

# Advance Applications of Nanotechnology in Medicine

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**Abstract:** The various nanoparticles have been used for positive effect on human health. A large number of the medical projects are under emergent stage. Nanotechnology-based nanomedicine means tools and device are technically designed in such a way which can interact at the molecular level and enhance the therapeutic index of drugs with no side effect. It poses a broad range of application in drug delivery, protein detection, robotics, cancer and cardiac therapy, etc. which are described in detail. Treatment and diagnosis of cancer have been restricted due to their poor sensitivity and specificity respectively. Nanotechnology-based cancer treatment is being developed used for diagnostic purpose. Cancer chemotherapeutic drug is possessed high toxic potential cause adverse effect to the body. For example- hair loss, weight loss and reduce urine and sugar formation. By using nanotechnology, enhance the therapeutic index of cancer chemotherapeutic drug, their tolerability, and efficacy and suppress their toxic effect. It also enhances pharmacokinetics, pharmacodynamics as well as bioavailability and provides better safety profile. In this review, other modalities of different aspects are being discussed such as potential hazards of nanoparticle in addition to microbivores and nanosome, etc. Urothelial cancer is cancer occur in the urinary bladder. Various kinds of nanoparticle are being used in diagnosis and treatment of urothelial cancer. In this review, discuss the types of course of treatment and nanoparticle used in the treatment of various kinds of disease. It is based on the stage of urothelial cancer. In this reviewed we have summarized the pharmaceutical application of Chitosan-based nanoparticle. Chitosan is derived from chitin are used as the pharmaceutical carrier for many drugs and vaccines. Being already observed the benefit of nanomedicine-based products. Hence, in this review, we have discussed the fundamental characteristic of nanomedicine and its clinical application in the field of medicine.

**Key Words:** Chitosan, Quantum Dot, Fullerenes, Dendrimer, Nano Bubble, Nano Shell etc.



## Introduction

Nanomedicine is the most active developing area of Nanotechnology (Wang et al., 2014). Due to their unique size property make it more superior and essential in the various field of applied nonmaterial (Salata, 2004). It delivers a valuable set of biomedical tools and research devices (Koprowski, 2014). Therefore, it can provide a possibility to use for biomedical research and its application (Kuo, 2011). For example- Drug Delivery, Tissue Engineering, Robotic, etc. (Agarwal, 2012). Commonly, nanotechnology based on Top-down approach (Rocci, 2008). In it, we can reduce the size of atom and molecule into nano forms (Sajanlal et al., 2011). Hence, their quantum and mechanical property get change due to their small size (Issa et al., 2013). Nanomedicine mainly used for the diagnostic purpose (Riehemann et al., 2009). It provides high safety profile and better prognosis (Navez et al., 2015). It is accurate and highly sensitive (Ida et al., 2013). Nanotechnology-based nanomedicine involves how to improve the life of human which is affected with the disease such as Cancer, HIV, Alzheimer's and Diabetes (Saha, 2009). By using biomedical tools, it is possible to apply therapy at the molecular level

(Khan and Lal, 2003). Nanotechnology is used in the field of tissue engineering, protein detection, drug delivery, robotics, DNA engineering, urothelial cancer treatment, gene therapy, in medicine, etc. (Fakruddin). Various biological tools have been developed (Hossain and Afroz, 2012). For example - Carbon nanotube, Quantum dot, Nanopores, fullerene, etc. (Sundelin and Lang, 2014). Incorporating fluorescent agents along with nanoparticle (Longmire et al., 2008). They emit fluorescence by absorbing a particular wavelength of light (Ahmed et al., 2013). Hence, we can monitor the exact location of the drug in vivo (Tremoleda et al., 2012). Interestingly, more than two dozen clinical nano products are approved by FDA (Onoue et al., 2014). Still the various safety platforms of nanomedicine are not completely defined (Wang et al., 2013). Researchers designed safe and more efficient multifunctional nanomedicine which is cell and tissue specific (Park, 2016). Its unique size, physicochemical and quantum properties make it more attractive (Tavakoli et al., 2015). Significant advancement and achievement can be achieved in nanomedicine if controlled the toxic effect and specificity (Fakruddin et al., 2012). Nano can transform and revolutionize almost all the area of society and industries like pharmaceutical and agriculture etc. (Ravichandran, 2010). Lots of money invested by governments in nanotechnology research because it possesses the ability to construct new materials and devices having a vast range of significant (Mansoori and Soelaiman, 2005).

### **Application of Nanotechnology in Tissue Engineering**

In Tissue Engineering, a highly porous extracellular material scaffold is used for the growth and regeneration of mammalian tissue (Hosseinkhani and Hosseinkhani, 2009). Tissue engineering is an emerging field of engineering, medicine and material science (Bao et al., 2007). It is totally concentrated how to enhance, create and replace tissue and organ function which are unhealthy (Ventola, 2014). It is successful may replace artificial implantation and organ transplantation (Bao et al., 2011). To improve the life of million patient's, regulating and maintaining cell function and activity (Guan et al., 2013). Virus-like nanoparticle successfully used in the treatment of tumour (Chen et al., 2008). Scaffolds established specific microenvironment inside the tissue (Xu et al., 2015). A cell which is present in the tissue is surrounded by extracellular matrix (ECM) (Fuchs, 2011). It plays important role in activating, depositing and rescue biological factors i.e.- cell-cell interaction (Antonio et al., 2014). ECM is successfully involved in the regeneration of tissue (Kopp et al., 2012). Recently designed microenvironment at nanoscale having an analogue to ECM (Geckil et al., 2010). It has been used to control growth factor (Dexter and Heyworth, 1994). It directly regulates the cellular behaviour at the level of cell adhesion and gene expression (McKeown et al., 2013). Nobel kind of scaffold which control cellular interaction and organisation, lack ability to oxygen and nitrogen dispense (Boyden et al., 2014). It shows vital role in tissue development (Massé and Dale, 2012). Drug delivery includes lipid-based carrier formulation (Antonio et al., 2014). Several anticancerous drug has been used in the treatment of Kaposi's sarcoma and breast cancer (Aslan et al., 2014). Surface modified liposome are hydrophilic polymers derived from polyethylene glycol (Nag and Awasthi, 2013). It is rapidly engulfed mononuclear phagocytic system (Suntres, 2011). It involves vastly clearance from circulation as well as increase half-life of blood (Longmire et al., 2012). If the surface of artificial bone which is implanted are smooth that reduce the contact of bone (Kuzyk and Schemitsch, 2011). As a result, rejection of implantation by the body (Nusselt et al., 2010). Due to the smooth muscles layer covered the surface of implant producing fibrous connective tissue (Oshida et al., 2010). Recently developed, nano-sized particles by knee prosthesis. It will decrease the chance of rejection and enhance the production of osteoblasts (Saghiri et al., 2015). It is responsible for the growth of bone matrix and is present in developing

bone surface (Clarke, 2008). A real bone mainly composed of collagen is a nanocomposite material (Bhowmick et al., 2013). It is mechanically tough which can protect from mechanical damage by tissue engineering (Kock et al., 2012). Titanium is a bone repairing material used in orthopedics and dentistry (Navarro et al., 2008). It can tolerate deficit bioactivity (Zhang et al., 2015). But not support growth as well as cell attachment (Needels et al., 1987). Hence, the various technique has been applied to produce apatite coatings on titanium (Sekhon, 2010). It can also tolerate low mechanical strength and severe attachment (Bose et al., 2013). An artificial hybrid material had been developed from ceramic NP(15-18). Poly copolymer possesses healing behavior involved in the coating on the surface of the tooth (Salata O.V, 2004).

