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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY

(PHARMACY INSTITUTE)

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PHARMACY INSTITUTE
Greater Noida
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PRESENTS

PHARMAINNOVATIONS

VOLUME 6
ISSUE 1

JUNE 2022

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Messages from the desk of the Editor

It gives us immense joy and satisfaction to introduce the first issue of 2022 of the magazine 'Pharma Innovations'. I hope you enjoy reading the magazine which will be beneficial to enrich your knowledge in Pharmacy, medicines, and health. As always this issue is also an attempt to bring out the knowledge concealed within the students and faculty. Before looking ahead, however, I would like to offer a word of thanks to our readers, our contributors, and our editorial board for their support of the journal and its mission I hope you enjoy reading this issue as much as we have enjoyed making it.

DR. R. MAZUMDER
PROFESSOR AND DEAN
NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY (PHARMACY INSTITUTE)
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Messages from the desk of the Associate Editor

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On behalf of the editorial board members, it is announced that the first issue of 2022 " Pharma Innovations". has been published. "Pharma Innovations" is a magazine that sturdily focuses on inspiring the faculty and students to gain knowledge and actively driving the mind toward research in health, medicines, and pharmacy. This unprejudiced attitude toward the scope of the magazine allows the reader to have a divergent and convergent aspect on different topics. Enables budding researchers to think in a rational way to make the scientific pavement.

DR. SWARUPANJALI PADHI
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FACULTY FORUM

EARLY MENOPAUSE AND DERANGEMENTS OF BONE HEALTH

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Menopause is a physiological condition that is caused by primary ovarian failure brought on by apoptosis, or programmed cell death. With age, ovarian function decreases. During menopause, women experience a wide range of symptoms and health problems, including cognition decline, heart disease, urogenital diseases, and bone fracture risk all of which are connected to the body's declining oestrogen levels. Menopause is the biggest risk factor for women over 49 to 50 years of age who have osteoporosis. Oestradiol production starts to decline when menopause begins while follicle-stimulating hormone (FSH) levels start to rise. The lack of oestrogen encountered during the stages of perimenopause and menopause has been linked to osteoporosis. Early menopause (before age 45), along with any protracted period of low hormone levels and irregular or absent menstrual cycles, results in bone mass loss. Osteoporosis is a degenerative disorder sometimes recognized as a "silent disease" that raises the possibility of fractures caused by fragility and is characterized by a loss of bone mass and an erosion of bone structure. According to the statement, osteoporosis is both gravely underdiagnosed and undertreated. In postmenopausal women, managing their bone health entails identifying and lowering fracture risk factors through nonpharmacologic initiatives, taking medications that increase bone density and strength, minimizing risk factors through lifestyle and diet changes, and using pharmacologic therapy. Living tissue like bone is essential for maintaining the body's structural integrity.

EARLY MENOPAUSE AND DERANGEMENTS OF BONE HEALTH

It must be strong enough to prevent fractures while remaining lightweight enough to allow for movement and agility. Bone has a core protein-rich framework with blood supply, nerves, and lymphatic supply to do this. Its strength is a result of the matrix being mineralized by various minerals, with Ca^{2+} playing the largest role. Through a procedure known as bone remodelling, the mineralized portion of the bone goes through regulation and maintenance. Resorption occurs when osteoclasts destroy old bone, and development occurs when osteoblasts fill these resorption pits with new bone by adding collagen and minerals.

STUDENTS' FORUM

INDIAN PHARMACEUTICAL INDUSTRY IN THE GLOBAL SCENARIO

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India is a major exporter of Pharmaceuticals, with over 200+ countries served by Indian pharma exports. India supplies over 50% of Africa's requirement for generics, ~40% of generic demand in the US, and ~25% of all medicine in the UK. India also accounts for ~60% of global vaccine demand and is a leading supplier of DPT, BCG, and Measles vaccines. 70% of WHO's vaccines (as per the essential immunization schedule) are sourced from India. Globalization is the tendency of business and industry to permeate national boundaries and spread across the globe. Globalization of the Indian pharmaceutical industry got a fillip with sweeping economic reforms in India in 1991. The reforms propelled the market and synergized the Indian economy with the world economy. The liberalization of the economy in India coincided with the setting up of the World Trade Organization (WTO) and the Agreement on Trade-Related Aspects of Intellectual Property (TRIPS). Indian government effected two major changes in its Patents Act to balance the requirements of TRIPS and public interest. It ended the "license era" and brought in the competition times, which brought the focus on product excellence and customer service excellence. Indian pharma companies leveraged the reforms and started operations overseas. Indian companies were also quick to adapt their research and development processes to international standards to compete in the global market. Patenting activity also increased manifold as companies showed interest in new product development.

