - lactic acid and glycolic acid.

1. Polyethylene glycol (PEG)

– It is a polyether.
– Its polymerization involves ethylene oxide condensation.
– Chains of PEG which are greater than 10 kDa are defined as polyethylene oxide (PEO).
– These polymers are biocompatible, biodegradable, non-toxic and low-immunogenic.
– Despite the natural lack of ability of PEG to bind proteins or cells, adhesion is possible with the incorporation of RGD peptides.

2. Polyurethanes

– Formed by reacting a di- or poly-isocyanate with a polyol.

– Fundamental constituents; hard segment - diisocyanate, soft segment – polyether or polyesters and chain extenders. Properties of resultant polyurethane polymers depend on the ratios of these components.

– It is combined with other biomaterials for improved degradation rate.

Small arteries, grafts of skin, cartilages and whole tracheae have been successfully implanted in patients. Complex organ tissues such as those of heart, lung, and liver have been recreated in laboratories, but procedures are still developing for their implantation in patients with the least amount of rejection and side effects. Lesser expensive alternatives are also being researched on.

These artificially engineered functioning human tissues can also prove to be useful during tests in drug development. This makes drug testing less expensive and reduces the number of animals used for research.

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MELANIN

Akshita Sharma, group 35. Scientific adviser: Zavada Oksana

Melanin - a pigment that gives our skin a beautiful bronzed sunblock, has not only aesthetic but also a very important physiological function. Intensification of the formation of melanin in the skin occurs due to the effects of ultraviolet irradiation, which causes and tan, and the appearance of freckles, etc. It plays a light-protective function, especially for the harmful effects of excessive rigid ultraviolet rays, which, damaging the DNA of the skin cells, and tighten the preconditions for the development of skin cancer.

Melanins (melanins, black melas (melanos)) are dark, black and Latin. -In (e) - a suffix denoting "similar") - amorphous pigments of black, dark brown or yellow, formed from tyrosine). In tissues, melanins are usually bound to proteins. Melanins are found to be normal in hair, skin, feathers and retina in vertebrates, as well as in plants, insects and some marine invertebrates. In animals, melanin concentrates in special cells – melanophores.

By chemical nature, melanins are a mixture of heterogeneous molecules that are formed, probably not in the process of enzymatic reactions, but by chemical condensation; by chemical structure - these are long chain polynomials of quinoids, constructed of indolyl-5,6-quinone units. By interacting with the protein, melanins form melanin proteins. Today, it is generally recognized that the wide range of colors of human hair and animals is due to the presence of two chemically distinct types of melanin: black-brown eumelanine and yellow-orange feomelanine (trichosedirins).

Melanin is formed during the polymerization of tyrosine oxidation products in the specialized process cells of the epidermis - melanocytes. Melanocytes are formed in the nerve ridges of the embryo and migrate to the skin, eyes (vascular membrane and iris) and hair follicles. Melanin contains carbon, nitrogen and hydrogen in a ratio of about 1: 5: 5, as well as in some cases sulfur (from 2 to 12%). Melanin is insoluble in water, acids, organic solvents, etc. But melanin hair is easily dissolved in alkalis and precipitates in the acidification of solutions.

ALGINATES

Harjot Kaur, group 35. Scientific adviser: Zavada Oksana

For the first time alginic acid was discovered in 1883 by W. Stanford. The applied value of alginic acid and its derivatives is determined by its structure, which is formed in the process of natural biosynthesis in brown algae of different regions of the oceans. A number of researchers argue that this is a high molecular weight polysaccharide, which is a D-mannuronic and L-hyaluronic acid copolymer block. Their ratio in alginates, which are mined in different countries, is noticeably different, and this, in turn, determines the difference in physical and chemical properties. It is the complex of these properties in alginates, in particular the ability to form viscous aqueous solutions and even pastes, homogenizing and emulsifying properties, film-forming ability and some others, which served as the basis for the wide use of these substances in various industries, including pharmaceutical and food. The alginic acid and its salts have a number of beneficial properties, and at the same time they are distinguished by the unique, inherent qualities of them. Outside, alginates are gelatinous substances, which, by adhesive force, exceed starch in 14, and gum arabic in 37 times. This property has allowed them to be used in various industries like thickeners and gelling agents

Today, more than 50 foreign companies produce about 250 ... 300 items of products based on alginic acid and its salts.

The use of alginates in medicine and the medical industry was formed in three main directions:

- as auxiliary chemico-pharmaceutical substances for the production of various medical forms of medical preparations;
- as medical products in the form of gauze, cotton wool, napkins, sponges, etc. for local hemostasis in external and intracavitary bleeding;
- as medicines and dietary supplements for food of multi-directional action. Widespread use of alginates is due to their harmlessness, good portability.

So to conclude, alginates are of utmost importance and with developing technology they can prove to be more beneficial

POLYMERS USED IN RECONSTRUCTIVE SURGERY

Haramsheel, group 35. Scientific adviser: Zavada Oksana

In reconstructive surgery polymers are used very widely. However, this area of use imposes on them the most stringent requirements for the criteria of toxicity, carcinogenicity, irritation, stability or instability in the body and several others.

The scope of use of polymers in reconstructive surgery is very extensive. These are suture and adhesive materials for joining tissues and vessels, materials for prostheses of various organs, dressings and much more. Accordingly, the purpose and requirements for polymers are different. To ensure the long-term functioning of the replaced tissues and organs, bioinert polymers are used.

They must be highly resistant to body fluids and must not change their initial characteristics during deformation. In addition, they must withstand various types of sterilization processing. Such polymers include mainly chain chains - polyethylene, polypropylene, polymethyl methacrylate. Of the hetero-chained bioinert polymers used for prosthetics of the functional units of artificial organs, is polycarbonate, from which bodies and parts of artificial ventricles and heart stimulants are made. Silicone rubbers are widely used for prosthetics of soft tissues. However, it was found that many women in the United States who underwent breast prosthetics using this polymer had malignant tumors. A company that produces this polymer for prosthetics suffers large losses on claims filed.

The main problem with the use of polymers for long-term functioning in the body is their incompatibility with the tissues of the body. This leads to the fact that the transformed substance of biological media is deposited on the surface of polymers. First of

all, this refers to thrombosis upon contact of the polymer with blood, which creates very serious difficulties when performing operations on the cardiovascular system.