#### **Application of Chitosan-based nanoparticles-**

Multifunction nanoparticles can be applied in the treatment of cancer (Lee, Kopelman 2012). Example: -isothiocyanate conjugated with glycol chitosan nanoparticles (Hou et al., 2011). It is labelled as fluorescence having box used as the carrier (Rastogi et al., 2014). It is right drug to malignant tissue showing them to malignant tissue showing the precise position of tumour cell (Aljabali et al., 2013). As a result, clearance of malignant tissue by radionuclide imaging (Aljabali et al., 2013). Chitosan nanoparticles used as a vehicle (Miller and O'Doherty, 1992). DNA vaccine, as well as small molecular weight drug, are natural polysaccharide derived from N-deacetylation of chitin (Kafshgari et al., 2015). It is prepared by cross-linking, ionic-gelation, chemically modified chitosan, emulsion-droplet coalescence and reverse micellar method (Bahreini et al., 2014). In mouse, Chitosan hydrogel nanotechnology used for the transfer of biomaterial into the inner surface of the ear (Venkatesan et al., 2014). It is used as the model organism (Davis, 2000). It crosses the round window membrane (RWM) (Gan et al., 2013). It will reach to the scale media present in the inner layer of the ear (Elliott and Shera, 2012). Labelled liposomal nanoparticles are incorporated into chitosan-based hydrogel (Thoniyot et al., 2015). Hydrogel release these liposomal nanoparticles into a perilymphatic system (Lajud et al., 2015). Chitosan has derived from the carrier which controlled transportation of agrochemicals and genetic material (Sekhon, 2014). It acts as a protective reservoir (Yasinskii, 2004). It protects and controls the surrounding environment ingredients and also the active ingredients (Coelho et al., 2010). Chitosan nanoparticle-based delivery system applicable in plant transformation (Wang et al., 1995). It also protects the environment by a pesticide. It poses a significant progress in the area of agriculture and medical science (Kang and Kim, 2015).

#### **In Respiratory Disease**

In the US, every year has been reported about 220,000 individuals are suffered from lung cancer (Damalas and Eleftherohorinos, 2011). In which, 85% are affected with Non-Small Cell Lung Carcinoma [NSCLC] (Highsmith, 2013). The remaining are affected with Small Cell Lung Carcinoma [SCLC] (Molina et al., 2008). Commonly, chemotherapy has been used in lung cancer treatment (Cutillas et al., 2001). It is injected through intravenously and circulate throughout the Bin (Seo et al., 2015). It involves the destruction of the cancerous cell. Example- Cisplatin and Carboplatin (Chin et al., 2007). Photodynamic therapy [PDT] and gene therapy are used against lung cancer (Tripathy and Oelmüller, 2012). It is photosensitized react with molecular oxygen (Schmitt et al., 2014). As a result, production of reactive oxygen species-activated by laser light (DeLong and Burkhar, 2007). It is often destructed the cancerous cell with chemotherapy (Paranjpe and Goymann, 2014). In lung cancer treatment, liposome used as the transportation system for gene and drugs (Kreuter et al., 2007). Cisplatin has been used in lung cancer treatment (Ravaioli et al., 2009). Lipoplatin have also been used in lung cancer treatment (Ravaioli et al., 2009). Lipoplatin reduce the toxic effect of Cisplatin and is also reduce

the neurotoxicity (Pereira et al., 2014). Paclitaxel widely used for lung treatment associated with the liposomal vehicle (Huo et al., 2012). It enhances the therapeutic efficacy of drugs. It is reducing the nephrotoxicity in NSCLC patient (Khan S.A, 2007). It does improve not only the primary tumour but also protective against metastasis (Golubnitschaja et al., 2015). Oral drug delivery has been not applicable in lung cancer treatment (Bhattacharyya et al., 2012). Due to the lack ability to penetrate lung tumour sites. Gold and silver particle play a vital role in it (BeiBei et al., 2011). Gold particle depends on biosensor system (Ramgir, 2013). A sensor can discriminate between SCLC and NSCLC (Kondo et al., 2003). It enhances therapeutic effectiveness (Testa and Kräme, 2009). Example- Methotrexate has severe tumour retention because of increase water solubility (Turner et al., 2015). Therefore, it associated with Gold particle and increases the therapeutic effect as well as retention capacity (Oliveira et al., 2013).

### **In Robotics;-**

Robotics like nanotechnology used for programming specific purpose and task. It is a programming machine (Pineda et al., 2015). The main purpose of nanorobotics is a modification of microscopic instruments (Fukuda et al., 2013). Hence, it concerns with construction and manipulation of materials at the nanoscale (Stefan Johansson, 2015). It is 0.5-3 micron larger than 1-100 nm (Li1 et al., 2013). It was first discovered by Richard Feynman in "There's plenty of room at the Bottom" in 1959. (Ge et al., 2014). A modified nanomachine applies to cure skin disease (Dattilo et al., 2015). It is also used in the killing of pathogenic organisms like bacteria, fungi and cancerous cells (deWit and Kumagai, 2014). It is also applicable to mouthwash space station, in mining, medicine and agricultural operation (Tarikh). The application of such technology is endless (Wan et al., 2012). Nanosensor and nano activator derived from Nano Electro Mechanical System [NEM] are used for locomotion and activity of nanorobotics (Cavalcanti et al., 2005). Nanorobotics device is the sensor that detects toxic chemical and suppresses the toxic effect of chemical (Ardebili, 2011). Nanorobotics is the little car derived from chemical process passes nano infrastructure (Ardebili K.N, 2011). It control and regulate the environmental temperature (Brück). Nubot is derived from "Nucleic acid robot" (Marshall D). It plays a vital role in the detection of blood cell and DNA structure (Noguez et al., 1993). Magnetic nanoparticle plays the significant important role in the field of robotics used as Robotic agents (Jain, 2010). Robotics involves modification of new functionalities in robotic agents (Nagrath et al., 2015). By addition, Nano components aimed to maintain physiologic environments inside the body (Jong and Borm, 2008). By using nanorobotics, 99% human-like biological robot have been the possibility to be constructed (Urban, 2015). It plays a vital role in the production of the robot by using nanoparticle (Korayem et al., 2014). Nanobots, nanites, nanometers and monoids are a nanorobotic device (Tate et al., 2015). Microscopic robots automatically move into the body (Prokopenk, 2014). It also involved in surgery and used as drug delivery (Bhushan).

