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# ARTIFICIAL INTELLIGENCE IN PHARMACEUTICAL ZONE

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## ABSTRACT
These introductions of artificial intelligence have not only caused devastating changes that were previously observed to be problems, as the introduction of specialised technology in the field of medicine has changed the conditions that were proven to be the severe ones from hope to have that was observed during the digitalization of the critical datasets of the patients during pandemic situations. With the help of contemporary robotics, which specifically perform their tasks in accordance with its algorithms, it was observed that there are numerous benefits as these artificial intelligence work on the most recent technology that covers all the different aspects of diagnosis, curing the affected patients by ascertaining their specific past histories from their beginning stages to their end stages that are proven to artelligence inteligence.

**KEYWORDS:** Artificial intelligence; Medicine, Disease diagnosis, Drug research, Drug evaluation, Creating drug, Drug reprocessing.

## INTERODUCTION
Artificial intelligence (AI) has piqued the public's curiosity with claims of better treatment quality and lower healthcare costs.[1] Media reports on alleged advantages take many different forms, some of which exaggerate the benefits while others undersell them.[2] The majority of AI applications, notably those in healthcare, are what some refer to as "narrow AI." A specific, well-defined activity that ordinarily requires human intelligence may be carried out by a computer with the aid of a specialised AI application, but nothing more. For example, a limited AI system may learn to identify the retinal picture patterns that signify diabetic retinopathy, but it would not comprehend the discussion the doctor and patient had on the problem, and it would not even be able to identify other retinal disorders.[3] To carry out a more challenging operation, like operating an automobile, a collection of focused apps may be integrated. This primer offers several illustrations of narrow AI. Using the informatics fundamental theorem, which argues that a person and a computer together are superior to either one acting alone,[4] The development of robots is usually seen as being the beginning of artificial intelligence (AI). In his 1921 drama "R.U. R" (Rossum's Universal Robots), author Karel Capek used the word robot, which is spelt robota in Czech. It stood for a factory that employs bio-engineered machines for forced labour. In a collection of short works of contemporary science fiction, Isaac Asimov immortalised the word "robot" in the middle of the 20th century. However, the earliest record of a humanoid automaton dates to China in the third century, when Yan Shi, a mechanical engineer, sent the Emperor Mu of Zhou a human-shaped mechanical workmanship made of leather, wood, and artificial organs.[5]

### Artificial intelligence in medicine
The Virtual Branch - Virtual and physical applications of AI in medicine are the two primary subfields. Machine learning, also known as deep learning, which is represented by mathematical algorithms that enhance learning via experience, is the virtual component. Machine learning algorithms may be classified into three categories:

(1) Unsupervised (Ability to detect patterns),
(2) Supervised (Classification and Prediction algorithms based on past instances), and
(3) Reinforcement learning.

The Physical Branch -The second type of AI use in medicine is physical things, medical equipment, and carebots, which are advanced robots that assist in providing care.[6] The employment of robots as aides, such as a robot companion for the elderly population with cognitive impairment or restricted mobility, is perhaps the most promising strategy. The most advanced versions of this technology are carebots from Japan. Robots are employed in surgery as solo or even as helper surgeons.[7]

**Artificial intelligence in pharmaceutical Research and Development:**

2018 has been a challenging year for artificial intelligence (AI) thus far. Cyberskeptics were in a feeding frenzy after a fatal accident involving a driverless car, allegations that social media users' personal information was misused for business and political gain, and the failure of a computer algorithm to invite 450,000 English women to breast cancer screenings.

**Artificial intelligence in Pharmaceutical and Healthcare research:**

Artificial intelligence (AI) is a collection of different intelligent behaviours and processes that have been produced using computer models, algorithms, or a set of rules that enable machines to replicate human cognitive abilities like learning and problem-solving. There are opportunities for AI to explore further in the field of pharmaceutical and healthcare research because of its ability to investigate enormous data from various modalities

**A) AI in disease diagnosis:** The development of new methodologies can define the applicability by illustrating the current existing situation that has not been covered, despite the existence of vulnerable, contradictory, and non-analyzing incongruities. This is supported by a considerable body of evidence. Diagnosis refers to the state where, upon certain pre-existing problems, one's condition is designated. Clinical trials that use AI benefit from improved subject selection and trial monitoring, which lowers dropout rates. The use of ML in clinical studies

**B) AI in drug discovery:** Due to a lack of adequate technology, it is more difficult to create a large number of therapeutic molecules from a chemical space. This situation can be improved by applying AI in the drug development process. Despite the existence of vulnerable, contradictory, and non-analyzing incongruities, the development of new techniques can define the applicability by illuminating the current scenario that has not been covered. There is a lot of evidence to back this up. In a different study, the optimisation genetic algorithm (GA) and support vector machine (SVM) classifier were used to categorise and diagnose tuberculosis.

**C) AI in forecasting of an Epidemic/Pandemic:** The scope of a pandemic is limitless, and it can result in morbidity and mortality. Black Death, Spanish flu, cholera, influenza, AIDS, and COVID-19 are just a few of the pandemic epidemics that have occurred globally and have the potential to disrupt social and economic life. In pandemics and epidemics, AI is utilised for detection, prevention, reaction, and recovery. Prediction, surveillance, and information are all being used more and more frequently in prevention, especially in light of the recent COVID-19 outbreak. The Zika research used a mobile application to track the mosquito population, and AI neural networks were used for early detection. A number of statistics and deep learning systems, including the feed-forward neural network (FNN), multilayer perception (MLP), autoregressive integrated moving average (ARIMA), and long short-term memory (LSTM), were used to explore the dynamical behaviour of COVID-19. The generated data may serve as a helpful guide for the COVID-19 forecast.

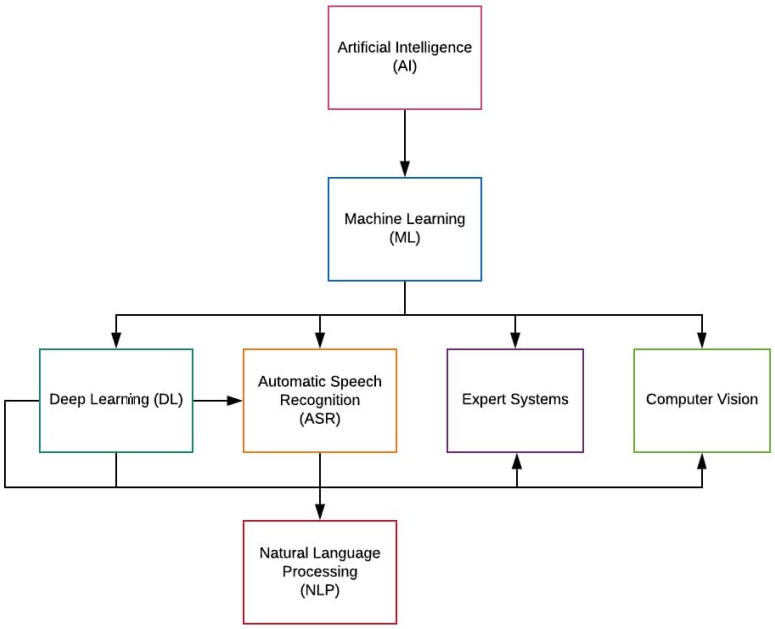


**Fig. no. 1**

***Application of artificial intelligence in pharmaceutical sector:-*** Artificial intelligence (AI) has been widely used recently to solve optimisation issues in the oil exploration and production sector. The analysis demonstrates how well AI approaches optimise a variety of objective functions necessary for industrial decision-making, such as minimal miscibility pressure, oil production rate, and volume of CO2 sequestration. artificial intelligence has numerous application in the pharmaceutical industry. Revolutionizing various aspects of drug discovery, development, manufacture, and healthcare delivery. Here are some key area where al is being applied in pharmaceutical. Among the fields that have been using AI techniques include the gaming industry, weather forecasting, heavy industry, process industry, food industry, medical industry, data mining, stem cells, and knowledge representation.