To ensure the temporary functioning of the body for the period of tissue regeneration, so-called bioassimilable polymers are used. They must have the ability to destructurize or dissolve under the action of body fluids without the formation of toxic products.

PROSTHESIS

Naina, group 35. Scientific adviser: Zavada Oksana

Prosthesis is branch of medicines in which the lost part of the body is replaced by prosthetic devices. The first metal prosthesis of the femoral head was created in 1940 by Moore, in 1946, the brothers, Juude, offered an endoprosthesis, which is an acrylic head reinforced with a special metal nail. These prostheses, intended to replace the articular end of one of the bones of the joint, have been called monopolar. In the future, the construction of single-pole endoprosthesis has been improved several times.

Cartilage provide padding between bones in a joint, due to which over time it may wear down / get damaged,which reults in severe pain and decreased movement of joints. Example : hip, knee & shoulder joints.

In 1959, KM Sivash applied a completely metal endoprosthetic of the hip joint, which implies that the two ends of the joint are indissoluble. In 1960, the endoprosthetic of the hip joint was applied, which included two components - a polymeric cup of the articular cavity and a metallic endoprosthetic of the femoral head. Currently, there are advanced modern total endoprostheses.

Each type of endoprosthesis has its own purpose and method of attachment. Ceramic prostheses are considered the most comfortable for survival in the body, however, the high cost and the presence of some contraindications to the installation are limiting their installation.

Metal endoprostheses are designed for increased loads. Recommended for people with an active lifestyle, as well as for those who are engaged in some types of sports training. Elderly patients are also often installed such prostheses.

Non-cement type prostheses are recommended for patients with a younger age with well-preserved bone tissue. In turn, non-cement dentures are divided into varieties depending on friction pairs: metal-polyethylene, ceramic-ceramic, metal-metal. Prosthetic devices are made up basically of lightweight plastic , in cases when extra strength ,

flexibility & energy are required customised carbon fiber structures & metal shaft are used.

NATURAL BIOPOLYMERS

Savidhi, group 35. Scientific adviser: Zavada Oksana

As is known, RNA molecules are contained in all living organisms, as well as viruses, where I can serve as a carrier of genetic information.

RNA molecules are natural biopolymers, which are formed as a result of polycondensation release. Common to all RNA molecules is that they are a sequence of RNA nucleotide residues in the single nucleotide chain. The formation of polymer RNA occurs (as well as in DNA) through covalent bonds between the ribose and the phosphoric acid residue of the neighboring nucleotides.

Nucleotides consist of nitrogenous bases (adenine A, guanine G, uracil U or cytosine C) in conjunction with sugar ribose and the rest of phosphoric acid. Phosphate residues, connecting with the riboses of neighboring nucleotides, “sew” the RNA constituent blocks into a macromolecule - polynucleotide. This forms the primary structure of RNA.

The formation of the secondary structure is due to the principle of complementarity of nitrogenous bases: adenine forms a pair with uracil by a double, and guanine with cytosine - a triple hydrogen bond.

Informational, or messenger RNA (mRNA) make up about 5% of all cellular RNA. They are synthesized in the nucleus (at the site of one of the chains of the DNA molecule) with the participation of the enzyme RNA polymerase.

Transport RNAs (tRNAs) are relatively small molecules of a specific structure, with relatively few of them 64. Their main function is the transport of molecules of natural alpha-amino acids to the site of synthesis of protein molecules (in ribosomes).

Ribosomal RNAs are concentrated in the nucleoli, they participate in the formation of the ribosome center, where protein biosynthesis takes place.

Heterogeneous nuclear RNA (a precursor of cytoplasmic mRNA), which are primary transcripts, are formed in eukaryotic cells, are processed in the nucleus. As a result, mature mRNAs are formed, which enter the cytoplasm and serve as a matrix for protein biosynthesis. Molecular weight 107.

FIBERS

Anoor Chaudhary, group 35. Scientific adviser: Zavada Oksana

Fiber is naturally or synthetic substance that is naturally longer than it is wide. Fibers are often used in in the manufacture of other materials. The strongest engineering materials often incorporate fibers.

Fiber optic cable 16 is used in medicine. An unordered bundle of optical fibers that can be used for illumination during an operation, and an ordered one is capable of transmitting an image to a screen. It is on this function that the use of ordered beams of optical fibers is constructed as the optical core of any endoscope.

Approximately the same principle is used when fiber welding takes place. Another physical property of the fiber is also extremely important from the point of view of medicine: the fibers are very flexible and this makes it possible to apply the laser beam extensively in therapy. So, in almost all types of therapy, in which laser energy must penetrate the human body: in pulmonology, urology, gynecology, etc. Light guides "help" the laser. In the same cases, when laser energy is injected directly into the bloodstream, catheters, also made from fiber, are used. It should be noted that in medicine only optical fibers created from high-frequency quartz glass are used, since the high mechanical strength and the adjusted optical properties make it possible to adjust the light loss in an optical cable.

Analysis of scientific publications and patent data from It shows a steady increase in the number of proposed biomedical developments of VOD for intracavitary application, demonstrates the possibility of their research in clinical trials with laser medical devices for various purposes. The current expansion of the market for fiber lasers and The development of fiber technology will lead to widespread the introduction of VOD, along with industry, and in medicine.

Section "CHEMISTRY OF POISONOUS PLANTS"

ACONITUM NAPELLUS

Gargi Gautam, group 38. Scientific adviser: Tishakova Tatyana

Aconitum Napellus is a herbaceous perennial plant. Aconitum plant belongs to Genus Aconitum of the family Ranunculacese, native and endemic to western and central Europe.

A. napellus is an extremely dangerous plant that contains various toxic alkaloids mainly ‘aconitine’. The toxin is mainly concentrated in roots of this plant. Aconitine, a bioactive alkaloid extracted from *Aconitum* plants (Monkshood) , has anti-inflammatory and analgesic activities, but can also induce severe arrhythmia and neurotoxicity.(1) Aconitum plant is extensively used as a herbal medicine to treat multiple diseases. Herbal medicines are commonly used in China and other countries to treat various diseases due to its natural, harmless and less adverse effects for thousands of years. Herbal poisoning may frequently occur because of inadequate processing and preparation, overdose, contamination, misidentification, and even in some suicidal or homicidal cases.(2)

Studies on *Aconitum* plants have showed its pharmacological properties such as anti-inflammation, analgesia, and anti-rheumatism. In addition, aconitine could also suppress tumour growth. Nevertheless, it was reported that there were some effective treatment methods or medicines to improve cardiac arrhythmias in aconitine-induced poisoning accidents.