### **In DNA engineering**

Designing the nucleotide of DNA molecule to modified the secondary and tertiary structure of DNA (Jabbari et al., 2015). It also changed shape, gene expression level and the property of gene product (Halfon et al., 2014). These biomolecule is having a broad range of application in the field of manufacturing and production of chemical component (North et al., 2014). It is applied in developing of biomolecules (Gonçalves et al., 2014). Nano-based biomolecular engineering control the genetic manipulation, exist in the genome (Schiffer). In Bio- molecular design modified the protein, DNA, RNA and lipid to improve their property and function (Zhou et al., 2012). Example- cell signalling and growth kinetic etc. (Chowdhury and Sarkar, 2015). It is



involved in the modification of gene responsible for protein production as well disease (Kumari and Usdin, 2009). Example-cancer, AIDS and arteriosclerosis (Ellis C.N, 2010).

### **In Biochip**

Biochip having a broad range of spectrum in computational analysis, sample preparation, treatment as well as in data- mining (Ahram and Petricoin, 2008). It contains biomolecule fixed in microwells (Some, 2013). It inserted into the body for transferring data (Baiotto and Marini, 2006). It detects physiological and biological changes occur after transferring (Facciotti et al., 2010). Biochips are either DNA, protein or carbohydrate (Morvan et al., 2012). Protein chip has also been prepared by using nanoparticles (Wang et al., 2005). Protein is a building block of cellular life and act as the essential nutrient (Liao et al., 2015). Recently, Protein chip is using by two companies such as Agilent, Inc and Nano link, Inc (Fakruddin et al., 2012). It is prepared by small protein molecules or chemical groups of protein (Zdyrko et al., 2009). It binds to the motif region of the protein and play a vital role in disease diagnosis (Sunda et al., 2015). Agilent applied inkjet programming at the nanoscale for the development of microarray by using c DNA and oligo probe (Li et al., 2008). Nano-ink based on Dip Pen Nanolithography[DPN] used for detection of protein structure at the nanoscale (Fakruddin et al., 2012). It also detects the expression of a gene (Kadota et al., 2006). Ink get a chemical-mediated deprotection step (Miller and Y, 2009). The aim of the microarray is to detect expression of hundred and thousands of gene (Tarca et al., 2006).

### **Application**

Imaging biological molecule in-vivo and having long-durable photostability (Pantazis et al., 2010).

### **Quantum dot**

It is highly sensitive and specialized nanocrystal (Khandare et al.,2015). It is used for biomedical operation such as breast cancer, prostate cancer and gastrointestinal cancer (Tu and Lin ).It enhanced the permeability of antibody by using NIR [Near Infra Red].It prevents deep penetration of rays (Amara).It emits fluorescence in the presence of light (Tropea et al., 2007).It is used to diagnose and treatment of tumor because it emits light by absorbing a particular wavelength of light (Breskey et al., 2013).Hence, we can monitor the exact position of drug and tumor.It posses upgrade strength and stability (McCann). Hence, it is used as the drug carrier (Yao et al.,2012).Quantum dot derived from semiconductor materials (Sheng et al., 2012).It is small, tiny and showing fluorescence property (Pan et al., 2013).It poses band gaps (Bhushan, 2007).The size of quantum dot determines the frequency of emitted light (Scholes and Rumbles).If the size of QDots is small, enhance the frequency of emitted light and vice versa. QDots are crystalline nanoparticle having a diameter of 2-10nm whereas self-assembled QDots having 5-50 nm in diameter (Kalele et al., 2006).It is based on quantum mechanical principle. It having high electrical property and electron confined in small space (Hasan et al.,2013).On nanotube induces the efficacy of immunological response, vaccine and diagnostic method. Example: -ELISA(Sin et al., 2014).It is used in gene transfer by DNA attaching to the tip of the nanotube (Zhang et al., 2011).It maybe Single-walled carbon nanotube [SWCNT], Double walled carbon nanotube [DWCNT] or Multiwalled carbon nanotube [MWCNT], discovered in 1991(Susi et al., 2015). It is used as drug vehicle (Meng et al., 2015).i.e.- Peptide and nucleic acid transport inside the cell labeled with fluorescent dye emit fluorescence in the presence of light (Salipalli et al.,2014).Amphotericin B Nanotube used for fungal strain (Surendiran et al., 2009).Carbon nanotubes with the non-conducting polymer are also may detect protein by using electrochemical spectroscopy (Sharma et al., 2012).Accurate imprinting sensors have been

developed derived from E7 protein for human papillomavirus (Sharma et al., 2012). This ultrasensitive electrochemical reorganization of protein based on bimolecular reorganization (Mashaghi et al., 2014). CNT are the strongest, light and an extremely conductive material having a diameter ranging from 1-50nm (Sarangdevot and Sonigara, 2015). It can be successfully inhaled and quickly adopted by skin (Freischlag and Orion, 2014). Hence, it launched a safe product on the market which is economically beneficial to the life of human (Reisch et al., ). It becomes almost free from side effect. Nanotubes are derived from carbon called as Graphene, a modified semiconductor (Monajjemi and Lee ). It is a cylindrical wall with hollow structure modified with tight and thick sheets of carbonate (Lai et al.,). The electronic property is much more affected by the structure of nanotube (Saifuddin et al., 2013). It is influenced by curvature and shape of the nanotube (Saifuddin et al., 2013). It is a single dimensional semiconductor having electric current density is  $4 \times 10^9$  A/cm<sup>2</sup> (Mao, 2013). The electronic property is thousand times higher than copper metal (Choi and D.W, 2014). It is safe and useful thermal conductor, transmit  $385 \text{ w-m-1k}^{-1}$  (Smallwood et al., 2001). Estimated thermal stability of CNT is up to 2800 oC in a vacuum and 750 oC in air (Shiren Wang, 2006). It can cross the biological membrane and reaches to the different part of an organ like kidney, liver (Scheepens et al., 2010). It causes harmful side effect and cell death (Souza et al., 2006). It possesses the ability to produce several inflammatory response and fibrosis (Linthout et al., 2014). CNT involves the removal of catalyst and maintains the structure of CNT (Saifuddin et al., 2012). It plays an important role in tissue engineering (Chan and Leong, 2008). It provide the frame for the growth and development of bone and also for micro-fabrication techniques (Burdick and Novakovic, 2009). It is also applicable to a polymer to improve the thermal and mechanical properties of an unorganized portion and biodegradable nanocomposite (Sarkar and Lee ). It leads a significant role in muscle, nerve tissue and cartilage. It provides protection to DNA by oxidation process (PACHER et al., 2007). It is also applicable in the field of chemical analysis and cell squeezing (Pakkanen et al., 2011). It is used in textile industry to improve and to modify physical and mechanical properties of fabrics (Perepelkin, 2005). Poly PMAS (2-methoxyaniline five sulfonic acids) or PMAS-SWNT enhance the quality of materials. CNT associated with sulphur and iron increasing porosity (Amin et al., 2014). It will increase the absorption of engine oil, vegetable oil and water contaminants like pesticides and insecticides (Rashed M.N). It is eco-friendly does not release any pollution in the environment (Crighton et al., 2013). Due to the large surface area of CNT enhance the absorbance capacity of organic and inorganic molecule present in contaminated water (Amin et al., 2014).