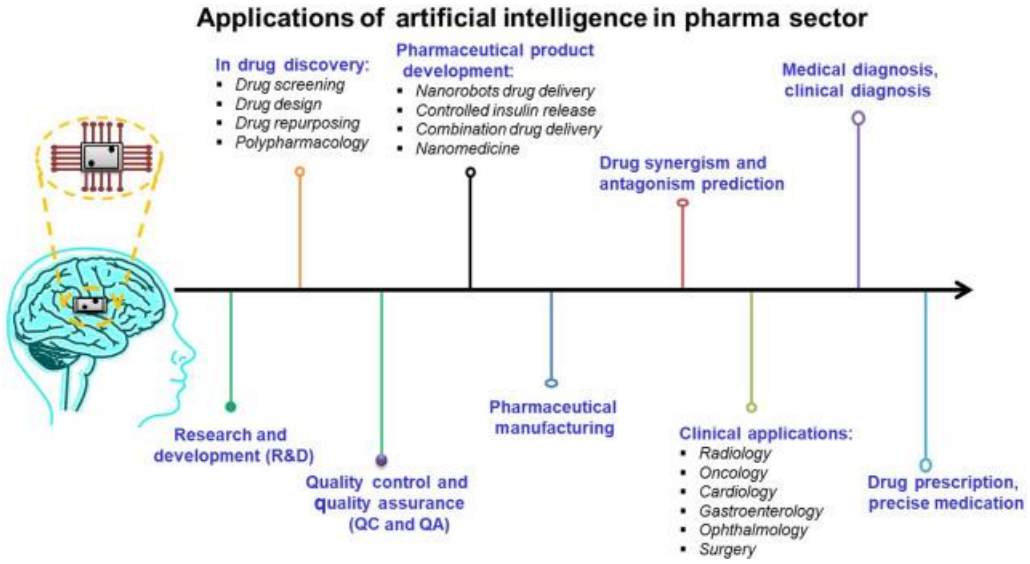


**Fig. no. 2**

**In drug discovery:-** Drug research has been an interdisciplinary endeavour with an industrial foundation for less than a century. When chemistry had matured enough to allow its concepts and methods to be applied to issues outside of chemistry itself, as well as when pharmacology had established itself as a distinct scientific field, drug research as we know it today had its start Protein structure determination has been substantially facilitated by advancements in structural biology, notably in nuclear magnetic resonance spectroscopy, robotic crystallisation, cryogenic crystal handling, x-ray crystallography, and high-speed computation.

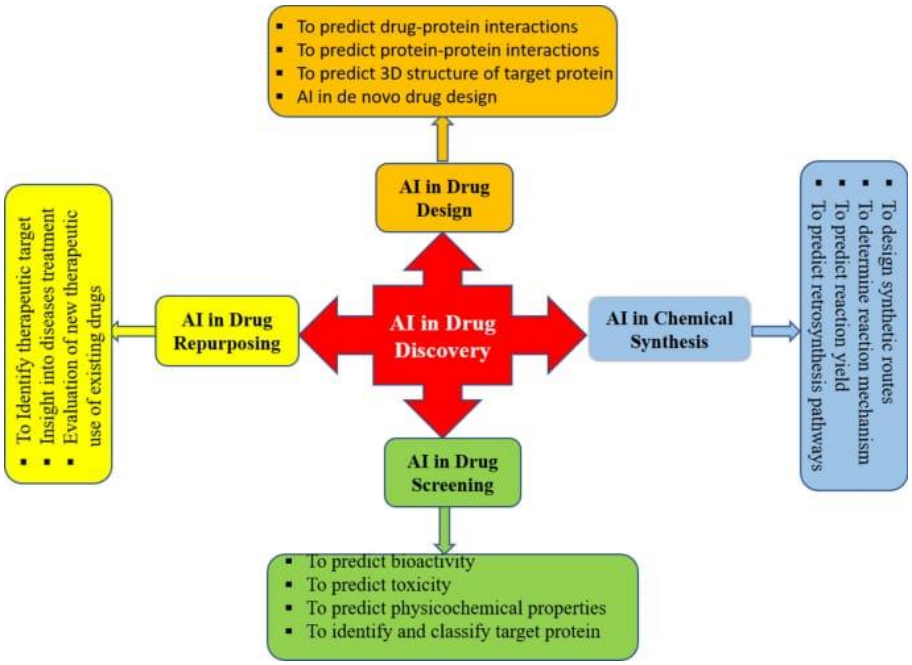


**Fig. no. 03**

**Drug screening** - The pharmaceutical business devotes a lot of time and money to the development of new drugs. The drug discovery industry is currently faced with the challenge of developing a process that is efficient in terms of time and money and covers the target identification and validation of new therapeutic targets, as well as the research of hit and lead molecules that could be used as therapeutic agents in clinical treatments.[1,2] there are several types of drug screening methods utilized in the drug discovery process, here are a few commonly used approaches.

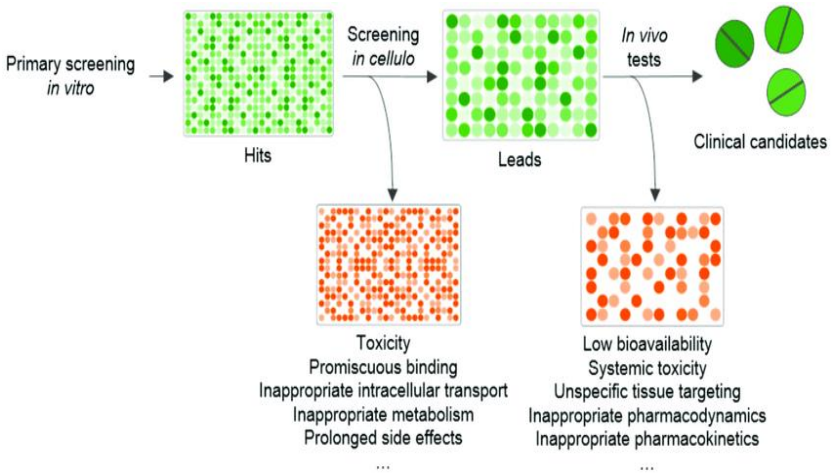


**Fig. no. 4**

1) **Hight throughput Screenini (HTS):-** HTS involves the rapid screening of large chemical libraries against a specific target using automated robotic system.It allow for the testing of thousand to millions of compounds in a short period.
2) **Virtual screening:-** Virtual screening involves the use of computer algorithms and molecular modeling techniques to screen large databases of chemical compounds. Virtual screening helps prioritize potential drug candidates for experimental testing
3) **Phenotypic screening:-** Phenotypic screening assesses the effects of compounds on whole cells, tissues, or organism than targeting specific molecular interactions. This approach is particularly useful when the target is unknown or complex
4) **Fragment-based screening:-** fragment based screening involves testing smaller chemical fragments or building blocks against a target of interest. These fragments are typically smaller and less complex than traditional drug molecules

**Drug design:-** Simon originally examined the nature of human reasoning before developing the idea of constrained rationality, particularly in unstable circumstances where alternatives can't be pre-listed but must be gradually produced. The company's primary managerial focus is on minimising risks and achieving a high chance of success at the lowest possible cost. The evaluation of the two projects and the scouting process shows that more comprehensive design processes lead to clear ideas about target cells or therapeutic candidates, not the starting point of drug discovery procedures. In accordance with other research, our study contends that despite the inherent uncertainty, learning processes must be invested in if new traits are to be explored: "Even though the risk of failure is increased, firms should constantly explore new lands." The benefit is the knowledge gained, which will pave the road for future achievement.