INDIAN PHARMACEUTICAL INDUSTRY IN THE GLOBAL SCENARIO

The organs of the Indian government should work in close coordination with regulatory compliance authorities of rich markets to help Indian companies penetrate deeply. The government should draw maximum mileage from its presence at the Pharmaceutical Inspection Convention (PIC). This shall help improve the imagery of the industry and effect speedy approvals. India has established its position as a reliable, cost-effective, and quality supplier of pharmaceutical products. A renewed thrust shall make it stand in the leadership position as an “innovative supplier” as well. Now is the time to explore and use the potential in biosimilars, gene therapy, and specialty drugs that would further fuel the growth of the industry at the international level. India can also now look forward to new markets such as that of Japan. The Japanese pharma market is worth US$80 Billion and the share of Indian companies in it is less than one per cent. The government can give tax breaks on R&D investments, transfer of technologies, targeted regulatory simplifications for sustained growth, and new entrants in the market. A liberal eco-system shall reward the industry to build a strong innovation pipeline. This shall ultimately help the Indian pharma industry to move up the value chain and establish its presence beyond the generics in biologic and patented formulations.

UTILISING NOVEL TECHNOLOGY FOR THE DEVELOPMENT OF VACCINES

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These days vaccine is playing a very important role in our lives to fight against several diseases. Vaccines are biological preparations that improve immunity to a particular disease. Inactivated and live attenuated vaccines have improved human life and significantly reduced morbidity and mortality of several human infectious diseases. However, these vaccines have faults, such as reactivity or suboptimal efficacy, and expensive and time-consuming development and production. Additionally, despite the enormous efforts to develop vaccines against some infectious diseases, traditional technologies have not been successful in achieving this. At the same time, the concerns about emerging and re-emerging diseases urge the need to develop technologies that can be rapidly applied to combat the new challenges. Novel approaches to vaccine development include structure-based immunogen design, gene-based vaccine platforms, and formulation of recombinant antigens with potent adjuvants. These technologies are producing encouraging results in the development of vaccines for globally important diseases such as tuberculosis, influenza, and respiratory syncytial virus. Vaccination remains a very effective method of preventing infectious diseases and represents a relevant contribution to human health. The immense success of vaccines against polio, smallpox, measles, diphtheria, tetanus, and rabies demonstrates the potential of this phenomenal approach in reducing the global burden of infectious diseases and, in the case of smallpox, in completely eradicating it.

UTILISING NOVEL TECHNOLOGY FOR THE DEVELOPMENT OF VACCINES

It is easy to argue that vaccine development represents humankind's most important and successful endeavor, such as the impact that vaccination has had on human morbidity and mortality over the last 200 years. During this time the original method of Jenner and Pasteur, i.e. that of injecting live-attenuated or inactivated pathogens, has been developed and supplemented with a wide range of alternative approaches which are now in clinical use or under development. These next-generation technologies have been designed to produce a vaccine that has the effectiveness of the original live-attenuated and inactivated vaccines but without the associated risks and limitations. Indeed, the method of development has undoubtedly moved away from Pasteur's three Is paradigm (isolate, inactivate, inject) towards an approach of rational design, made possible by improved knowledge of the pathogen–host interaction and the mechanisms of the immune system. These novel vaccines have explored methods for targeted delivery of antigenic material, as well as for the control of release profiles so that dosing regimens can be matched to the timelines of immune system stimulation and the realities of healthcare delivery in dispersed populations. The methods by which vaccines are administered are also the subject of intense research in the hope that needle and syringe dosing, with all its associated issues regarding risk of injury, cross-infection and patient compliance, can be replaced. This review provides a detailed overview of new vaccine vectors as well as information pertaining to the novel delivery platforms under development.

ORPHAN DRUG

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An orphan drug is a pharmaceutical agent that is developed to treat certain rare medical conditions.

An orphan drug would not be profitable to produce without government assistance, due to the small population of patients affected by the condition. (The condition that orphan drugs are used to treat is referred to as orphan disease).