### **Application**

Researchers injected CNT inside the skin to detect the nitric oxide concentration in the blood (XiaoJing and Zhuang, 2012). It monitored the inflammatory disease (Castele et al., 2014).

### **Fullerenes**

Fullerenes are also known as ‘Buckyball’ was discovered in 1985 (Castellini et al., 2006). Its structure show resemblance with the ball used in football (Schein and Gayed, 2014). Hence, it is called as ‘Buckyball’ (Xu et al., 2013). It is derived from carbon (Rashidi et al., 2014). It is having the capacity to cross the biological membrane (Fiedler et al., 2014). It ranges from 7A0 in diameter (Shirahata et al., 2015). It posses arrangement of carbon atom called as Truncated icosahedrons (Robert et al., ). It is small, hydrophobic and possess electronic configuration used in medical chemistry (Wilson and Arkin, 2010). C60 are possessed electrochemical, physiological property used in medical science (Ding et al., 2015). It is used as a radical scavenger and involved in the cleavage of DNA (Zeng et al., 2015). It involves majorly in drug

delivery and gene transferring (Zhang et al., 2015). It readily interacts with the surface of living organisms (Viitala et al., ).It's the structure similar to the structure of biological molecule such as protein (Shibuya et al., 2010).Fullerenes possess antiviral, antibacterial and antioxidant activity used in HIV infection therapy (Thakral and Mehta, 2006).It provides protective immunity against mitochondrial infection by inducing the production of free radicals (Lobo et al., 2010).It is a highly purified used for diagnostic purpose. i.e.- in a case of ELISA (Berrizbeitia et al., 2012).It is stronger than diamond and possess high electrical and heat resistant property (Sarangdevot and Sonigara, 2015).C60 fullerene associated with thyroglobulin produced concrete and specialized immune response (Saptarshi et al., 2013).It is applied in cancer therapy during photosensitization (Ismail et al., 1990).

### **Nanobubbles**

It releases free radicals (Kalra et al.,1990).It has a broad range of significant in many fields of science, engineering and technology (Donges and Nol, 2014).For example: - like water purification, biodegradation of pesticide and insecticide. Potential of nanobubbles provide key for the production and fabrication route to nanomaterial (Diez,2010).It possesses unique optical, electrical, biological, chemical and magnetic property (Chey et al., 2013).

### **Nanoshell**

It is the dielectric core composed of a gold shell (Levin et al., 2009).The aim of nanoshell is that creating and synthesizing of material with different morphology i.e. wire, rod and tube (Yuan and Müller, 2010).It involves in enhancing the properties of the biosensor, drug delivery, luminescence and chemical stability of colloidal substance (Wolfbeis, 2015).Gold nanoshell applicable for the therapeutic purpose (Jonathan et al., 2012).It diagnoses the immunoglobulin in plasma and blood about nanogram per milliliter (Segeja et al., 2010).It had the ability to cross the blood immunoassay (Johnston et al.,2015). It is used in cancer, diabetes and tumor therapy by immunoassay method using infrared (Sharma et al., 2014). It is embedded in hydrogel polymer (Henríquez et al., 2014). After absorbing the particular wavelength of light, polymer start to melt (Yousif and Haddad, 2013).Hence, drug release in tumor tissue and reduce + (Riva et al., 2011). Nanoshell is discovered by West and Halas, Rice University (Hu et al., 2008). It is highly stable (Lan et al., 2015). So, it is used in the insulator and dielectric material like silica (Sharma and Gupta, 2015). Silica is chemically inert, water-soluble as well as optically transparent (Wolfbeis, 2015). It was made by Naomi.J.Halas and her team at Rice University in 2013 (Korolev, 2013). Nanoshell has mainly used for head and neck cancer treatment and its diagnosis (Abajo et al., 2014). Gold nanoshell has a binding site that gets attached to the cancerous cell(Jaishree and Gupta, 2012). It helps in the identification and treatment of cancer (Aguilar et al., 2001). It is possible due to plasmonic absorption and distribution (Lee et al.,2015). Gold nanoshell is engulfed by the cell membrane (Gong et al., 2015).It involved in the metabolism of cell and enzyme present within tumor cell (Streffer,1994).It enhances the permeability and retention factor (Maeda, 2002).It ranges from 10-200 nm (Peyruchaud and Mosher, 2000).It shows infrared absorption in the presence of NIR region of electromagnetic radiation (Wolfbeis, 2015).

### **Nanosome**

It is also called as Liposomes (Suntres, 2011). A droplet which applied on the surface of the skin as a lotion maintains effective moisture on skin than regular cream (Bhushan et al., 2012).It enhances the solubility of an active ingredient. For example vitamin (NANJWADE et al., 2011).It is encapsulated (Laha et al., 2009).It possesses 40% phosphatidylcholine (Simonato et al., 2011).It having non-antigenic property and are highly biodegradable (Akagi et al., 2012).Raoul Kopelman,s group at the University of Michigan, working on nanosome known as

PEBBLEs. It is mainly used for CNS tumor therapy. It is used for targeting and diagnosis disease (Croft et al., 2015).It can show photocatalytic activity (Ohtani, 2014).It involved in the damaging of the target cell and tissue, production of reactive O<sub>2</sub> species (Weidinger and Kozlov, 2015).It is safe and non-toxic, successfully used in Cancer chemotherapy (Patyar et al., 2010).