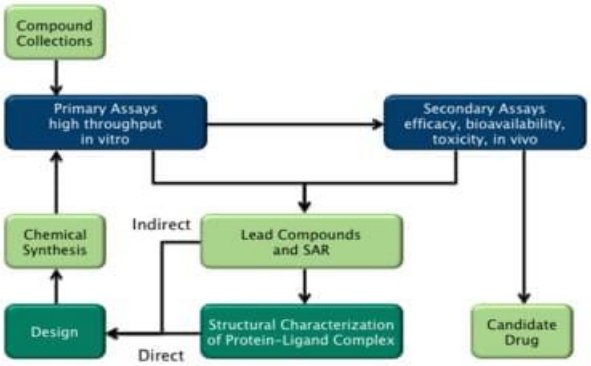


**Fig. no. 5**

**Drug repurposing:-** By reducing the significant financial and time-related expenses and hazards involved with traditional drug discovery, drug repurposing has the potential to complement the discovery of new uses for already-existing molecules. With a failure rate of about 45% related to toxicity or safety issues. also known as drug repositioning or drug reprofiling, refers to the process of identifying new therapeutic uses for existing drug that are already approved or in advanced stages of development for a different indication. instead of starting from scratch with a new compound, drug repurposing aims to leverage existing drug known safety profiles. The pharmaceutical sector has shown increasing interest in drug repurposing due to several advantage it offers over traditional drug dilevery.

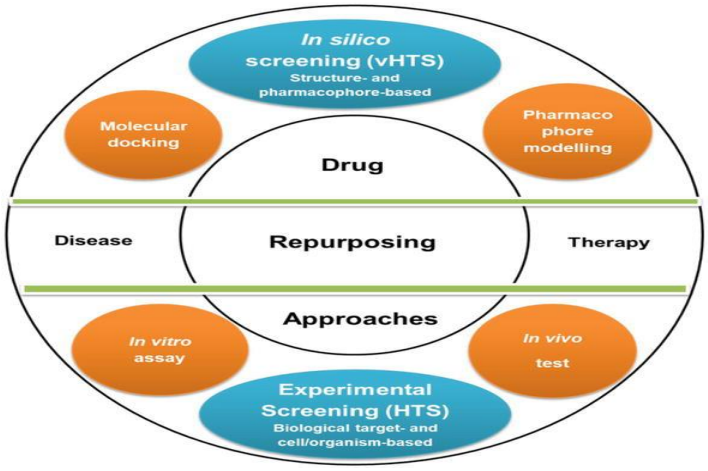


**Fig. no. 6**

1) **Reduced cost and Time:-** Repurposing existing drug can be significantly faster and more cost effective compared to developing new chemical entities. The initial stages of drug development such as safety testing formulation development.
2) **Known safety profiles:-** Since repurposed drug have already been tested I humans for their original indications, their safety profiles are better understood compared to newly developed drug.
3) **Diversification of revenue streams:-** Repurposing existing drug can help pharmaceutical companies extend the lifecycle and profitability of their products.by identifying new therapeutic applications, they can generate additional revenue from drugs that may be approaching the end of their patent protection period.

**Polypharmacology:-** The "one drug, one target, one disease" philosophy was a cornerstone of drug development for many years. Numerous clinical investigations on licenced pharmaceuticals show that this presumption is a very constrained perspective of how drugs function. Contrarily, the most potent pharmaceutical components engage in several target interactions in pharmacologically relevant concentrations. The emerging area of pharmacological science that deals with these issues is called polypharmacology. Recognising a tiny chemical compound's off-target actions is the goal of polypharmacology. The interaction between polypharmacology and chemogenomics is very strong.

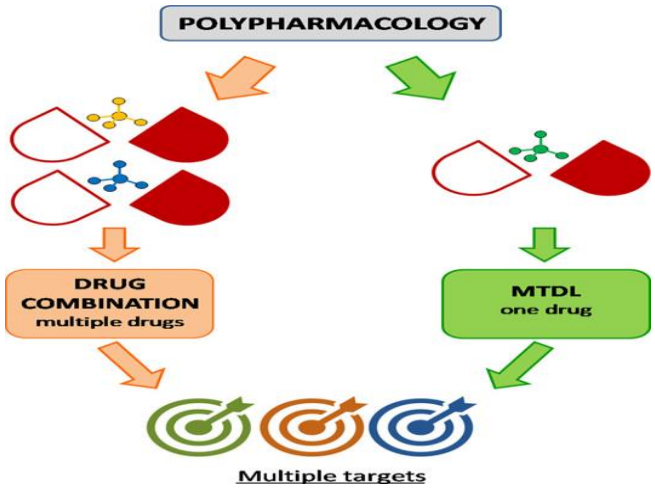


**Fig. no. 7**

**Pharmaceutical product development:-** The crucial characteristics for pharmaceutical development are determined by the active pharmaceutical ingredient's (API) physico-chemical and pharmacological properties. The goals of the QbD product development programme are to meet desired patient needs and identify qualities that a drug product should have in order to have the intended therapeutic effect .A series of scale-ups are used in pharmaceutical product development and manufacture today, commencing with modest amounts of material for preliminary safety or clinical tests and progressing to a manufacturing facility to produce commercial quantities. Development of pharmaceutical products differs. Pharmaceutical product development typically has to continuously focus on making the supplies required for clinical trials rather than on developing long-term robust manufacturing processes due to the importance of ensuring an adequate supply of clinical trial materials in a timely manner, uncertainty of product approvals, and resource limitations in the development groups.

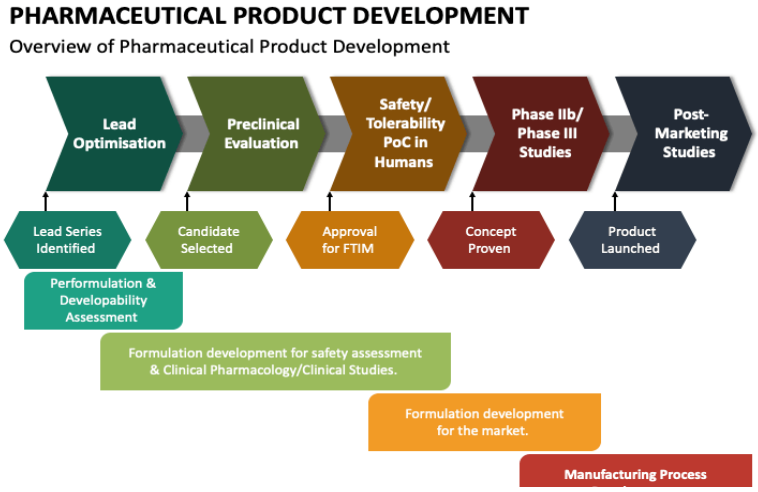


**Fig. no. 8**

- **Nanorobots drug delivery:-** A possible approach to addressing this issue is the drug delivery system based on nano carriers. Nanotechnology application can increase medication solubility, alter drug distribution in diverse tissues and organs, modify release rate to provide sustained release and controlled release profiles, and encourage drug aggregation in its target. These advantages have led to substantial research into nanodrug delivery methods. Even though there have been numerous scientific studies and reports on nanodrugs, only few have entered clinical trials, and even fewer have been authorised. The fundamental purpose of industrial robots is to automate dangerous and predictable macroscale developed liabilities, whereas therapeutic robot devices were created specifically for disease diagnosis and management. Therefore, unlike traditional (old) robots that function through enormous mechanical systems, therapeutic robots increase repeatability in the human body while using fewer portions and insolent resources for intricate tasks. With the help of technological developments including the integration of control theory, motors, components, and medical imaging, medical robotics has made impressive progress, as seen by the increase in surgeon-patient acceptance.