On the one hand, Aconitine is very unstable and decomposed easily in the human body. On the other hand, it is not detected routinely for common toxicology analysis in present forensic practice. It has a narrow therapeutic window, is considered to be the principal highly toxic DDA in *Aconitum* alkaloids. The incubation period between ingestion of aconitine and the onset of symptoms may be as short as several minutes, indicating that aconitine can be absorbed rapidly after oral administration.Patients with aconitine poisoning generally present with a series of gastrointestinal, cardiovascular, and neurologic symptoms. The gastrointestinal features can be nausea, vomiting, diarrhoea, and abdominal pain. Neurologic symptoms include numbness in mouth and limbs, paraesthesia, central nervous system depression, respiratory muscle depression, convulsions, and seizures. Cardiovascular manifestations predominantly include hypotension, palpitations, chest pain, bradycardia, sinus tachycardia, ventricular tachycardia, and ventricular fibrillation.(3) Furthermore, the severity of symptoms appears to be related to the doses and time of exposure of aconitine. It is rather difficult to define precisely the therapeutic dose and toxic dose of aconitine because of its narrow therapeutic index.

With the widespread use of Chinese herbal medicines, herbs-induced poisoning may be frequently encountered in the world.(4) Aconitine, a high bioactive diterpenoid alkaloid derived from *Aconitum* plants, has great medicinal value, but also can cause serious poisonous cases, even leads to death.

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POISONOUS PLANT "JATROPHA CURCAS"

Akriti Singh, group 42. Scientific Adviser: Kalinenko Olha

Jatropha curkas is an evergreen shrub or small tree growing up to 6 meters in height. Grows in Central America and Mexico. It is considered a unique tropical plant for increasing energy sources.

Young shoots are used for cooking. Ash from the roots is used as salt. Seeds are laxative and poisonous when consumed in large quantities.

All parts of the plant are very poisonous. Great care must be taken when using it. Seed oil contains toxins, curcasin. Croton resin contained in the plant causes redness and pustular rash on the skin.

However, the plant also has a positive use in medicine. It is used as an antibiotic in the fight against a number of fungal diseases; has a coagulating effect on blood plasma.

Juice of the bark is used to treat malaria fever and is also useful for reducing the swelling caused by inflammation. Also, juice is used to treat burns, eczema, scabies and depriving.

Paste from the bark is applied to the gums for the treatment of wounds and edema, used to clean the teeth and treat ulcers on the tongue and mouth.

Infusion of the leaves is used as a diuretic, for the treatment of cough, for swimming. The leaves are also effective in jaundice, fever, rheumatic pains, and hemorrhoids.

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CHINABERRY (MELIA AZEDARACH L.)

Lakshmi Narayana Tadiboina, group 42. Scientific adviser: Kalinenko Olha

Chinaberry is a tree with a purple, reddish bark from North America. However, it grows in China, India, Australia, Mexico, Argentina. This handicraft plant grows up to 15 m in height and up to 60 cm in diameter (1).

In spring, long fragrant, lilac flowers grow in the leaf axils. Round yellow to yellow-green round drupes are formed after flowering and can persist after the leaves fall in autumn. Fruits are mucous-sticky, hard, rounded; marble seed Birds effectively spread the seeds, but the fruits are poisonous to humans and other mammals. Since the seeds are poisonous, birds can become paralyzed after swallowing the seeds. Chinaberry also propagates vegetatively when the tree is cut, producing suckers that form a dense stand of vegetation.

For many years, the plant has been used as an ornamental. Unfortunately, Chinaberry has all the qualities of a successful weed. This plant adapts to many environmental conditions, contains almost no diseases and insects, and thrives in disturbed or open places.

Fruits contain a tusendanin, coulombone, caulkton, kulolakton. In the roots there is apigenin-5-O-β-D-galactopyranoside. The leaves contain rutin, kaempferol-3-O-β-rutinoside, astragalin.

The plant is very resistant to insects, therefore insecticides are obtained from poisonous fruits.

Tree bark and roots have antipyretic and anthelmintic action; leaves have a tonic and restorative effect.

In medicine, it is used to treat viral infections, herpes, abdominal pain caused by intestinal parasites. Outwardly used in scabies and lichen, dermatosis and other pustular skin diseases. A decoction of fruits and bark is used externally with leprosy. For external use, an ointment is also made: the crust pounded into powder, mixed with melted pork fat and applied to the sore spot.

Patients with hepatitis or nephritis should use medications from neem bark with caution.

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JACK IN THE PULPIT (ARISAEMA TRIPHYLLUM)

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Jack-in-the-pulpit is a wildflower, originally from America and Canada, with a tall stem and a hood at the top. The height of the flower is 30-80 cm. The fruits are red in color and ripen at the end of summer. It grows in lesaz on wet soils in the shade. Mammals and birds eat berries of the plant.

Chemical composition: glycosides, sterols, sugars, organic acids, oxides of silicon, saponins and others. The plant also contains crystalline calcium oxalate, which causes irritation on the skin, eating away at it.

The root of the plant is used as an antiseptic, diaphoretic and stimulant. The decoction of the root is used when washing the eyes. Earlier in North America, the Indians used decoction as a contraceptive: 1 teaspoon of the root prevents conception during the week, while 2 teaspoons cause infertility.

Jack-in-the-pulpit is considered a poisonous plant that causes inflammation of the mucous membranes. It affects the mucous membranes of the mouth, eyes, digestive tract, anus. The person has a strong salivation, feels a burning sensation in the mouth and throat, and a rash appears on the skin. The patient has the following symptoms: diarrhea, nausea, vomiting, slurred speech, impaired swallowing.

When treating milk is prohibited. On the contrary, it promotes the assimilation of poison. They give ordinary water or tea to the patient, also activated carbon and call an ambulance.

Thus, Jack-in-the-pulpit, known as Indian turnip, has both beneficial and harmful effects on the body. It has been used as food, poison, and medicine.