### **Healthcare**

Bone attach easily with titanium dioxide (Pitkin, 2013).It acts as anti-inflammatory drugs and inserted in the area of an implant and prevent inflammation (Parikh et al., 2014).CNT with labeled nitric oxide embedded in skin (Gruber et al., 2010).Sensor present on it (Tropea et al.,2007).

It is easily monitored the inflammatory disease (Scott and Lichtenstein, 2014).Artificial muscles with CNT associated with wax inserted in the injured region (Goldsmith, 2014).It tolerates 200 times higher weight than normal muscles (Dorner and Posthauer).Antibody-mediated nanotechnology are got a door with protein secreted by breast cancer cell (Jaishree and Gupta, 2012).It gets absorb this protein and involved in their destruction (Saburova et al.,2006).

### **In medicine**

Nanoparticle are engineered which are used in the treatment of diseased cell and reduce the damage to healthy cells (Wolfbeis, 2015).Researchers of Illinois University demonstrated the gelatin nanoparticle can be used for the treatment of damage brain tissue (Ahlberg, 2014).For example:- Nan sponges are coated by RBC membrane move freely in bloodstream and absorb toxin (Liao et al.,2013). Nanocrystalline silver act as antimicrobial agent used for the treatment of wounds (Dai et al.,2010). Accurate nano-based drug delivery reduce the side effect and enhance the bioavailability (Santos et al., 2015).Hence, avoid consumption of higher doses (Jones, 1997). Nano device implanted inside the body (Bhushan, 2007).Hence, its sensitivity and efficacy get enhance (Kasabov, 2013).It prevents tissue damage by reducing rate of clearance and decrease toxic effect on non-target tissue (Bernt et al., 2003).

### **In drug delivery**

Liposome act as carrier of drugs and protein for the treatment of disease (Torchilin). A large number of the organic and inorganic molecule have been used as drug delivery vehicle (Chan, 2009).We can accelerate the activity of therapeutic by decreasing immunogenicity and upgrade hydrophobic drugs solubility (Kalepu and Nekkanti, 2015). Hence, management frequency and the toxic effect will be reduced (Amichot et al.,). By using nanotechnology, nano-based drugs have successfully transferred to their target tissue (Oliveira et al.,2013). Drug delivery system involved improving pharmacokinetics, pharmacodynamics and bioavailability of nanomedicine (Junghanns and Müller, 2008). It also regulate tissue damaging and enhance the solubility of drugs by controlling drug release and its distribution as well as their clearance rates (Liang et al.,2010).

### **Paramagnetic nanoparticle**

It is rare oxide and hydroxide produced by MRI agents (Tsuzuki, 2012).Gadolinium hydroxide possess T(1) & T(2) relaxation based on proton exchanging between the surface of particle and water known as Inner sphere relaxation (Vuong et al., 2012).It is also applicable for diagnostic purpose. It identified specific tissue and organ used in magnetic resonance imaging (Padhani et al.,2009). Leuschner et al. discovered in the vivo reorganization of breast cancer cell by paramagnetic labeled with HER-2/neu antibody (McCarthy et al.,).Antibody direct the nanoparticle to remove and destruct the cancer cells. It is used for monitoring prostate-specific antigen (Connor et al.,).

### **Dendrimer**



Dendrimer-based delivery system able to cross the cellular barrier (Beg et al., 2011). It is safe and free from toxic effect (Anand et al., 2008). It is applicable for Biomedicine and pharmaceutical operation (Jaberidoost et al., 2015). It is an emerging field of nanotechnology (Ravichandran). A dendrimer is the circular shaped polymeric molecule (Johnson et al., 2008). Example -Nylon and plastic both possess well-defined structure and is easily uptake by the cellular cell, derived from acrylic acid and diamine (Isikgor and Becer, 2015). Michigan nanotechnology Institute for Medical and biological science, firstly use Dendrimer (Kelly et al., 2008). A dendrimer is derived from Greek word "Dendron" means tree and suffix "mer" means segment (Pachisia, 2014). It is recognize and diagnose the disease state (Antonio et al., 2014). Multifunctional dendrimer used in cancer and tumor treatment, attaching fluorescent detecting molecule init (Liu et al., 2011). Its size ranging from 1-10nm (Sharma and Kakkar, 2015). Due to their unique size, shape and physiological properties used in drug delivery and many other diagnostic purpose (Agnihotri et al., 2014). About 40% drug delivery manufactured by pharma industry (Longmire et al., 2008). It have been eliminated low permeability of cell membrane, water solubility and also reduce bioavailability (Poindexter et al., 2007). It is showing the side effect when it reaches to the other parts of body (Kent, 2007). PAMAM poly [Dendrimer of poly] based on nanoparticle are successful involved in drug delivery by formulation the physical and chemical properties of drug (Kini and Nandeesh, 2003). It is used in antiviral, antifungal, antibacterial and anticancer therapy as well as in vaccine production (Donio et al., 2013). Gene delivery are under processing state (Kim et al., 2013). It is having better future prospectus for pharmaceutical and biomedical science (Fakruddin et al., 2012). Poly[amidoamine] is also called as PAMAM derived from ammonia[NH<sub>3</sub>] or ethylenediamine[C<sub>2</sub>H<sub>8</sub>N<sub>2</sub>] attached with amino group[R-NH<sub>2</sub>] and also amide group[-CONH<sub>2</sub>R] (Fakruddin et al., 2012). Dendrimer is also called Artificial protein (Yavuz et al.,). It is because their most property show resemblance with protein due to their will defined structure, synthesis and dimmetric property (Antonio et al., 2014). It soluble in organic solvent (Niftrik and Jetten). It will upgrade the hydrophobic activity of molecule (Voronov et al., 2002). Its immunogenic and non toxic property influence the rate of versatility, biocompatibility, biodistribution and bioavailability of many drugs (Aqil et al., 2013). It will enhance the permeability of drugs, possess effective therapeutic effect (Karande, Mitragotri, 2009). It is widely used in pulmonary disease therapy (Mapel and Roberts, 2012). Commonly it is taken orally (Anand et al., 2008). Drug and dendrimers are interact with each other by electrostatic bond, by electrostatic interaction and encapsulation (Markowicz et al., 2012). PAMAM used as nano carrier drugs for coming year (Vidal and Guzman, 2015). It is administered via various route and required low dose with effective therapeutic effect (Younger et al., 2014). 3 dimension structure of many dendrimer have been determined by molecular dynamics (Kanchi et al., 2015). Tecto Dendrimers are the most complex from dendrimer, branched size of dendrimer are under controlled condition (Abbasi et al., 2014). It is used in gene therapy (Giacca). Desired gene are insert inside the cell by endocytosis reaches to nucleus where transcription of gene takes place (Kamimura et al., 2010). It provide viral vector for the transferring of gene to brain and breast cancer therapy (McCrudden C.M and McCarthy H.O, 2014). US-FDA on July 2013, give clearance to dendrimer based drug act as antiretroviral, successfully applied in HIV infection treatment (Lawrence R and Jeyakumar E, 2013). Dendrimer based drug posses antibacterial activity against Pseudomonas and Streptococcus aureus (Silva et al., 2014). Dendrimers with hydrophobic surface have successfully used renal and liver clearance (Aslan et al., 2013).