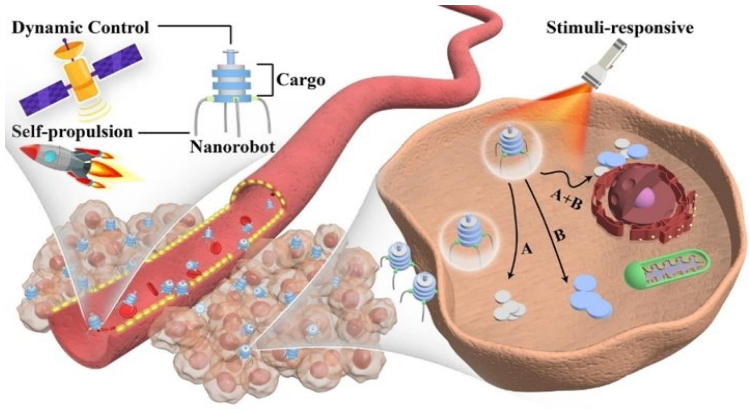


**Fig. no. 9**

- **Controlled insulin release:-** Diabetes, a chronic condition marked by insufficient insulin production or inefficient insulin use that results in a buildup of blood glucose levels, has a serious negative impact on a person's quality of life and even poses a threat to life. Although the standard treatment, which involves multiple daily insulin injections and regular blood glucose monitoring, can control the glucose concentration to a normal level, its main drawback is the challenging real-time adjustment of the insulin dosage depending on patients experiencing frequent and unanticipated fluctuations in blood glucose. Insulin release is primarily regulated by the pancreas, specifically the beta cells located in the islets of Langerhans. The release of insulin is crucial for regulation blood sugar levels in the body. Diet is Consuming a balanced diet that includes food with a low glycemic index can help regulate insulin release. Carbohydrate management is a monitoring and managing carbohydrate intake can help control insulin release. Reducing the consumption of simple carbohydrates, such as sugary drinks, white bread, and sweets can prevent excessive insulin spikes. A lot of research has gone into creating glucose-responsive polymer-based self-regulated insulin delivery systems.

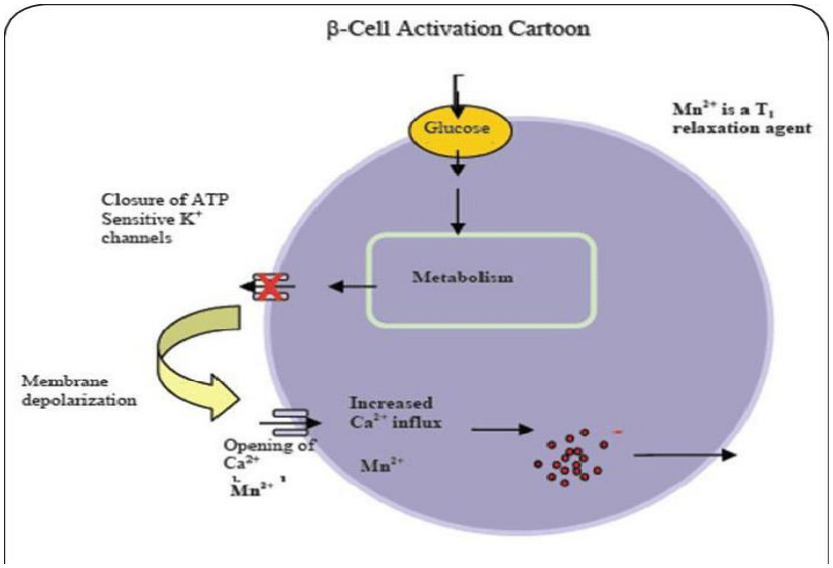


**Fig. no. 10**

- **Combination drug delivery:-** Using a carrier-mediated drug delivery system to administer two or more medications simultaneously, the combination system is predicted to produce synergistic anticancer benefits and reduce individual drug-related toxicity. While the majority of research efforts are concentrated on single agent delivery systems, this topic of delivering several medications using a single vehicle is still relatively unexplored. Therefore, we shall discuss carrier-mediated drug delivery systems here that contain a variety of anticancer medications for the treatment of cancer in general, not just metastatic breast cancer. Systems for medication delivery that use carriers rather than physical mixtures of many pharmaceuticals can have significant benefite. Additionally, a single delivery system that administers numerous medications on the same platform can result in synchronised and regulated pharmacokinetics for each medication, improving pharmacological efficacy. A single formulation can also increase solubility and bioavailability.

**Drug Synergism and Antagonism prediction:-** Drug Synergism and Antagonism prediction refer to the ability to predict the combined effects of multiple drug when used together either resulting in a greater effect. (synergism) or a reduced effect (antagonism) compared to using the drug individually. Predicting drug synergism or antagonism is a complex task that involves understanding the interactions between different drugs and their targets in the body. drug synergism and antagonism prediction involve assessing the combined effects of multiple drugs or compounds and determining whether their interaction result in enhanced or diminished therapeutic effects compared to the individual drug alone. Combining drugs may lessen side effects and boost treatment effectiveness, providing a potential approach to treating a variety of complicated disorders. However, due to the size of the combinatorial space, it is still difficult to find combinations that work.