Global statics:

As of 2014, there were 281 marketed orphan drugs and more than 400 orphan-designated drugs in clinical trials. More than 60% of orphan drugs are biologics (Biologics: are a subset of a class of medications called disease-modifying antirheumatic drugs 'DMARDs') The U.S. dominated the development of orphan drugs with more than 300 trials, followed by Europe. Cancer treatment was the indication in more than 30% of orphan drug trials.

Number of orphan drugs in clinical trials: - 40

Number of orphan drugs in phase 2 trials: - 231

Number of orphan drugs in US clinical trials 350 in the pipeline until registration.

Orphan Drug Act (January 1983)

The Orphan Drug Act was passed in the United States with lobbying from the national organization for rare disorder and many other organizations.

ORPHAN DRUG

Examples of some selected diseases:

Cystic fibrosis: In the 1980s people with cystic fibrosis rarely lived beyond their early teens.

Drugs: Pulmozyme and tobramycin both developed with aid from the Oda

Familial hypercholesterolemia: The 1985 Nobel Prize for medicine went to two researchers for their work related to familial hypercholesterolemia. Their research led to the development of statin drugs (which are now commonly used to treat high cholesterol).

Wilson's disease: penicillamine was developed to treat Wilson's disease.

Cancer: Imbruvica (is used to treat certain types of cancer).

SOLVENT REGULATED HYDROGELS

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Introduction

A hydrogel is a three-dimensional (3D) network of hydrophilic polymers that can swell in water and hold a large amount of water while maintaining the structure due to chemical or physical cross-linking of individual polymer chains. Hydrogels were first reported by Wichterle and Lim (1960).

Water must constitute at least 10% of the total weight (or volume) for a material to be a hydrogel. Hydrogels also possess a degree of flexibility very similar to natural tissue due to their significant water content. The hydrophilicity of the network is due to the presence of hydrophilic groups such as -NH*2*, -COOH, -OH, -CONH*2*, - CONH -, and -SO*3*H.

The unique feature of being simultaneously soft and hydrated enables hydrogels to be applied in many fields, such as tissue engineering, drug delivery, and stimuli response. However, conventional chemical hydrogels usually suffer from their mechanical weakness and poor recoverability, and therefore can rarely be utilized in applications that require reusability. Since 2000, immense efforts have been taken to develop self-recoverable hydrogels, among them, hydrophobically associating (HA) hydrogels stand out as a kind of physical hydrogels that possess various fascinating properties, such as self-healing ability, remoulding capability, shape-memory behaviour, and high ductility.

SOLVENT REGULATED HYDROGELS

The hydrophobically associating domains formed by side groups of surfactants and hydrophobic monomers in the HA gels serve as non-covalent cross-linkers to promote the cross-linking of polymer chains, giving rise to the recoverable mechanical properties of the HA gels. The only drawback of the HA gel system is the relatively low mechanical strength (on the order of 10^{-1} MPa) compared with other tough hydrogels such as double network (DN) hydrogels. Enhancing the mechanical properties of the HA gels is expected to significantly broaden their applications.

The toughening strategy of hydrogels is usually based on a classic “sacrificial bond concept” proposed by Gong et al., in 2003, i.e., introducing an additional energy-dissipation mechanism into the gel system. For HA hydrogels composed of hydrophilic polymer chains that are non-covalently cross-linked by hydrophobically associating domains, compatible nanosheets are often incorporated into the networks to achieve enhancement. It has been noted that the physical interactions such as hydrogen bonding between the nanosheets and polymer chains can serve as the sacrificial bonds in the HA gels, dissipating a large amount of energy prior to the global failure upon loading. Furthermore, the introduced nanosheets, commonly composed of abundant functional groups, endow the HA gels with extra functions such as electrical conductivity and adsorption capability of water contaminants Generally, the toughening effect is proportional to the amount of added nanosheets, whereas only a low concentration of nanosheets is usually allowed into the HA system due to their easy aggregation in the precursor solution, dramatically limiting the toughening effect. A more efficient way to toughen HA hydrogels is necessary