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TAXUS BACCATA

Varuni Ravishankar Upadhya, group 42. Scientific adviser: Kalinenko Olha

Taxus Baccata or commonly known as the yew or the English yew of the family Taxaceae is a conifer. As it is typical of most conifers, yews are trees or shrubs with modified leaves that we call 'needles'.

Used are very slow growing and long-lived. All parts of the yew, with the exception of arils contain toxin alkaloids. The toxicity is not decreased on drying, do hedge trimming are toxic as the plant itself. Some deer seem able to eat the foliage and sheep have been known to browse on it unharmed. However some other animals like cattle, horses, dogs and humans are poisoned if they eat leaves or branches. Poisoning of livestock is usually prevented by ensuring that they do not get access to these trees.

These trees are conifers are native to Western, Central and Southern Europe. All parts except the berry's flesh contain Taxine, a complex of alkaloids which is rapidly absorbed. Also present are Ephedrine, a cyanogenic glycoside (taxiphyllin) and a volatile oil. [1]

Taxines have been known since the mid-nineteenth century when Peretti performed chemical analysis of English yew needles. It was not until the mid 20th century, however that Graf and Boedekker discovered that taxine was a heterogenous mixture. Later on spectrophotometry, chromatography and infrared analysis made it possible to recognise 2 major types of taxine alkaloids Taxine A and Taxine B.[2]

Taxine A

IUPAC name 2 alpha, 13 alpha – Diacetoxy – 7 beta, 10 Beta- dihydroxy -9- oxo-2(3-20)-abeotara-4(20),11-dien -5 alpha-yl(2R,3S)-3-(dimethylamino)-2- hydroxy-3-phenylpropanoate.

Chemical formula C35 H47 N O10

Taxine B

IUPAC name 10 beta -acetoxy-1,2 alpha,9 alpha -trihydroxy-13-oxotaxa -4(20) 11-dien-5 alpha yl(3R)-3- (dimethylamino)-3-phenylpropanoate.

Chemical formula C33 H45 N O8

The taxine alkaloids are cardiotoxins with taxine B being the most active. Taxine alkaloids have no medical uses but paclitaxed and other taxanes that can isolated from yews have been used as chemotherapy drugs.[3]

Gradually, the other isoforms and esters of the major taxines we identified further investigation such as isotaxine B or taxine 1 and 11.Taxine B is responsible for the greatest cardiac toxicity. The mechanism of its effect involves the elevation of cytoplasmic

calcium in cardiac myocytes with sodium and calcium channels antagonism. The effect is similar to that of Verapamil. The cardiac specificity of taxines is high. The gastrointestinal tract of affected to a far lesser extent and the effect is not specific.

When yew poisoning is suspected, toxological screening relies on thin layer chromatography and the detection of 3,5 dimethoxyphenol, yet specificity is not 100%. During intoxication positive values of 3,5 dimethoxyphenol usually amount to over 300ng/ml. The biological half of taxine metabolites ranges between 11 to 13 hours and after investigation on ingestion they may be still detectable even around 120 h following digestion.

Due to the presence of unsaturated lactone group, the chemical structure of taxines is similar to that of digitalis, which may lead to false positive results digoxin testing.

The time from ingesting a lethal dose to death is usually 2 to 5 h with symptoms occurring from 30min to 1 h following ingestion. Symptoms of signs of yew poisoning are non-specific, including nausea, vomiting, impaired vision (colour), abdominal pain out muscle spasms. Clinical symptoms include dilated pupils, dyspnea, tachycardia in the earlier phase followed later by bradycardia.[4].

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RICINUS COMMUNIS

Mary-Anne Alfa, group 42. Scientific adviser: Kalinenko Olha

Ricinus Communis, commonly known as the castor oil plant, is a suckering shrub that can reach the height of a small tree (around 12m), belonging to the Genus Ricinus of the family Euphorbiaceae. Castor is indigenous to the south eastern Mediterranean Basin, East Africa and India, but is widespread to most tropical regions.

The poison of the castor oil plant is ricin is a lectin, a carbohydrate-binding protein, and is contained in the hull of the castor bean or seed. This toxin is highly potent and very toxic if inhaled, ingested, or injected. It acts by preventing cells from assembling amino acids into proteins and thus inhibiting protein synthesis.

By ingestion, ricin enters the gastrointestinal tract and may cause pain, inflammation, and haemorrhage of the mucous membranes. These symptoms can quickly progress to severe nausea, vomiting, diarrhoea, dysphagia (difficulty swallowing), melena (bloody faeces) and hematemesis (vomiting of blood). The low blood volume leads to organ failure in the kidney, pancreas, liver and gastrointestinal tract. 5-20 beans is fatal to an adult.

By inhalation, an allergy may develop. The symptoms that occur are oedema of the eyes and lips, asthma, bronchial irritation. Congestion, sore throat, vesication (skin blisters), skin redness, wheezing, chest tightness, skin irritation, and watery eyes.

Death usually occurs within 3-5 days of exposure, if not treated.

Symptomatic treatments are available for ricin poisoning. These treatments minimize the effects of the poison. These treatments include electrolytes, assisted ventilation, flushed by ingested activated charcoal or the performance of gastric lavage.

Vaccination is possible by injection of an inactive form of protein chain A.

Alcoholic extracts have been proven to protect the liver from certain poisons. Methanolic extracts of the leaves of the plants were shown to have antimicrobial properties. In the ethanolic extract of the root bark, antihistamine and anti-inflammatory properties were found.

Castor beans without the hull were used for birth control, constipation, leprosy, and syphilis. Castor seed paste is applied to the skin as a poultice for inflammatory skin disorders, boils, abscesses, inflammation of the middle ear, and migraine headaches.

Castor beans are crushed to extract castor oil. As ricin is not oil-soluble, little is found in the extracted oil. Castor oil was used as a laxative, start labour in pregnancy, start the flow of breast milk, to soften skin, dissolve cysts growths, and warts, and also applied to skin to treat osteoarthritis. Currently, it is used in the production of synthetic resins, plastics, such as polyamide 11, which is, when mixed with polypropylene, is strong enough to be used in a car, fibres, paints, varnishes, and plasticizers. It is also used in cosmetics, hair oils, and dyeing aids. Castor oil consists of triglycerides ricinoleic acid.