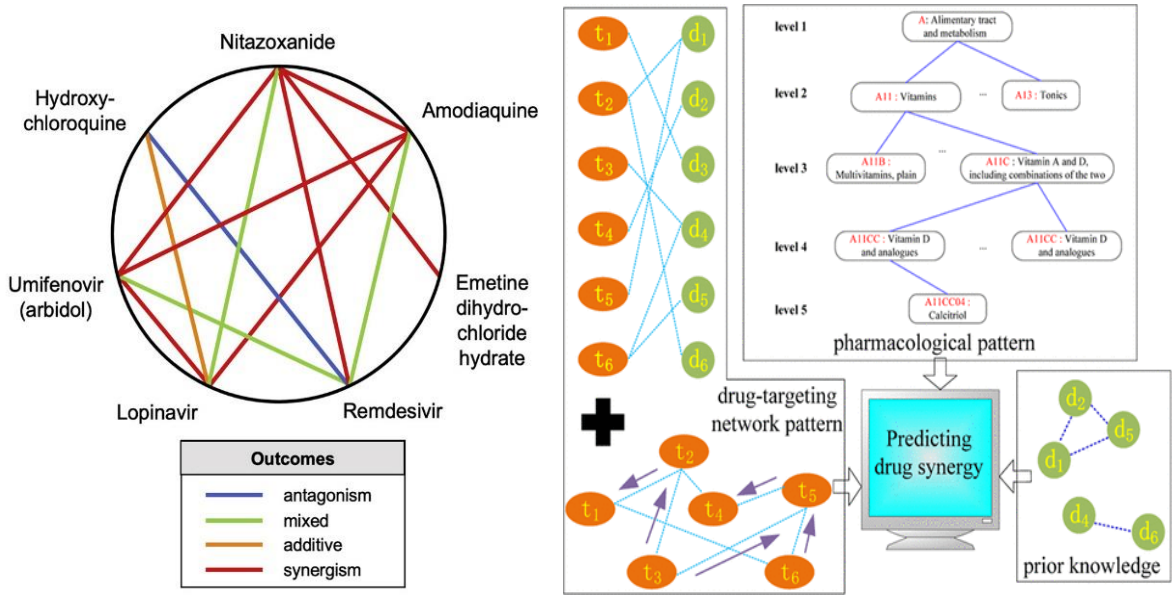


**Fig. no. 11**

***Medical diagnosis, Clinical diagnosis*:-** Along with technologies, certain clinical uses for nanodiagnostics are addressed. In this article, a few instances of the application of nanodiagnostics for the diagnosis of cancer, infections, and neurological illnesses are briefly discussed. A manual on nanomedicine has more thorough explanations. routine investigations Patients with CJD typically have normal cerebrospinal fluid (CSF) parameters (cell count, barrier function, and inflammatory reactions) in conventional examinations. A minor pleocytosis (between 5 and 11 cells/mm3) and mildly diminished brain-blood-barrier function are seen in 25% of cases in individuals with neuropathologically diagnosed CJD (n=148). The idea that basic science may play a crucial role in enabling the reconstruction of the relationship between signs/symptoms and diagnoses by giving these relationships meaning and, consequently, memory, is based on these first findings. In terms of the coherence of categories, theories of cognition support this argument. New alternatives for clinical diagnostic procedures are provided by nanomolecular diagnostics, the use of nanobiotechnology in molecular diagnostics, the use of various nanotechnologies, and their applications in the life sciences. There is presently no established classification system for nanodiagnostics, although a potential system comprising the major technological categories is provided in.

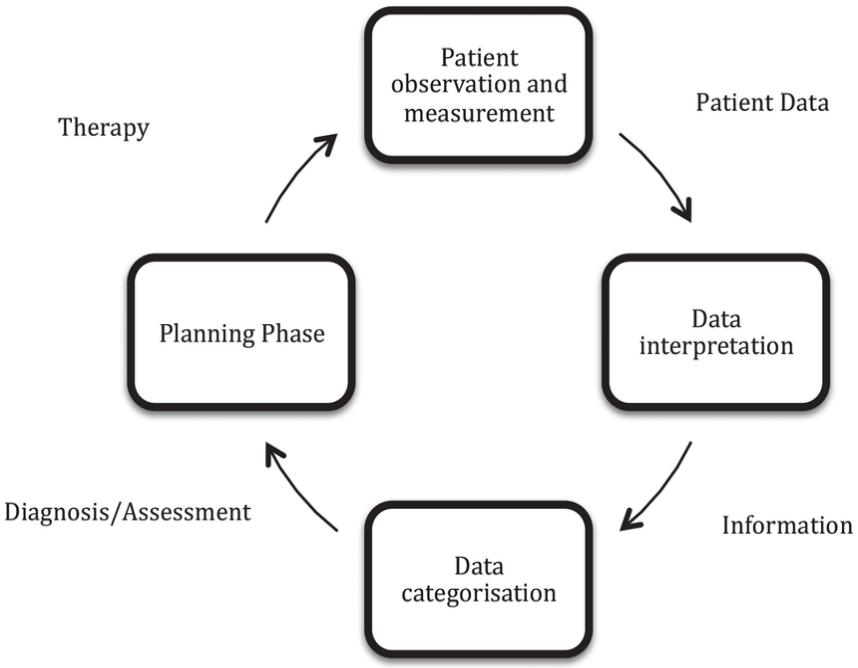


**Fig. no. 12**

***Research and Development (R & D)*:-** It is often believed that research and development (R&D) activities are challenging to finance in a market that is free from restrictions on competition. Although the idea itself was only hinted at by Schumpeter (1942), support for this position in the form of economic-theoretic modelling is easy to find and likely starts with the classic articles of Nelson (1959) and Arrow (1962). From the standpoint of investment theory, R&D differs from regular investment due to a variety of factors. First and foremost, the salaries and wages of highly qualified scientists and engineers account for at least 50% of R&D investment in practies. Their work builds the company's knowledge base, an intangible asset that will bring earnings in the coming years. This information is embedded in the human capital of the employees of the company to the extent that it is "tacit" rather than formalised, and is thus lost if they quit or get fired. Giving businesses extra cash exogenously and watching them spend it on investment, R&D, or giving it to shareholders is the ideal experiment for determining the effects of liquidity constraints on investment.

**Quality Control and Quality assurance (QC and QA):-** One of the most crucial components of any study is quality control because the reliability of the findings is largely dependent on the calibre of the data gathered. Poorly gathered data with a lot of random noise reduce the power of a study and can lead to type II errors. The collecting of biassed data as a result of flawed tools or implementation mistakes that produces an inaccurate report of relationships is an even worse outcome. An even worse outcome is the gathering of biassed data as a result of flawed tools or mistakes in the application of the protocol, which results in an inaccurate report of relationships (type I error). The completeness and clarity of questionnaires, the interviewer's delivery, the precision of mechanical tools, and technicians' measurement techniques are only a few of the factors that can affect the quality of the data collected. quality assurance Even when procedures appear to be automated, evaluations of data generated at a reading centre or laboratory over time are important. Even though the laboratory employed normal processes and kept its Centres for Disease Control and Prevention certification during that time, one investigation (the Cardiovascular Health investigation) discovered that cholesterol levels had dramatically fluctuated over a 3-year period. In a another instance, researchers discovered that the hiring of a new reader at the reading centre caused some electrocardiography values to increase during the course of the study's first year (Mary Ann McBurnie, Department of Biostatistics, University of Washington, Seattle, WA, personal communication, 1996). Often, these kinds of issues can be immediately found using straightforward plots and graphs.


**Fig. no. 13**

**Pharmaceutical manufacturing:-** To guarantee a constant supply of high-quality pharmaceutical items in the USA, the Food and Drug Administration (FDA) supervises these products. The FDA's Pharmaceutical Quality for the 21st Century Initiative's goal in regulating the pharmaceutical manufacturing industry is to encourage a maximal.[1]

Contrary to other chemical process industries, the pharmaceutical production sector is in transformation, although overall processes—which are mostly batch in nature—remain comparatively inefficient and less understood.[2] Lack of adaptability, flexibility, and robustness in the pharmaceutical manufacturing industry could endanger public health since production facility failures that result in subpar products can cause medicine shortages.[3] Over the past few years, the pharmaceutical sector has increased its efforts to better understand processes, with a primary focus on raising product quality and decreasing costs in product development and manufacturing.[4] such as the FDA in the United States. One of the most significant changes in pharmaceutical production processes in recent years is the switch from batch mode to continuous mode1. Applying continuous manufacturing (CM) to the pharmaceutical sector has a number of advantages. First, CM can produce vast volumes of goods using the same machinery.[5]

In continuous manufacturing, the materials generated at each process step are continually delivered to the following phase for additional processing. Each processing step must consistently result in an intermediate material or finished product with acceptable properties. It might not be practical for continuous

manufacturing to extend the processing time of specific unit operations (such as synthesis, crystallisation, blending, drying, etc.) in order to attain the desired quality since it might interrupt unit operations farther down the production line. In order to provide proper process control and product quality, continuous production frequently demands a greater level of process design than batch manufacturing.[6]

The pharmaceutical sector is paying more attention to continuous manufacturing (CM) since it has the potential to significantly reduce production costs while raising product quality.[7]

Pharmaceutical procedures frequently include semi-continuous or continuous processing phases like tablet compression and milling, but these activities are started and stopped to mimic batch processing in other steps. These processes can more easily be carried out continuously, which can result in a product with a higher level of consistency.