SOLVENT REGULATED HYDROGELS

Although HA hydrogels usually possess a homogeneous single-phase network structure, phase separation can be induced by altering the solvent. It is well-established that the characteristics of polymer hydrogels, such as optical, mechanical, and thermal properties, are strongly related to their internal structure, which sensitively changes with the solvent affinity to the polymer. Except for the special co-nonsolvency phenomenon where a gel collapses in a mixture of two good solvents, a gel usually swells extensively in good solvents, exhibiting high transparency and elastic properties. On the other hand, a gel shrinks in poor solvents, becoming opaque due to microphase separation. Taking advantage of this mechanism, phase separation in HA gel can be induced and mediated by immersing the gel in poor solvents, which could greatly enhance the mechanical performance. In this work, we report the simultaneous strengthening, stiffening, and toughening of HA hydrogels by solvent-regulated phase separation. A common and low-toxicity solvent, tetrahydrofuran (THF), is selected as the solvent for the HA gel system. The hydrogels are immersed into the mixtures of THF/water that are poor/good solvents for HA gels, respectively. The affinity of the mixed solvent to the polymers in HA gels is controlled by the weight concentration of the poor solvent (C_{THF}, wt%). By increasing the C_{THF} in the mixed solvent, the HA gels gradually de-swell, leading to an increment of polymer volume fraction (ϕ). The dehydration dramatically enhances the inter/intra polymer interactions inside the HA gel, giving rise to a transition of its optical property from transparent to opaque, along with an improvement of the mechanical properties such as fracture stress, Young's modulus, and toughness by up to 270-, 9200-, and 2500-folds, respectively.

SOLVENT REGULATED HYDROGELS

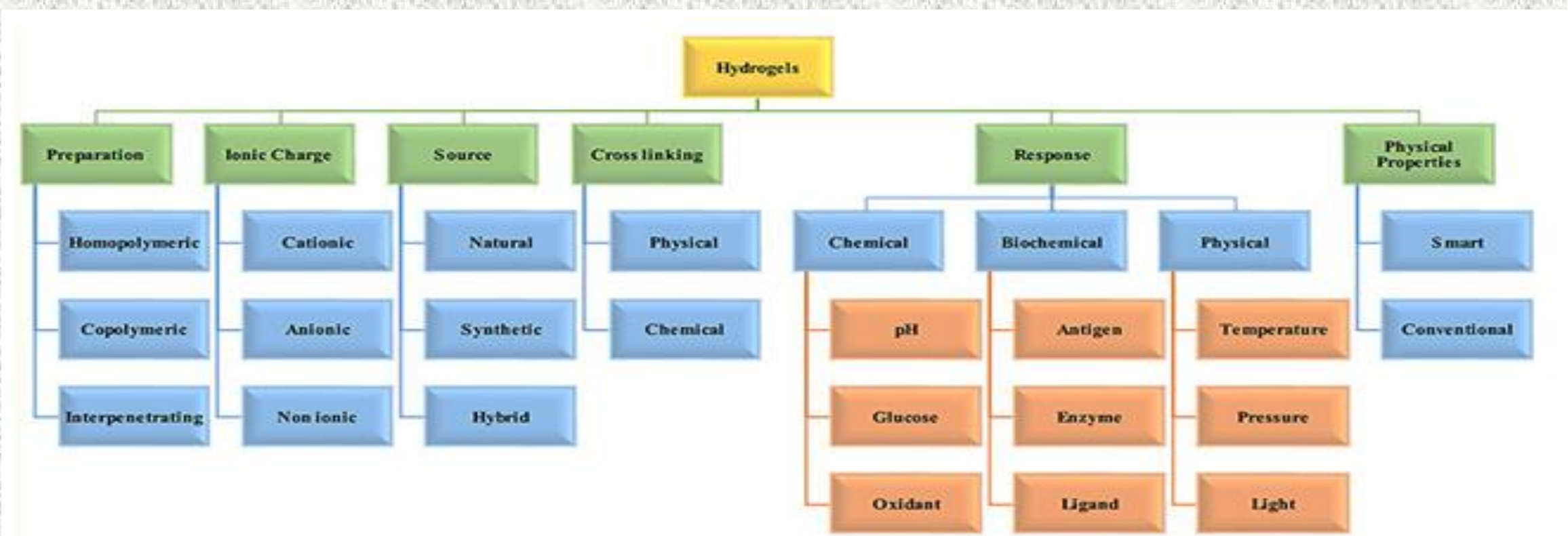
Evaluation of the hydrogel-solvent affinity

Because the HA hydrogel contains a small number of hydrophobic polymers (~1 wt. %) for which water is a poor solvent, it is important to clarify the polymer-solvent affinity between the HA hydrogel and two kinds of solvents (THF and water). For this purpose, an as-prepared gel is first immersed in pure THF or water to examine the swelling behavior.