With the widespread use of this known plant for cosmetics and technological advances, ricin poisoning may frequently occur. The castor oil plant has great medicinal value, but can also cause very serious poisoning cases that even lead to death.

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CELANDINE PLANT

Suparn, group 43. Scientific adviser: Kalinenko Olha

INTRODUCTION:

The plant of celandine is straight and reaches the height upto 50-100cm this plant belongs to a dicot family and comes under poppy family it is also known as common weed in some areas of Russia,Ukraine and Belarus but this plant have a lot of biological and medicinal application and also some poisonous properties.

This plant is commonly found in areas of Easten Europe and also in some parts of America

In Russia and Ukraine, this weed is grown for its medicinal and poisonous properties.

CHEMICAL COMPOSITION:

This plant contain a lot of poisonous as well as useful chemicals such chemicals are listed below:

Alkaloids, chelidonine (one of the major alkaloid in this plant which is a very poisonous one as causes depression and then paralysis in animals mainly central nervous system paralysis)

Sanguinarine (it is also a type of alkaloids which also show a negative impact on animals as well as human beings it causes convulsions, causes irritation followed by anaesthesia).

Some flavonoids, saponins, carotene and other biologically active substances.

POISONOUS PROPERTIES:

The major poisoning of this plant is present in its latex and also in its leaves but the poisoning decreases as the plant get dried or died.

It causes blisters or skin ulcers, also it causes skin burns.

It can also causes vomiting and nausea if by chance the plant on inhaled.

Other poisonous things it can do are respiratory tract irritation, dyspnea, cough, sleepiness, nerve paralysis and if long time effect can cause carcinogenesis

It can also causes damages to our liver and kidney.

MEDICINAL PROPERTIES:

It can be used to treat cancer but most commonly greater celandine.

It can also a powerful antioxidant.

It help in cholegonosis (that is it help in normal production of bile juice)

Both grass celandine is used for washing wounds, ulcers and other skin lesions as well as it can be also used to remove severe dandruff.

The juice of celandine is used for the removal of warts dry corns, stomach ulcers, papilloma and skin lesions.

CONCLUSION:

If celandine poisoning is caused so the first step of the person is to take medical advice such that the infection of this plant can be cure as much fast as it can before it get wide spy whole through the body.

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PLUMERIA ALBA

Priyanka, group 44. Scientific adviser: Zavada Oksana

White plumeria comes from Central America and the Caribbean, imported to South Asia, where it is widely cultivated for decorative purposes. This is an evergreen sprawling shrub or tree with narrow oblong leaves, pubescent below. Flowers are large, with a bright aroma. Petals are white, yellowish at the base, twisted spirally. In dry weather, Plumeria white can lose leaves. In Cambodia, the plant is used in folk medicine, flowers are eaten.

Small trees (height up to 7–11 m) and shrubs, dichotomously branching, with thick succulent branches, at the ends of which bunches of leathery leaves up to 40–50 cm long develop. The flowers are fragrant, funnel-shaped (diameter 5–10 cm), out of 5 (and more) accrete petals, collected in corymbose inflorescences, red (P. rubra), white (P. acutifolia, P. alba).

Plumeria was first mentioned in 1552 in the famous treatise Libellus de Medicinalibus Indorum Herbis (The Little Book of Medicinal Plants of the Indians), the first Aztec herbalist. The treatise was written by physician Martin de la Cruz (Martin de la Cruz), in the local Aztec language Nahuatl, and later translated into Latin by Juan Badiano. The genus Plumeria (Plumeria) was officially named Linnaeus in 1753 in honor of its discoverer Charles Plumier (Charles Plumie 1646-1704), a Franciscan monk and botanist at the court of French King Louis XIV, who gathered and studied a great number of missions in the West Indies Caribbean plants.

Due to the amazing aroma, frangipani flowers are widely used in perfumery. The natural fragrance of flowers is incredibly beautiful and rich, sometimes it may even seem

like these are ready-made perfumes. The plant has a rich, thick floral-sweet smell with spicy and green notes in the final. Frangipani Ormonde Jayne women's fruity-floral fragrance is filled with tenderness, similar to the natural scent of Frangipani. . For cool weather, the languid Serpentine Roberto Cavalli perfume is perfect. Annick Goutal Songes. Truly luxurious scent of tropical paradise. Romantic and sweet, it is based on tones of tropical flowers of plumeria and ylang-ylang, complemented by tiara flowers, sambac jasmine, woody notes and vanilla.

ATROPA BELLADONNA

Akansha Singh, group 44. Scientific adviser: Kalinenko Olha

Atropa belladonna is a perennial herbaceous plant. It belongs to the Solanaceae family. This plant is also known as “Deadly nightshade”. This plant is known as the highly toxic plant. The word ‘atropa’ is derived from the greek word “Atropos” which belongs to one of the fates which cut the fate of life and the word ‘belladonna’ means “beautiful women” in Italian.

The leaves of this plant are oval and pointed. They are pale green in colour. The flower of this plant is purple-brown in colour. It is bell-shaped. The berries of this plant are sweet and are firstly green in colour and later on turns into shiny black in colour which looks like cherries. This plant consist of a fleshy rootstock with large tapering roots and grows almost upto 2 metres.

This plant is usually found in Europe, north Africa, and western Asia. The distribution of this plant extends from great Britain in the western side to the western Ukraine and Iranian province of Gilan towards the east. This plant is also found in some parts of Canada and the united states.

Atropa belladonna is highly toxic plant but it is flabbergasting to known that it can be cultivated legally without license in United States. All the parts of this plant and its extract are legally traded in U.S.

Folklore about atropa belladonna

In earlier times, it was believed that this plant was used in witchcraft, being equated with aggressive female sexuality and feeling of flight. It was believed that witches use to make mixture of belladonna, opium poppy and some other poisonous plants, in flying ointment they applied to help them fly to gather with other witches.

Carlo Giuzburg, an Italian historian said that flying ointments were just preparations for encouraging unreal dreaming or hallucinatory dreaming.

Further moving on other story about deadly nightshade folklore. In ancient roman times, this plant was used by Italian women to dilate pupils to make them look attractive and also applied to cheeks to give them a pinkish red appearance, which later on resulted in some harmful ocular changes like pupillary dilation and paralysis of ciliary muscle.