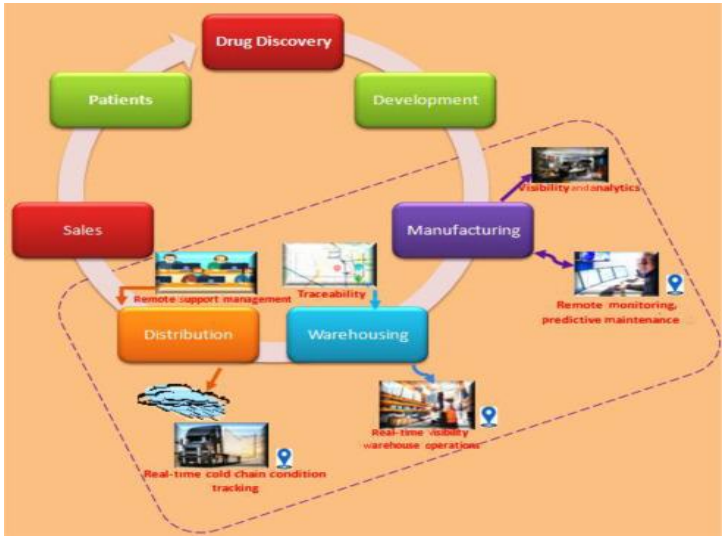


**Fig. no. 14**

**Clinical application:-**Proteinaceous substances called bacteriocins are made by bacteria and typically have bactericidal effects on other bacterial species.[1] The strains that produce bacteriocin have evolved a defence mechanism against their own bacteriocin. Each bacteriocin has a unique immune system, which is typically expressed simultaneously with the genes that make up the bacteriocin.

The most researched bacteriocins are those produced by Gram-positive bacteria. They combine to generate a diverse range of peptides and proteins. They can be effective against germs from different bacterial genera or only those from closely related species (limited spectrum). Although they are typically located on plasmids, their genetic determinants are typically organised in the form of operons and may be encoded on the bacterial chromosome.[2] Recommended changes to the classification of the bacteriocins made by Gram-positive bacteria to take into account information regarding the annual description of a variety of bacteriocins, some of which have unique properties. Based on theinformation currently available, Table 1 presents a classification scheme that combines both classifications with minimal adjustments. According to it, there are three basic classes of bacteriocins that Gram-positive bacteria can make, and each of these classes has subclasses.

Small peptide-based bacteriocins from classes I and II are more prevalent and have potential industrial uses.[3] Murein hydrolases—lysostaphin is an example of this class of enzymes—perform this. Murein hydrolases often have an N-terminal signal peptide before a second domain that houses the enzymatic activity.[17] Additionally, the N- or C-terminal side of the catalytic domain of these proteins is flanked by repetitive sequences

- **Radiology:-** Because volumetric imaging has greatly increased the number of images each case, the rapid rise of medical imaging has increased the demands on radiologists.

Additionally, radiologists are able to identify approximately 50,000 causal relationships and 20,000 diseases.

It may result in burnout, intra- and interreader variability, and diagnostic mistakes. Artificial intelligence (AI) has emerged as an appealing partner in this situation, one that may support case interpretation2, 3, and support different non-interpretive parts of the work in the radiological clinic. Although radiologists won't ultimately be replaced by AI, many in the field of radiology think that radiologists who use AI will.[4–7]


**Fig. no. 15**

- **Cardiology:-** The phrases "cardiology" and "cardia" are Greek words that mean "study of the heart" and "cardia," respectively. Cardiology is a field of medicine that deals with conditions affecting the heart, including congenital problems as well as acquired conditions including coronary artery disease and congestive heart failure. Cardiologists are doctors that specialise in cardiology and are in charge of managing various heart ailments medically. The doctors who undertake surgical operations to treat heart conditions are known as cardiac surgeons.

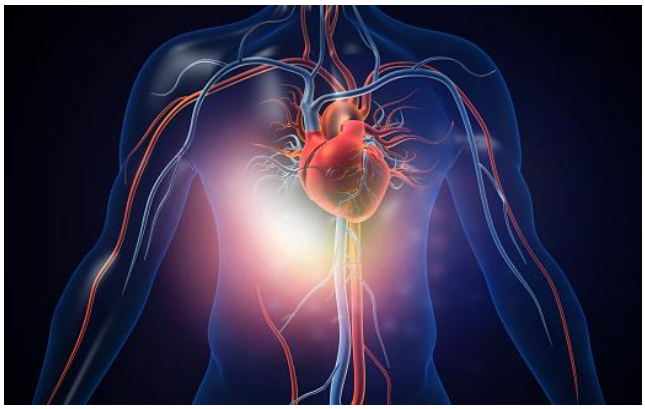

**Fig. no. 16**

**Fig. no. 17**

- **Gastroenterology:-** Gastroenterology is the study of conditions affecting the oesophagus, stomach, small intestine, colon, rectum, pancreas, gallbladder, bile ducts, and liver as well as their normal function. It requires a thorough understanding of the physiology of the gastrointestinal organs and their typical functions, which include the motility—or movement—of substances through the stomach and intestines, the digestion and absorption of nutrients into the body, the elimination of waste products from the system, and the role of the liver as a digestive organ. It comprises prevalent and

significant illnesses such hepatitis, gastric reflux disease, peptic ulcer disease, colitis, gallbladder and biliary tract disease, nutritional issues, irritable bowel syndrome (IBS), colon polyps, and cancer. In essence, the study of all normal activity and sickness of the digestive organs includes.

**Fig. no. 18**

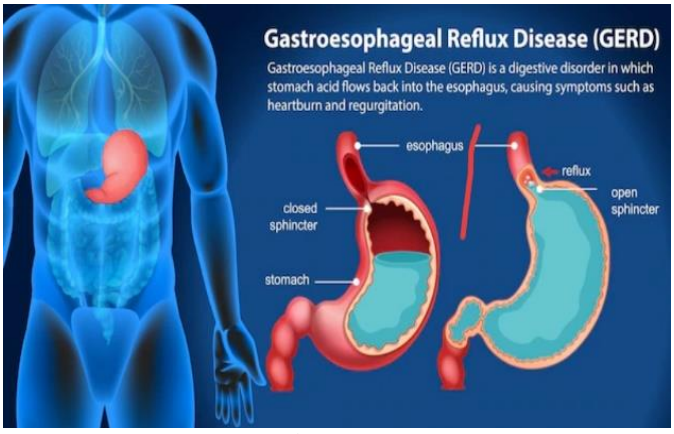


**Fig. no. 19**

- **Ophthalmology:-** A doctor who has completed specialist training in both medical and surgical eye care is called an ophthalmologist.

Ophthalmology specialists must do extra postgraduate residency training in that discipline after receiving their medical degrees. An integrated one-year internship that includes more comprehensive medical training in disciplines like internal medicine or general surgery may be part of this. A fellowship or extra specialisation training in a specific area of ocular pathology may be obtained after residency.

Ophthalmologists use laser therapy, do surgery when necessary, and prescribe drugs to treat conditions such eye disorders. Primary and specialised medical and surgical eye care are both offered by ophthalmologists.