### **In Gene Therapy:-**

It is applied for the treatment of monogenic hereditary or disease generated by integrative or non-integrative vector (Kaufmann et al., 2013). It involved to the transfer of therapeutic gene (Boyd, 1998). Integrative vectors are modified vector that introduced therapeutic transgene into target cell genome (Bernal, 2013). Whereas non-integrative vector, the therapeutic transgene that not expressed in target cell (Bouard et al., 2009). In gene delivery, probably immunogenic viral vector (Alhakamy et al., 2012). Nanoparticles based less immunogenic viral vector are successfully introduced nano sized gene in host cell (Sharma, 2013). As a result, repairing and removal of the defective gene (Krupa et al., 2011). Gene therapy is an advanced approach (Fajac et al., 2001). It is used for diagnosis and treatment of many genetic disorder like diabetes mellitus, cystic fibrosis, breast cancer, down syndrome, autism, alpha-1 antitrypsin deficiency, cri du chat, colon cancer etc (Bevec et al., 2009). It is caused by alternation in the set of gene, number of chromosome and position of chromosome (Guilherme et al., 2015). Nano gene therapy is used for transferring DNA inside cell membrane (Ira et al., 2003). This is because naked DNA not able cross the cell membrane, which are negatively charged (Wyrozumska et al., 2006). Gene therapy tried to used liposome in the treatment of liver disorder like hepa titis A,B,C,D, and E, Wilson's disease, cirrhosis and fascioliasis (Ahmad and Ahmad, 2012). Niu et al worm, gene of human insulin in chitosan nanoparticles (Rinaudo, 2015). It is used for transferring in STZ diabetic rat by gastrointestinal tract (Zhao et al., 2013). As a result, decrease glucose level and increase insulin level (Korićanac et al., 2004). Expression of insulin mRNA are used in study of rat morphology and physiology (Perrot and Funkenstein, 1999). It helps in the development of new and advance therapy for Type 1 diabetes mellitus (Danne et al., 2007). In Northwestern University and Argonne National Laboratory designed "Hybrid nano device". It posses titanium dioxide, a semiconductor nanoparticles (Gupta and Tripathi, 2011). It covalently attached to the oligonucleotide DNA (Boutorine et al., 2000). This sequence helps the transferring of nano device inside the nucleus (Akita et al., 2005). In the presence of X ray, TiO<sub>2</sub> catalyst endonuclease activity of Nucleic acid (Flett et al., 2015). It cleaves the DNA to a specific nucleotide sequence which have been used in treatment of malignant (Mylykangas et al.,). Viral vector based nanoparticles transferring mammalian nervous system that will reduce the toxicity (Martínez et al., 2011). As a result, increase the efficacy of transfection (Hashemi et al., 2012). It also increase blood brain barrier and effective in the treatment of brain cancer (Bhowmik et al., 2015). It will kills the brain cancerous cell and enhance the life cycle of animal (Hu and Fu, 2012). Recently, nanoparticle during surgery transferred in brain but not directly for the treatment of glioma (Seekell et al., 2013). It play vital role in it (Trivieri, Anderson, 2013). They are under processing state (Johnson, 1973). This technique enhance the transfection and show excellent transfection level (Smith et al., 2005). Carbon nanotubes used as non-viral agents of drug delivery (Liu et al., 2011). In this phenomenon magnetic nanotube consisting Nickel labelled with DNA (Mendes et al., 2013). Therefore, magnetic field and angle present between magnetic flux and cell membrane (Pashut et al., 2011). As a result, particles moves towards the membrane and than enter into cytoplasm (Yaron et al., 2011). Cell viability become unaffected and approx 100% transfection level occur in Bal-17 B lymphoma cell (Mok et al., 2013). It will increase the efficacy of cell fusion (Tan et al., 2013). Gene therapy are widely successful used in retina and phase 1 clinical trial (Jacques et al., 2013). In which transport (PEDF) pigment epithelium-derived factor through AAV to patient's eye for detection of age-related macular degeneration (AMD) (Holz et al., 2014). Therefore suppression occur in case of neurogenesis, retinal degenerative disease (Quin et al., 2013). Modified HIV vector are

successfully used to conserve some function of retina (Marconi et al., 2000). AAV vector used during gene delivery for inflammatory response and expression of transgene (Wang et al., 2014).

#### **In Cardiac and Pharmaceutical Therapy:-**

Heart is a pumping set of blood (Thiriet, 2014). People who have suffered with heart attack or any kinds of cardiac disease used heart transplantation or surgery (Pincott and Burch, 2011). By using nanotechnology, developed Gold mediated heart patch (Rahman et al., 2013). Cell which are present in it, all beat at exact time (Hersch et al., 2013). Major problem is that, heart is a conductive organ and scaffold used for are non-conductive (Ahadian et al., 2013). Therefore, tissue cannot contract as heart tissue (Yuan et al., 2011). Tal Deir and Brain Timko headed by Daniel Kohane developed tiny gold wires inside patches. It will increase the electrical conductivity (Dhanaraj et al., 2010). It also enhancing the communication between cardiac cells and contraction cells (Souders et al., 2009). As a result, coupling of electricity (Feng and Lan, 2012). Periostin and neuregulin increase and improve heart regeneration and heart function (Steinhauser and Lee, 2011). It directly injected into heart, studying in mice (Laakmann et al., 2013). Angiotensin 1 type 1 reflector, release large amount after the heart attack (Qian et al., 2008). It will injected near the infarcted region of cardiac (Yeghiazarians et al., 2009). It binds heart tissue which are scarred (Weber, 2003). It release factor bind system cell of planet (Betney et al., 2010). It discriminate in cell of heart muscle and blood vessel that would better benefited after heart attack (Chamuleau et al., 2009). Stem cell therapy have been applied for improving heart attack (Chamuleau et al., 2009). In which, cell implanted inside the heart having ability to transformed into cardiac cell (Hong, Bolli, 2014). This property used in replacing, repairing of damaged and disease affected part of heart (Mari, 2006). During heart attack, injury occur in heart cells (Xiao, 2011). So that, patient go to MRI to detect the location in heart which are required to repairing (Saleem, 2014). New stem cell are implanted in affected region and further returned to MRI to detect the accurate implantation (Zhou et al., 2006). Jokerst had used silica nanoparticle for improvement the resolution of ultrasound (Khanal et al., 2015). Before transplantation, it insert into stem cell (Askling and Heiderscheit, 2014). It will track the location of injured region (Askling and Heiderscheit, 2014). Ultrasound frequency is much more higher than human ear frequency (Cunningham and Reichmuth, 2016). When the  $\lambda$  of these frequency is increased, it get reflect back (Träger, 2012). It measures with the help of specific instrument. So we can recognize the internal part of body (Rubik, 2012). There is no need of MRI because ultrasound shows the location (Hodgson and Grainger, 2012). Hence, it is time consuming and effective therapy (Tremoleda et al., 2011). Jokerst, also assembled nanoparticle with silica fluorescent dye and gadolinium and insert in stem cell (Srivastava and Bulte, 2014). Before implantation, MRI scanner shows the image of treatment. Nanomedicine helps in recognise individualmente which poses risk of heart disease (Cores et al., 2015). It able to prevent the heart attack (Kjekshus, 2001). The aim of nano based pharma is to improve the drug delivery (Gremião and Chorilli, 2015). To make and developed effective models against like cancer, aids, malaria, diabetes, etc (Sandoval and Cáceres, 2013). It is under processed and some are commercially available (Benesty et al., 2007). It involved in destruction of many dangerous disease (NAISH, 2012). In 20th century, thereby ending is much painful and suffering (Matthews, 2004).