Toxicity of belladonna

The berries of this plant are dangerous for the children because they attractive and deceptively sweet at the very first bite. Only two berries of this plant can kill a child and it takes 10 to 20 berries to kill an adult. And consumption of a single leave of this plant can prove fatal to humans. This plant contain atropine and other dangerous alkaloid chemicals like scopolamine and hyoscyamine. Atropine is fatal in doses as 100mg which is equal to 5-50g of belladonna herb.

Harmful effects of belladonna

Atropine crosses the blood brain barrier and patients with central anticholinergic syndrome shows

-loss of memory

-confusion

-disorientation

-hallucination

Severe cases may also result in

-coma

-seizures

-respiratory and cardiovascular failure

This plant causes inhibition of secretions and relaxation of smooth muscles, dryness of mouth, diminished bowel sounds and urinary retention. The heart rate increases with hypertension as a result of parasympathetic block caused by anticholinergic agents.

Conclusion

Belladonna has been used for centuries in the treatment of various illnesses, both conventional and traditional medicine. Although there are many side effects and contradictions of belladonna, it is also valuable in the medical field if precisely used. It could be used for the treatment of respiratory, cardiovascular neuromuscular and gastrointestinal condition.

POISONOUS PLANTS IN INDIA

Shreya Mehta, group 46. Scientific adviser: Zavada Oksana

Gloriosa magnificent full deserved her name. This unique, growing from tubers climbing plant, limited to a maximum half-meter-long shoots, rightfully ranks among the most spectacular indoor vines. In Gloriosa, everything is beautiful: the foliage of a rich color, and flowers, which are difficult to find equal in shape and color. Wavy, deviating petals resemble flames, and the red-yellow transition only underlines this effect. Flexible and surprisingly graceful, this tropikanka requires special conditions and constant attention. But the luxurious inflorescences of gloriosa, which today is considered one of the most spectacular plants for making bouquets, are worth it.

Gloriosa (Gloriosa) is a genus of herbaceous perennials with a tuberous rhizome belonging to climbing vines. Flexible, very thin, but not able to twist around the supports and fragile shoots are densely dotted with rather large leaves. Shirokolantsetnye, with a spectacular elongated tip, full-glossy leaves with bright green color surprise with its simple elegance and elegant tendril at the ends, thanks to which the clinging clings to the support. Alkaloid colchicine is extracted from the Royal Lily (Gloriosa Superba). 20 grams of royal lily tubers contain 60mg, and one seed - 3.5mg. It is used in genetics and medicine. As well as the alkaloid kolhamin (omain), which is used to treat certain diseases of the blood and a number of e-malignant tumors. Colchicine is a valuable medicinal substance used to treat gout.

Poisoning is possible when eating the bulbs of a plant (mistaken for a onion). In large doses (for a child it is one onion), it causes nausea, vomiting, severe diarrhea, hair loss, a bleeding disorder and kidney damage. All parts of the plant contain colchicine and similar poisonous alkaloids. Contact with the stem and leaves may cause skin irritation.

Gloriosa has anti-inflammatory, anti-tumor, analgesic, antiseptic properties.

Plant preparations are used in traditional medicine in Africa and India. In India, the flowers of Gloriosa are placed on window sills, so that snakes cannot enter the house.

DATURA

Nandni, group 46. Scientific adviser: Zavada Oksana

Datura - the name of the plant itself is associated with some kind of negative action, which is partly right - the beekeepers know that insects often die when collecting nectar from its flowers. Gardeners dope is known as a weed, and amateur growers often grow this

plant (decorative forms) in flower gardens for beautiful and fragrant flowers. Every professional chemist knows about dope, since his alkaloids are considered in the basic course of organic chemistry.

Alkaloids - the main active ingredients of Datura, which just cause its healing properties. The quantitative composition of alkaloids depends on many factors, in particular, on the growing conditions or the phase of plant development. The percentage in various parts of the plant is approximately as follows: leaves - about 0.4%; stem - up to 0.24%; roots - in the range of 0.12 - 0.27%; flowers - about 2%; pericarp - 0.38 - 0.41%; seeds - up to 0.8%.

The most important among the dope alkaloids are scopolamine, atropine and hyoscyamine. Hyoscyamine is the richest Indian dope, so its pericarp is used for the industrial production of this compound. In the alkaloids of the dope ordinary, on the contrary, scopolamine predominates.

The ability of hyoscyamine to block M-cholinergic receptors determines its use. The action of hyoscyamine is similar to atropine, but much more powerful. For example, the effect of hyoscyamine on the circular muscle of the eye is 2 times stronger, on the heart muscle - 3 times, on the muscles of the intestine - 10 times.

The intake of hyoscyamine inside causes an increase in the frequency and strength of heart contractions, while there is a decrease in the secretory activity of the salivary and sweat glands, the production of digestive enzymes and the activity of the pancreas are reduced. Hyoscyamine reduces the muscle tone of the bronchopulmonary system and the abdominal cavity, and also tones the respiratory center. Pharmacokinetics of hyoscyamine causes its use as an antispasmodic in case of asthmatic attacks, as an antidote for poisoning with alcohol and sleeping pills (when depression of the respiratory center is observed).

RICINUS COMMUNIS

Ishan Verma, group 47. Scientific adviser: Zavada Oksana

The name of the plant comes from the Latin word ricinuc - tick, which is associated with the shape of the seeds, resembling an oriental tick. Grassland is tropical Africa. There, the plant has a tree form and reaches a height of 10 meters. In temperate climates, it is an annual plant up to 2 m high, with a branched stem. Large finger leaves grow on long petioles. On the ends of the shoots or in the leaf axils there are racemes.

Castor bean seeds contain 45–60% non-drying fatty oil, which contains unsaturated ricinoleic acid glyceride (castor oil), lipase enzyme, stearic, oleic, linoleic acid, and

glycerin. Protein substances such as globulin and albumin, a small amount of alkaloids, a small amount of nitrogen-free substances, and fiber are also found in the seeds of the plant.

Castor oil is widely used in medicine. It is prescribed for inflammation of the gastrointestinal tract, colitis and feverish conditions. Externally, the oil is used to treat ulcers, burns, and also as an aid in the removal of warts. In cosmetology, it is used for whitening pigment spots and rapid growth of eyelashes. In gynecology, oil is used to stimulate the contractile activity of the uterus. In addition, an infusion of herbs treats inflammatory diseases of the uterus, and for colds and bronchitis they rub their breasts.