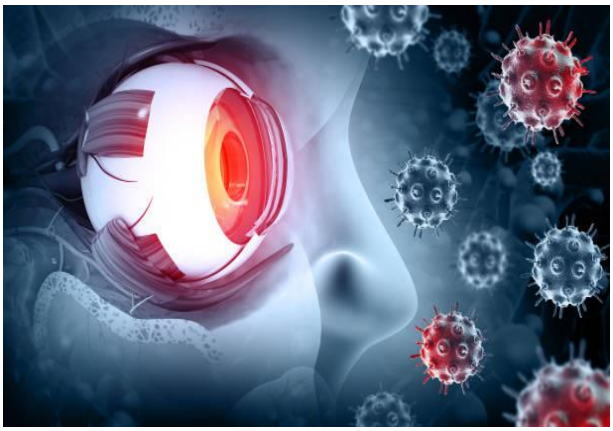

**Fig. no. 20**

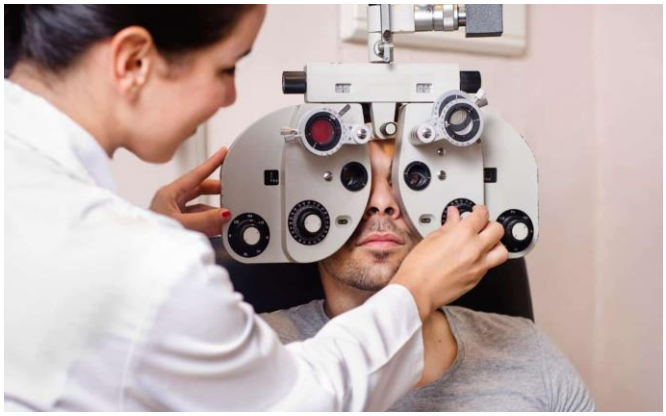

**Fig. no. 21**

- **Surgery:-** In order to investigate or treat pathological conditions like a disease or injury, alter bodily functions (for example, with bariatric surgery like the gastric bypass), improve appearance (cosmetic surgery), or remove/replace unwanted tissues (like body fat, glands, scars, or skin tags) or foreign bodies, surgery[a] uses manual and/or instrumental techniques to physically reach into a subject's body. Typically, the subject undergoing surgery is a person (i.e., a patient), though non-human animals can also be the topic (i.e., veterinary surgery).

**Fig. no. 22**

**Fig. no. 23**

**Drug prescription:-** In order to improve population-level health outcomes and halt the rise in health care costs in the US, the prevention and management of chronic disease are essential. Approximately 75% of outpatient clinic appointments at hospitals and doctors' offices involve medication use. The drug distribution process can be diverted at any step, from the original production facility to the wholesale distributor, the doctor's office, the retail drugstore, or even the patient. ptionDiversion can happen in a variety of ways, such as the unlawful sale of prescription drugs by doctors and "loose" chemists, "doctor shopping" in which patients visit multiple doctors to obtain multiple prescriptions, prescription theft, forgery, or modification, and prescription fraud. Thefts from retailers, distributors, and pharmacies; thefts of institutional drug supply; and thefts

by healthcare professionals and patients.

There aren't many descriptions of prescription drug use among elderly people in general.1-4 More knowledge regarding the patterns of prescription drug use among the elderly in the community, the causes of usage, and the severity of possible problems with prescription drug use are needed in order to improve the quality of drug therapy for these patients. According to reports5-7, 20% of older individuals had polypharmacy, which is characterised as the reported use of three, one, five, two, or six3 distinct medicines.

Age, the frequency of doctor visits, the number of illnesses and symptoms, and polypharmacy have all been linked. The level of healthcare use as well as the most common diagnoses in both primary care and hospital settings. Reporting on the extent of multiple drug use defined as the use of at least five distinct prescription medicines during 1994 as well as the factors related to multiple drug use was another goal.


**Fig. no. 24**

## CONCLUSION

The growth of AI and its amazing tools continuously seeks to lessen the difficulties that pharmaceutical businesses experience, affecting both the drug development process and the full lifetime of the product, which could lead. The importance of automation will increase as a result of the use of the most recent AI-based technologies, which will not only shorten the time it takes for products to reach the market but will also increase product quality, production process safety, and resource efficiency. Despite the fact that many of the novel approaches have yet to result in the development of pharmaceuticals for the market, early indications point to the possibility that they will play a greater role than has previously been the case in drug discovery. It has been demonstrated that the new systems can effectively design novel chemical structures, anticipate for the desired molecular property profiles, and even know how to synthesise those compounds through the use of new and promising approaches. Although several of these study fields have been promised repeatedly, a perfect storm of numerous advancements is now occurring as they all reach their pinnacle at once.

## REFRENCES

1. Insights F. AI and healthcare: a giant opportunity. Forbes. February, 2019; 11.
2. Chen JH, Asch SM. Machine learning and prediction in medicine—beyond the peak of inflated expectations. The New England journal of medicine, 2017; 6, 376(26): 2507.
3. Friedman CP. A "fundamental theorem" of biomedical informatics. Journal of the American Medical Informatics Association, 2009; 1, 16(2): 169-70.
4. Nelson SD, Walsh CG, Olsen CA, McLaughlin AJ, LeGrand JR, Schutz N, Lasko TA. Demystifying artificial intelligence in pharmacy. American Journal of Health-System Pharmacy, 2020; 1, 77(19): 1556-70.
5. Hamet P, Tremblay J. Artificial intelligence in medicine. Metabolism, 2017; 1, 69: S36-40.
6. Cornet G. Robot companions and ethics a pragmatic approach of ethical design. J Int Bioethique, 2013; 24(4): 49–58 [179-80].
7. Levin S (2018) Uber crash shows 'catastrophic failure' of self-driving technology, experts say, The Guardian, 2018; 22. https://www.theguardian.com/technology/2018/mar/22/self-driving-car-uber-death-womanfailure-fatal-crash-arizona
8. Chen, M.; Decary, M. Artificial intelligence in healthcare: An essential guide for health leaders. In Healthcare Management Forum; SAGE Publications: Los Angeles, CA, USA, 2020.
9. Toepper, M. Dissociating Normal Aging from Alzheimer's Disease: A View from Cognitive Neuroscience. J. Alzheimer's Dis, 2017; 57: 331–352. [CrossRef]
10. Okoli, C. A Guide to Conducting a Standalone Systematic Literature Review. Commun. Assoc. Inf. Syst, 2015; 37: 879–910. [CrossRef]
11. Madhav, N.; Oppenheim, B.; Gallivan, M.; Mulembakani, P.; Rubin, E.; Wolfe, N. *Pandemics: Risks, Impacts, and Mitigation. Disease Control Priorities: Improving Health and Reducing Poverty*,