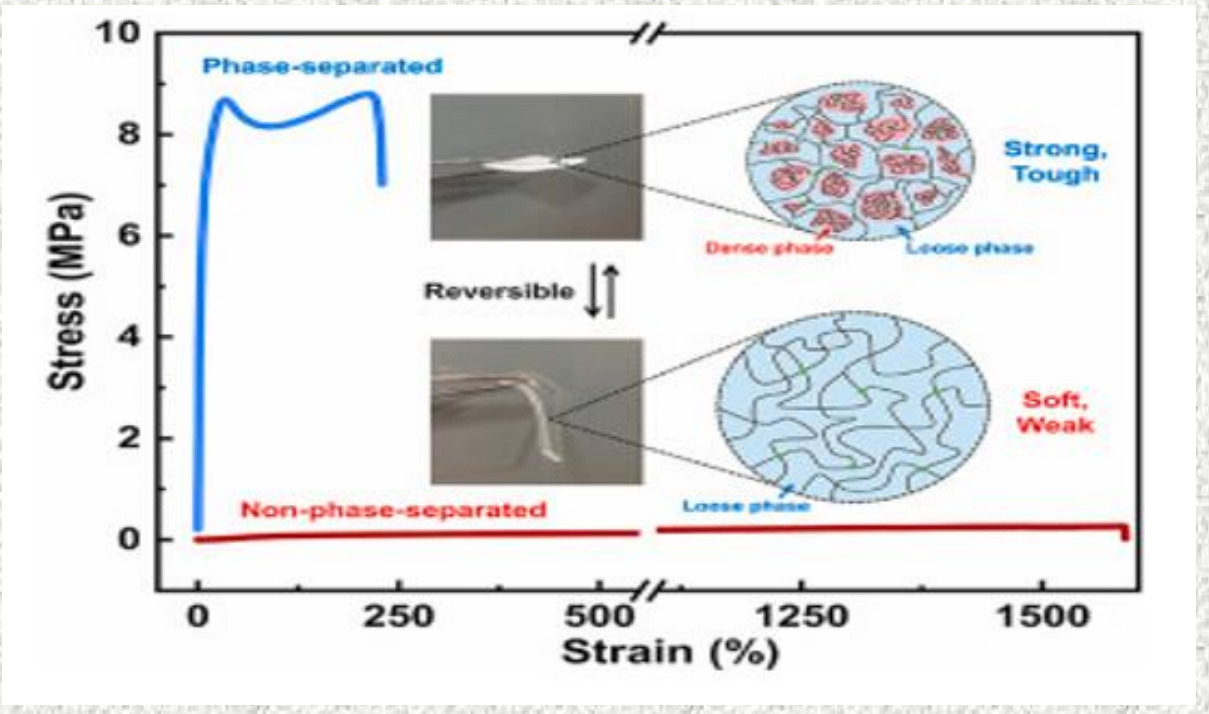
Classification of hydrogels

According to the source, hydrogels can be divided into those formed from natural polymers and those formed from synthetic polymers. Depending on the ionic charges on the bound groups, hydrogels may be cationic, anionic, or neutral. The types of cross-linking agents also can be the criteria for classification. Hydrogels can be physical, chemical, or biochemical. Physical gels can undergo a transition from liquid to gel in response to a change in environmental conditions such as temperature, ionic concentration, pH, or other conditions such as the mixing of two components. Chemical gels use covalent bonding that introduces mechanical integrity and degradation resistance compared to other weak materials. In biochemical hydrogels, biological agents like enzymes or amino acids participate in the gelation process. Hydrogel shows the highest absorption capacity, the swelling/deswelling behavior, and its rate depends on various factors such as particle size, porosity, solvent concentration, cross-linking density, etc.