The seeds of this plant can cause serious damage to health, because it is considered the most poisonous of all seed species. The toxins present in the grass inhibit the synthesis of proteins in the intestinal wall, as a result of which it is destroyed and the intestine stops functioning. However, the plant produces castor oil, which is considered safe. Seeds of plants can easily be poisoned.

The first signs of castor poisoning can appear only after several hours. Symptomatically, this is manifested by yellowing of the skin, the appearance of burning and pain in the abdomen, nausea and vomiting, severe headache, weakness, cramps, acceleration or deceleration of the pulse and possible cessation of breathing.

HARMFUL AND BENEFICIAL ASPECTS OF TANACETUM PARTHENIUM

Arjun Batish, group 47. Scientific adviser: Zavada Oksana

There are several versions of the origin of the Latin name tansy, according to one of them, the name Tanacetum Parthenium comes from the Greek word Partenon, one of the buildings of the Athenian acropolis, during the construction of which one of the workers was wounded and then cured with the help of tansy maiden. According to the second version, the name of the plant is associated with its use in women in order to get rid of menstrual pain (gr. Parthenos). The existence of these versions of the name confirms the fact that the healing properties of tansy maiden were known in ancient Greece.

In the Middle Ages, tansy was used as an antipyretic property (by the way, the name of tansy in English is feverfew, which means antipyretic), for relieving headaches, in treating inflammatory processes of the joints and skin, with problems with digestion.

In our time, girlish tansy is widely used in traditional medicine for the treatment and prevention of migraine, rheumatic pains (also as compresses), edema, difficult healing wounds, as a tonic and immune-strengthening remedy.

One of the main active substances of tansy maiden is parthenolide, a sesquosterpene lactone that blocks the release of serotonin, which affects vasoconstriction and vasodilation. This action of parthenolide may be useful in the case of migraine, when serotonin levels increase and spontaneous platelet aggregation increases.

Its leaves and flowers contain substances that have analgesic, anti-inflammatory and antipyretic properties, which, at least, indirectly confirms the effectiveness of its traditional use in the treatment of migraines, fever, colds and arthritis.

Studies have also confirmed that maiden tansy can have an abortive effect, so it should not be used during pregnancy, and the appropriate warning should be placed on packages with any tansy-based drugs.

APPLICATION OF POLYMERS FOR SURGICAL SUTURES

Neha Kashyap, group 52. Scientific adviser: Zavada Oksana

SURGICAL ARTIFICIAL MATERIALS - Threads that are used in surgical operations to cross-stitch different tissues or stop bleeding (dressing). The structure distinguishes the following threads: 1) Monofilaments (monofilament) - have a uniform structure and a smooth surface on the transverse section, do not have "knotty" properties; 2) polyline (polyfilament), consisting of several threads and can be twisted, woven, complex, that is, with a covering. According to the ability to biodestruction Hs.m. may be dissoluble and not absorbable

Stitch materials play a significant role in medicine, because without them, no surgical operation is completed. Modern medical technologies enable doctors to develop and invent new, more advanced suture patterns that will provide effective and rapid healing of postoperative wounds

In fact, suture material in most cases of surgical intervention is the only alien body remaining after surgery. Therefore, its quality, safe chemical composition and high level of compatibility with human body tissues are very important.

Requirements for suture material:

1. Biocompatibility - absence of toxic, allergenic, carcinogenic and teratogenic effects on the body.

2. Good slip in the tissues without a "pyloric" effect.

3. Elasticity, flexibility of threads.

4. Durability.

5. Reliability of the nodes (minimum slip of the thread and the strength of fixation in the node).

6. Possibility of gradual biodegradation.

7. Versatility of application.

To date there is not an ideal suture material that could be used under all circumstances in every operation. Therefore compromises must be made in selecting a suture material.

ARTIFICIAL HEART VALVES

Lisha Singh, group 52. Scientific adviser: Zavada Oksana

Polymers are chemical compounds whose macromolecules consist of a large number of repetitive sites and, in this connection, have a high relative molecular weight. Polymers play an important role in the field of medicine. They have certain advantages over metal and glass counterparts: economy, availability of materials, and increased resistance to the effects of various environments.

Among the artificial organs, one of the most common are valves of the heart. Annually in the world almost 300 000-400 000 implants of heart valve prosthesis are implanted, and, based on the tendency to increase the number of degenerative valve failures due to the increase in average life expectancy and the general aging of the population in developed countries, an increase in cardiac surgery is expected.

The first world clinical studies of the heart valves of the petal type on the basis of polymeric materials are in the mid-1950s, tripe-in - in 1962, the first implantation was carried out in 1963 year. Early experiments did not have a positive result due to the lack of conditions for the synthesis of polymer with satisfactory characteristics and imperfections of the methods of manufacturing products.

An ideal heart valve must meet the following requirements:

1) to function effectively like a normal natural valve;

2) kept unchanged for the whole life of the patient;

3) to have no negative influence on cellular and molecular components of blood, in particular, not to stimulate thrombotic formation.

Unfortunately, none of the implantable valves currently can satisfy all of the listed requirements. Two types of prosthetic valve valves currently used - mechanical and biological, have their advantages and disadvantages

With a significant amount of polymers that you can already use, they are still constantly being modified.

CONTACT LENS MATERIALS

Pinki Roushan, group 52. Scientific adviser: Zavada Oksana

The real revolution in the contact optics occurred in 1938, when Americans Theodore Obrig and John Mullen made the first contact lenses made of synthetic polymer polymethylmethacrylate (or differently PMMA). Ophthalmic products from such a plastic essentially differed from glass. They were easy, not slipped out of the cornea, it was easy for them made by casting method. In 1947 production was started. Eye contact lenses with PMMA diameter 12 cm. Such models could be wear longer time.

Thanks to the latest technology, hard contact lenses are now gas permeable, so they can be worn for a longer time without compromising eye health, and they are more comfortable.

The advantage of hard contact lenses is that they can correct complex eye defects that are not amenable to correction with soft lenses (keratoconus or corneal deformity after injury or surgery, as well as some cases of astigmatism). Rigid contact lenses are made individually for each patient, so they take into account the features of the eyes as much as possible and allow accurate vision correction. At the same time, such lenses can last much longer than soft ones - with proper care, hard contact lenses can be used for several years (of course, while maintaining the sight indices).