3rd ed.; The International Bank for Reconstruction and Development/The World Bank: Washington, DC, USA, 2017; 9: 315–345.
12. OECD. *Artificial Intelligence in Society*; OECD: Paris, France, 2019.
13. Ab Wahab MN, Nefti-Meziani S, Atyabi A A comprehensive review of swarm optimization algorithms. PLoS ONE, 2015; 10(5): e0122827
14. Narvekar M, Fargose P Daily weather forecasting using artificial neural network. International Journal of Computer Applications, 2015; 121(22):9–13. https://doi.org/10.5120/21830-5088
15. J. Drews, in Quest of Tomorrow's Medicines (SpringerVerlag, New York, 1999.
16. St. K. Burley et al., Nature Genet, 1999; 23: 151.
17. Macarron, R.; Banks, M.N.; Bojanic, D.; Burns, D.J.; Cirovic, D.A.; Garyantes, T.; Green, D.V.; Hertzberg, R.P.; Janzen, W.P.; Paslay, J.W. Impact of high-throughput screening in biomedical research. Nat. Rev. Drug Discov. 2011, 10, 188–195. [Google Scholar] [CrossRef]
18. Vuignier, K.; Veuthey, J.-L.; Carrupt, P.-A.; Schappler, J. Global analytical strategy to measure drug–plasma protein interactions: From high-throughput to in-depth analysis. Drug Discov. Today, 2013; 18: 1030–1034. [Google Scholar] [CrossRef]
19. Simon, H.A. Decision Making and Problem Solving, Research Briefing. National Academy Press, Washington, DC, 1986.
20. Moulin, A.M. Le dernier langage de la médecine, P.U.F., Paris, 1991.
21. Ashburn TT, Thor KB Drug repositioning: identifying anddeveloping new uses for existing drugs. Nat Rev Drug Discov, 2004; 3: 673–683.
22. Sams-Dodd F. Target-based drug discovery: is something wrong? Drug Discov. Today, 2005; 10(2): 139–147.
23. ICH. *The International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use, Quality Guideline Q6A Specifications: Test Procedures and Acceptance Criteria for New Drug Substances and New Drug Products: Chemical Substances*, 1999. Oct, [Last cited on 2009 Aug 10]. Available from: http://www.ich.org/fileadmin/Public_Web_Site/ICH_Products/Guidelines/Quality/Q6A/Step4/Q6Astep4.pdf
24. Basu PK. Pharmaceutical process development is different. Chem Eng Prog, 1998; 94: 75–82.
25. Sharma, M.; Pandey, C.; Sharma, N.; Kamal, M.A.; Sayeed, U.; Akhtar, S. Cancer Nanotechnology-An Excursion on Drug Delivery Systems. Anti-Cancer Agents Med. Chem, 2019; 18: 2078–2092. [Google Scholar] [CrossRef] [PubMed]
26. Farjadian, F.; Ghasemi, A.; Gohari, O.; Roointan, A.; Karimi, M.; Hamblin, M.R. Nanopharmaceuticals and nanomedicines currently on the market: Challenges and opportunities. Nanomedicine, 2019; 14: 93–126. [Google Scholar] [CrossRef] [PubMed]
27. Estape R. Robotic surgery: single-site robotic surgery in gynecology. Berlin: Springer, 2021.
28. McCormack, J. G. Med. Chem. Res, 2001; 10: 480−492.
29. Home, P. Diabetes Metab, 2003; 29: 101−109.
30. P. Edman, E. Bjoerk, L. Ryden, J. Controlled Release, 1992; 21: 165–172.
31. A. Jemal, R. Siegel, J. Xu, and E. Ward, "Cancer statistics, 2010," CA Cancer Journal for Clinicians, 2010; 60, 5: 277–300.
32. F. Greco, M. J. Vicent, S. Gee et al., "Investigating the mechanism of enhanced cytotoxicity of HPMA copolymerDox-AGM in breast cancer cells," Journal of Controlled Release, 2007; 117, 1: 28–39.
33. B. Al-Lazikani, U. Banerji, and P. Workman, "Combinatorial drug therapy for cancer in the post-genomic era," Nature biotechnology, 2012; 30, 7: 679.
34. Jain KK. A Handbook of Nanomedicine. Tatowa, NJ: Springer Bioscience/Humana Press, 2007. (in press).
35. Jacobi C, Zerr I, Arlt S, Schröter A, Otto M, Poser S. Cerebrospinal fluid pattern in patients with definite Creutzfeldt-Jakob disease. J Neurol, 2000; 247(3): III/14.(Google Scholar)
36. Patel VL, Evans DA, Groen GJ. Biomedical knowledge and clinical reasoning. In Evans DA, Patel VL, eds. Cognitive Science in Medicine. Cambridge: MIT Press, 1988; 53–112.
37. Aghion, Phillippe, and Patrick Bolton. An Incomplete Contracts Approach to Financial Contracting," Review of Economic Studies, 1992; 77: 338-401.
38. Bond, Stephen, Dietmar Harhoff, and John Van Reenen. "Investment, R&D, and Financial Constraints in Britain and Germany," London: Institute of Fiscal Studies Working, 1999; 99: 5.
39. Bass, B.M., & Avolio, B.J. Training and development of transformational leadership: Looking to 1992 and beyond. European Journal of Industrial Training, 1990; 14: 21–27.
40. Dischinger P, DuChene AG. Quality control aspects of blood pressure measurements in the Multiple Risk Factor Intervention Trial. Control Clin Trials, 1986; 7(3): 137S-57S.
41. Keltner JL, Johnson CA, Beck RW, et al. Quality control functions of the Visual Field Reading Center (VFRC) for the Optic Neuritis Treatment Trial (ONTT). Control Clin Trials, 1993; 14: 143-59.
42. Cooper GR, Haff AC, Widdowson GM, et al. Quality control in the MRFIT local screening and clinic laboratory. Control Clin Trials, 1986; 7(3): 158S-65S.
43. U.S. Pharmaceutical CGMPs for the Century - A Risk-Based Approach. Maryland: Food and Drug Administration, 2004; 21.
44. Myerson AS, Krumme M, Nasr M, Thomas H, Braatz RD. Controlsystems engineering in

continuous pharmaceutical manufacturing May 2014 continuous manufacturing symposium. J PharmSci, 2014; 20–21. doi:10.1002/jps.24311
45. Ierapetritou M, Reklaitis G, Muzzio F. Perspectives on continuous manufacturing of powder-based pharmaceutical processes. AIChE Journal, 2016; 62(6): 1846-1862.
46. Allison G, Cain YT, Cooney C, et al. Regulatory and quality considerations for continuous manufacturing. May 20–21, 2014 Continuous Manufacturing Symposium. Journal of pharmaceutical sciences, 2015; 104(3): 803-812.
47. U.S. Guidance for Industry: Q7A good manufacturing practice guid- ance for active pharmaceutical ingredients. Maryland: Food and Drug Administration, 2001.
48. Plumb, K. Continuous Processing in the Pharmaceutical Industry: Changing the Mind Set. Chem. Eng. Res. Des, 2005; 83: 730–738.
49. Thomas, H. The Reality of Continuous Processing. Manuf. Chem, 2005.
50. Centers for Disease Control and Prevention. Therapeutic drug use. https://www.cdc.gov/nchs/fastats/drug-use-therapeutic. htm. Accessed May, 2017; 28.
51. Weathermon RA. Controlled substances diversion: Who attempts it and how. US Pharm, 1999; 24(12): 32–47.
52. Chandra A, Ozturk A. Health professionals beware of prescription pain medication abuse and diversion. Hosp Top, 2004; 82(4): 34–7.
53. Anderson G, Kerluke K. Distribution of prescription drug exposures in the elderly: description and implications. J Clin Epidemiol, 1996; 49: 929- 35.
54. Enlund H, Martikainen J, Turakka H, Nissinen A. The use of prescription drugs among elderly Finnish men. J Clin Pharm Ther , 1990; 15: 115- 22.
55. Heng, N.C.K.; Wescombe, P.A., Burton, J.P.; Jack, R.W.; Tagg, J.R. The diversity of bacteriocins in Gram-positive bacteria. In Bacteriocins: Ecology and Evolution; Riley, M.A.; Chavan, M.A., Eds, Springer: New York, NY, USA, 2007; 45–92.
56. Nissen-Meyer, J.; Rogne, P.; Oppegård, C.; Haugen, H.S.; Kristiansen, P.E. Structure-function relationships of the non-lanthionine-containing peptide (class II) bacteriocins produced by Gram-positive bacteria. Curr. Pharm. Biotechnol, 2009; 10: 10–37.