SOLVENT REGULATED HYDROGELS



Classification of hydrogels based on the different properties



Phase separation in hydrogels with respect to stress and strain

BIODEGRADABLE POLYMERS USED FOR IMPLANTS

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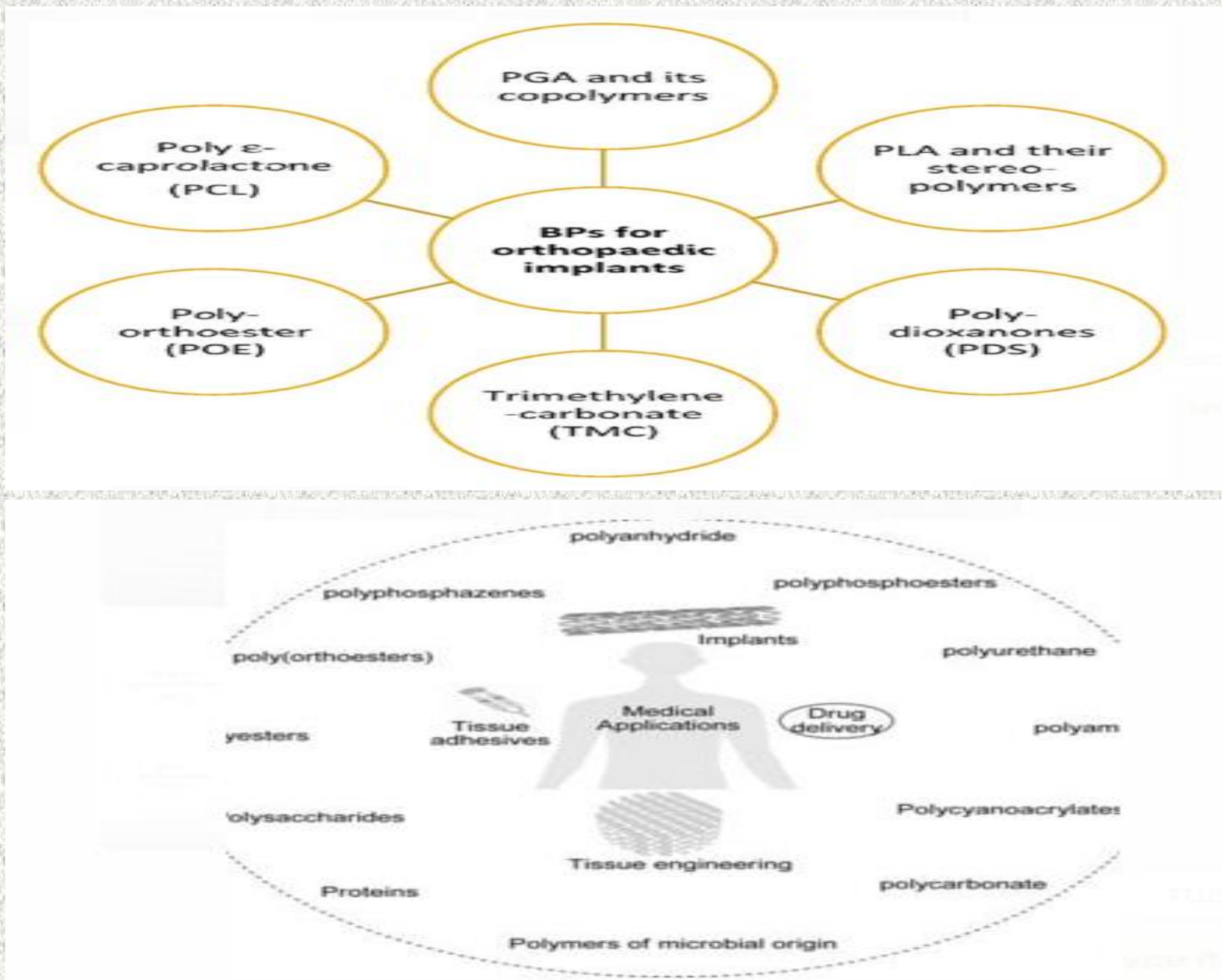
Recent progress made in biomaterials and their clinical applications is known from the last 5-decades. A variety of bioimplants are currently used in either one of the forms Some of these materials are designed to degrade or to be resorbed inside the body rather than removing the implants after their function is served. Many properties such as mechanical properties, non-toxicity, surface modifications, and degradation rate are taken into consideration. The current abstract focuses on state-of-the-art biodegradable bio-ceramics, and implants that employ biodegradable materials. The essential functions, properties, and their critical factors are yet to be discussed. Bioimplants are prostheses made for regularizing physiological functions and biometrics represent one classification of bioimplants based on material type. The development of biodegradable implants is described in the reviews and technical details, about implants and polymers are highlighted specifically for researchers working in the field. The discovery of biodegradable polymers at the beginning of the 1960s was the 1st step to developing biodegradable implants. The advantages of biodegradable implants over non-biodegradable implants motivated further research. A detailed summary of the polymers used in BIDDS is provided as well as their therapeutic application in chemotherapy vascular disease occurs during drug delivery.

Moreover, improvements in the formulation to increase efficacy and patient adherence and minimize adverse effects are reviewed.

BIODEGRADABLE POLYMERS USED FOR IMPLANTS



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