#### **Application of Nanoparticles in Urothelial Cancer of the Urinary:-**

Bladder cancer is mainly occur the in epithelial lining of urinary bladder (Pasin et al., 2008). Therapeutic nanoparticles used for enhance therapeutic effect of drugs (Aslan et al., 2013). It is obtained by enhancing its durability and efficacy (Zhang et al., 2006). Researchers

designed safe, effective, multifunctional therapeutic nanoparticles used in drug delivery (Lohcharoenkal et al., 2014). It increased penetration of drugs into the injured region of urothelium because convention of drug delivery rate is too low (Burnstock, 2014). There are 73,510 individual had been diagnosed and 14,880 individual dead in US in 2012 (Xu et al., 2013). Cost of treatment is very high, 5th most extravagant treatment of malignancy (Nattinger et al., 2015). Transitional cell carcinoma (TCC), a type of bladder cancer in which indefinite growth of abnormal cells takes place (Pasin et al., 2008). Symptoms- painless hematuria and gross hematuria (85% of patient, urine colour from dark yellow to bright red or cola, abdominal pain) (Shah et al., 2015). It is a 4th most common disease in America and 5th in European males (Ajaikumar et al., 2008).

### **In Cancer Treatment:-**

A large number of liposomes, organic and inorganic molecules used as a drug delivery vehicle for the treatment of cancer therapy (Zhang et al., 2009). Last two decades, developed multifunctional nanoparticles (Vij, 2012). It target to cancerous cells and bind to the receptor present on the surface of cancerous cell (Bendas and Borsig, 2012). Decrease the toxic effect on normal tissue, which are located nearby tumor cells (Shamova et al., 2007). However, enhanced the efficacy of treatment (Buckway et al., 2014). Nanoparticles based chemotherapy is a advance therapy, cost-effective and have faster screening (Jain, 2010). It is safe and free from normal tissue damaging (Giardi et al., 2010). The aim of nanoparticles based cancer treatment is to increase efficacy, screening of drug and to improve life of several cancerous patient (Babu et al., 2013). According to National Institute of Health, in 2010 more than 1.5 million cases of cancer had been reported in US (Dey et al., 2012). Cancer is complex and highly destructive (Ahmad, 2013). The aim of nanoparticle based chemotherapy is to provide efficacious and early precision treatment (Antonio et al., 2014). It is free from side effects. In US, mortality rate is very high and it becomes slightly increase to worldwide level (Schneider and Chen, 2013). Cancer nanoparticles enhance personalized oncology in which treatment and identify molecular profile of patient (Chames et al., 2009). The therapeutic drugs associated with monoclonal antibody bind to antigen with receptor and damage tumor cell (Costello and Franklin, 2012). There is a minimal destruction of normal cell and tissue and is developed from several carcinogenic process (Seyfried and Shelton, 2010). It progress by tumor invasion self-sufficiency and metastasis (Koukis et al., 2013). Its treatment early on pathologic and clinical staging determined by using histopathologic and conventional radiological examination (Fang et al., 2015). Success of therapies based on express of target molecule act as cancer specific biomarker (Fang et al., 2015). Nanoparticle having ability to detect malignant cells and locate their position inside the body (Chinen et al., 2015). It also involved in the killing of cancerous cell with minimum damaging rate of normal cells (Hegyi et al., 2013). Laser treatment have been used for the destruction of malignant cell (Krieg et al., 2010). It produced atomic O<sub>2</sub> that is cytotoxic in nature (Mochalin et al., 2012). If it migrate into eye and skin, causes carcinogenic effect (Nordlund, 2013). To avoid this problem we can used ormosil nanoparticle (Salata, 2004). It trape the atomic O<sub>2</sub> and inhibit the migration in other parts of body (Kumar and Pandey, 2013).

### **In protein detection**

In recent year, it was discovered that iron oxide peroxidase and iron act as artificial inorganic peroxidase (Karigar et al., 2011). Nanoparticle is showing enhanced peroxidase activity as well as increase sensitivity to glucose (Wang et al., 2015). Glucose assumed as a model system; it releases H<sub>2</sub> peroxide indirectly after its oxidation (Gáspár). Protein is a building block of cellular life (Willingham, 2012). During DNA replication, it responds to various stimuli and



transportation of molecule from one place to another location (Morga and Bastin, 2013). Protein plays an important role in it (Geng et al., 2015). For identified protein-protein interaction, gold nanoparticle has been most widely used (Brun and Roselli, 2014). Raman scattering spectroscopy is commonly used for detection and identification of molecule (Kong et al., 2015). That means if the protein is present, that disrupts the interaction of polymers (Bouvier, and Koza, 2014). It is producing a well defined response of fluorescence pattern (Mesch et al., 2015). This pattern is characterized at the nanoscale for individual protein and discriminated by linear discriminant analysis (Chou et al., 2012). Nanotechnology has optical properties and produces quantum effects (Mochalin et al., 2012). For example: - In solution, Gold particles show deep red – black in color and melt at much lower temperature ~300°C (Engelbrekt et al., 2009). It is 2.5 nm in size (Dong et al., 2013).