Soft contact lenses are hydrogel and silicone-hydrogel. They are made from hydroxyethyl methacrylate (HEMA) and copolymers of hydrogels and silicone. The material of the lenses is biocompatible and does not cause any reactions of rejection and allergies among users. To date, about 90% of patients use exactly soft contact lenses for vision correction.

Hydrogel contact lenses appeared before silicone-hydrogel. They make the vision clear, do not cause irritation and are well compatible with the tissues of the eye, but do not by themselves pass oxygen to the cornea. To the eyes in the hydrogel lenses "breathe", the lenses contain a sufficient amount of water, which transports oxygen to the cornea.

HYDROGELS IN MEDICINE

Alberta Bredu-Appiah, group 52. Scientific adviser: Zavada Oksana

Polymer materials are wide and diverse but are used in modern therapeutic and surgical ophthalmology. Chief editor By the way, they are used in the production of contact lenses, implants, substitutes for the vitreous body, artificial eye lens, cornea, drainages for the treatment of glaucoma, viscoelastics, preparations of artificial tears. As part of the systems drug delivery (LP): drops, films, hydrogels, nanoparticles, microspheres - are used both synthetic and natural polymers. Polymeric hydrogel is a bonded-colloid system based on a three-dimensional a grid consisting of crosslinked hydrophilic polymers capable of holding a large amount liquids.

At present, polymer hydrogels are used due to a number of their unique mechanical and physicochemical properties. in pharmaceuticals, medicine and other industries. Hydrogels in their microstructure have similarities with an intercellular matrix of many tissues and are able to simulate physical and chemical properties intercellular matrix. Thus, they are the ideal cellular microenvironment for the proliferation and differentiation of cells.

Synthetic polymers are widely used for the preparation of medicinal gel forms, since they have reproducible mechanical properties and microstructure. Depending on the nature of the polymers, such hydrogels are characterized by a controlled degradation rate either its absence. The most widely used in medicine Acrylic and methacrylic acid derivatives, cellulose ethers, ethylene oxide polymers and their derivatives, polyvinyl alcohol, silicones, aerosols and bentonites.

Carbomers (carbopoles) are cross-linked derivatives acrylic acid having good peppermint adhesive properties. Gel-forming mechanism. It is based on the neutralization of their acidic colloid- dispersions that are converted into gels. Due to its biocompatibility, elasticity, diversity of composition and physical characteristics of the hydrogel by themselves or in combination with cells or medications found application in many areas of medicine, including in ophthalmology.

POLYMERS IN MEDICINE

Vinay Upadhyay, group 52. Scientific adviser: Zavada Oksana

The use of macromolecular compounds in medicine is the result of close cooperation between the three sciences - chemistry, medicine and biology. Sometimes it

seems that the achievements of scientists in this field are the wildest of our dreams, which somehow miraculously have embodied in reality. Yes, today no one is surprised by the synthetic equivalents of human tissues (bones, teeth, joints, walls of blood vessels, etc.). In clinical practice with great success are used artificial valves and ventricles of the heart, copolymer substitutes for human plasma.

Polimery is a natural component of visco-molecular spoluki, molecules come together with great numbers of repetitions of odd ones or different atomic groups (monomers), drawn by coordinating them, with the help of your own patterns, with the help of your own patterns, with the help of your own patterns.

Termin "Polimera" Book of Instruction in Science нау. Bercelusus (1779–1848) in 1833 r. for poznachennya peculiar mind izomerії, with a yakiy rehovini odkovogo warehouse molecular weight. For example, ethylene and butylene, oxygen and ozone.

Polymer processing into a wide variety of shapes is carried out using extrusion, molding, spinning, weaving, knitting and casting techniques.

Polymeric materials can also be processed using lathes, grinders and shapers in similar manner to metals.

Polymeric materials have a wide variety of applications for implantation, as they can be easily fabricated into many forms: fibers, textiles, films, foams, solid, rods, powders, liquids etc. Polymers have been used in medicine. Every year they are improved and find new areas of use.

Endoprosthetics (Greek endō inside + prosthesis) replacement by implants of the musculoskeletal system, vessels, heart valves, mammary glands, missing facial parts, etc. The term has become most widespread after the introduction of total replacement of the affected.

USAGE OF BIOPOLYMERS IN MEDICAL APPLICATIONS

Nikhil, group 52. Scientific adviser: Zavada Oksana

Polyhydroxyalkanoates (PHA) are polyesters synthesized by a variety of microorganisms when cultivated under different food and environmental conditions (usually when limiting nitrogen, phosphorus, sulfur, oxygen or magnesium, or with an excess of polymer precursors). Microorganisms synthesized by PHA include some of the Archaea and certain gram-positive and gram-negative bacteria. Some other microorganisms can accumulate PHA even in the presence of high concentrations of nutrients (for example, Pseudomonas putida, Sphaerotilus natans, Bacillus mycoides,

Azotobacter vinelandii, Alcaligenes latus). PHA producers accumulate these polyethers intracellularly in the form of mobile, amorphous, liquid granules, which can be observed as reflective deposits or electrolytic bodies, which, when overproduced, can significantly change both the size and morphology of these bacteria.

The main properties of polyhydroxyalkanoates are biocompatibility and biodegradability. The properties of PHAs are determined by their structure; first of all, they depend on the structure of the side groups in the polymer chain, as well as on the distance between the ether groups in the molecule. Currently identified over 150 PHA. Despite this diversity, there are currently only a few types of PHAs in the area of attention of researchers: poly-3-hydroxybutyrate, poly-3-hydroxybutyrate-co-3-hydroxypropionate, poly-3-hydroxybutyrate-co-4-hydroxybutyrate, poly-3 β-hydroxybutyrate-co-3-hydroxyvalerate, poly-3-hydroxybutyrate-co-3-hydroxyhe-xanoate, poly-3-hydroxybutyrate-co-3-hydroxydecanoate.

The possibility of replacing plastics with polyhydroxyalkanoates has great potential in the future, since PHAs are completely biodegradable, and their decomposition rate under natural conditions is much higher than that of plastics, which allows for the expansion of the use of these biopolymers in medicine.

Відповідальний за випуск: ас. Каліненко О.С.