### **In Microbivores**

Microbivores act as WBC in blood stream which trap the microbes present in blood (Manjunath and Kishore, 2014). During septicaemia, pathogenic microbes present in blood stream (Bullard and Dunn, 2001). It engulfs such microbes by phagocytosis and provides natural defense to the body against pathogenic infection (Rigby and DeLeo, 2012). It also enhances the specific immune response (Juknat et al., 2013). It could be applied in therapy of cerebrospinal fluid and meningitis (Cohen, 2001). It involves in the management of inflammatory cytokines without enhancing sepsis (Malik et al., 2012). In addition, it could be used to engulf bacterial biofilm at a rate of approximately 4 microns/minutes (Fuente et al., 2013). Bacterial infections are commonly found in tissue, mucous membrane of lung, digestive tract and gastrointestinal tract and act as antibacterial agents (Baron, 1996). During cases of bacteremia, viremia and fungemia, microbivores are involved in their killing and removal outside the body (Robert and Freitas, 2001). It was discovered by Robert A Freitas Jr. (Freitas, 2005). It is 3.4 microns long and 2 microns in width (Zhang, 2012). It would be 80 times more effective than WBC and about 1000 times faster than naturally occurring WBC (Cicarelli et al., 2013). The mission of Robert is to apply microbivores in mass fabrication, in medicine and pharmaceutical operations (Shrair, 2010).

### **Potential hazards of nanoparticle-**

Nanoparticles are able to cross the biological membrane due to their small size and reach different portions of the body (Alkilany and Murphy, 2010). Example:- Kidney, liver, brain etc via blood (Yi and Kabanov, 2013). It may be possible to cause destructive effects due to their highly toxic properties (Sharma et al., 2012). It depends on the chemical composition of the nanoparticle, reduced by modifying the surface of the nanoparticle (Kheshen et al., 2015). Example:- Nanotubes are nanometers in diameter and micrometers in length (Johansson, 2015). Researchers studying nanotechnology demonstrated that they are highly toxic in nature (Ray et al., 2009). It is able to cause harmful effects to the body when inhaled nanoparticles by respiratory, pulmonary and lung inflammation (Omlor et al., 2015). Charge of nanoparticles is highly effective than size (Bantz et al., 2014). Only negatively charged nanoparticles are able to cross the cell membrane (Cho et al., 2010). Nanoparticles used in drug delivery, vaccination and in gene delivery (Choi et al., 2014). Sometime, the surface of these particles is modified to avoid elimination by the immune system (Bogart et al., 2014). Nanoparticles are derived from metal, carbon, organic and inorganic molecules (Bakunin et al., 2004). They produce qualitative and quantitative products which are altered from their original state (Emec et al., 2015). Example:- Gold is stable at normal scale but at nano scale, it acts as a strong catalyst (Tao et al., 2008). Carbon nanotubes cause much more toxic effect than carbon black and quartz (Madani et al., 2013). Example:- Intestinal and peribronchial inflammation and epithelioid granuloma (Alpert et al., 2006). Radomski et al. studied in vitro

found that nanotube show proaggregatory effect and enhance thrombosis activity in rat (Fakruddin et al., 2012). It is also upgrade prothrombosis response (James et al., 2013). As a result, damaging of cell takes place (Elkind et al., ).

### **Regulation of nanotechnology**

Enhancing commercial application of nano products are regulated by United State Environment Protection Agency (Rahman et al., 2013).It is also regulated by food and drug administration in US or Health and Consumer protection Directorate of European Commission (Magnuson et al., 2013).Hence, it is necessary to test each particle separately (Suraj et al., 2015).There is no standard protocol for testing the toxic effect of nanoparticle as well as effect of these nanoparticle in environment (Kalantzi and Biskos, 2014).Barkley is only one in US who regulate the nanotechnology (Shukla, 2014).FDA have responsibility to regulate different nano substance and nano products (Magnuson et al., 2013).To identify the effect of nano material in environment, people and plants, FDA provide guidance on technical data for its staff and sponsors and described regulatory issue (Valerio, 2011).FDA collaborate with domestic and foreign counterparts involve sharing of their information and perspectives on regulatory policy issue (Cristancho et al., 2015).FDA support industry to consult with agency to find nano based safety information (Guo et al., 2014).FDA monitored the market place where manufacturing of nano based product (Guo et al., 2014).To safe, consume and avoid any kind of risk to human, environment and animal life (Bawa and Anilkumar, 2013). Before launching the products like food additives, drugs, cosmetics in market, submit data to FDA to answer safety and regulatory status of product (Barei et al., 2013).

### **Conclusion:**

The Nanotechnology approaches outlined here are in their infancy, they are already contributing to meaningful drug development decisions by accelerating hypothesis-driven medicinal biology, by modeling specific physiologic problems in target validation or clinical physiology and by providing rapid characterization and interpretation of disease-relevant cell and cell system level responses. Nanotechnology-based nanomedicine means tools and device are technically designed in such a way which can interact at the molecular level and enhance the therapeutic index of drugs with no side effect. It poses a broad range of application in drug delivery, protein detection, robotics, cancer and cardiac therapy, etc. which are described in detail. By using nanotechnology, enhance the therapeutic index of cancer chemotherapeutic drug, their tolerability, and efficacy and suppress their toxic effect. It also enhances pharmacokinetics, pharmacodynamics as well as bioavailability and provides better safety profile. Other modalities of different aspects are being discussed such as potential hazards of nanoparticle in addition to microbivores and nanosome, etc. Urothelial cancer is cancer occur in the urinary bladder. Various kinds of nanoparticle are being used in diagnosis and treatment of urothelial cancer. Different types of course of treatment and nanoparticle used in the treatment of various kinds of disease. It is based on the stage of urothelial cancer. Tthe pharmaceutical application of Chitosan-based nanoparticle is derived from chitin are used as the pharmaceutical carrier for many drugs and vaccines. Being already observed the benefit of nanomedicine-based products. The application of Nanotechnology to medical practice is the future of medicine. Its realization will see drug discovery and the design of multiple drug therapies and therapeutic gene circuits being pursued just as occurs now with modern, complex engineering products. In the near future, the most pressing task is to investigate our identified sub networks in the laboratory. Because large interaction networks are suspected to contain many false-positives, an initial experiment would be to verify that the interactions in each sub network are reproducible and present under

the subnet's particular set of conditions. Routine network screening has to be performed to define novel modes of regulation, to identify evolutionarily conserved pathways, or to interrogate regulatory circuits responding to the entire spectrum of drugs and human diseases.

**Acknowledgement:** Author would like to thank to Dr. Prashant Ankur Jain (Assistant Professor, CBBI, JSBB, SHIATS-Allahabad, U.P., India) and Dr. Raghvendra Raman Mishra (Associate Professor, Department of Biotechnology, Ashoka Institute of Technology and Management, Sarnath, Varanasi, U.P., India) for supporting this work by providing a good research environment and related facilities.

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