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REVIEW ARTICLE

Pico technology: Instruments used and Applications in pharmaceutical field.

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ABSTRACT:
Pico technology is a combination of pico meter and technology, which is similar the term nano techn-ology. The market-leading Pico Scope software supplied with the oscilloscopes enables analysis of voltage waveforms, includes automatic measurements such as frequency, duty cycle and rise time, and has a variety of trigger settings. It gives scientists the ability to construct new processes that can enhance biological systems, medicine, imaging, computing, printing, chemical catalysis, materials synthesis, and many other fields. With Pico technology we will be able to dive into structures on a pico-molecule level. A strand of DNA, one of the building blocks of human life, is only about 2 nanometers in diameter, both of which are much larger than a picometer. Drawing on the natural picoscale of biology, many medical researchers are working on designing tools, treatments, and therapies that are more precise and personalized than conventional ones and that can be applied earlier in the course of a disease and lead to fewer adverse side effects.

KEYWORDS: pico, technology, pico technology, future of nano, nano technology, future

INTRODUCTION[1]:
Pico technology is a combination of pico meter and technology, which is similar the term nanotechnology. This is the future of nano technology; the pico meter is the trillionths of a meter in other way pico scale (10^{-12}). This size is one third of nano meter and these orders of magnitude smaller than in the field of chemistry transformations and measurements. It is explaining by consideration at the atomic level. A future innovative development of this technology is femto technology it would involve working with matter at the subatomic level.

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The Pico Scope and PC Oscilloscopes[2]:
The Pico Scope 2104 and 2105 PC Oscilloscopes are connected to and powered entirely by the USB port of a PC or laptop. The market-leading Pico Scope software supplied with the oscilloscopes enables analysis of voltage waveforms, includes automatic measurements such as frequency, duty cycle and rise time, and has a variety of trigger settings. It allows the Pico Scope 2104 and 2105 to be used as: Oscilloscopes, Spectrum analyzers, Voltmeters or all three at the same time. The unit has a built-in probe for convenience, and the probe tip can be easily replaced when needed. Also incorporated is a probe-tip light to illuminate the area being tested ideal for those hard-to-see connections.

Special feature of Pico technology[3]:

The majority of biological processes occur at the atomic and subatomic level. Therefore, since working at the Picoscale is at the atomic and subatomic levels, it gives scientists the ability to construct new processes that can enhance biological systems, medicine, imaging, computing, printing, chemical catalysis, materials synthesis, and many other fields. Pico technology is not simply working at even smaller dimensions; rather, working at the picoscale enables scientists to utilize the unique physical, chemical, mechanical, and optical properties of materials that naturally occur at that scale. When particle sizes of solid matter in the visible scale are compared to what can be seen in a regular optical microscope, there is little difference in the properties of the particles. But when particles are the size of a picometer, which is a trillionth of a meter (often represented as 1×10^{-12} meters or fully as 0.000,000,000,001 meters) where the particles can be "seen" only with powerful specialized microscopes, the materials' properties change significantly from those at larger scales. This is the size scale where so called quantum effects rule the behavior and properties of particles. Properties of materials are size - dependent in this scale range. Thus, when particle size is made to be picoscale, proper ties such as melting point, fluorescence, electrical conductivity, magnetic permeability, and chemical reactivity change as a function of the size of the particle. Picoscale gold illustrates the unique properties that occur at the picoscale.

Picoscale[4] gold particles are not the yellow color with which we are familiar; Picoscale gold can appear red or purple. At the nanoscale, the motion of the gold's electrons is confined. Because this movement is restricted, gold nano particles react differently with light compared to larger - scale gold particles. Their size and optical properties can be put to practical use: picoscale gold particles selectively accumulate in tumors where they can enable both precise imaging and targeted laser destruction of the tumor by mean s that avoid harming healthy cells. A fascinating and powerful result of the quantum effects of the picoscale is the concept of "tunability" of properties. That is, by changing the size of the particle, a scientist can literally fine -tune a material property of interest (e.g., changing fluorescence color; in turn, the fluorescence color of a particle can be used to identify the particle, and various materials can be "labeled" with fluorescent markers for various purposes). Another potent quantum effect of the picoscale is known as "tunneling," which is a phenomenon that enables the scanning tunneling microscope and flash memory for computing. Over millennia, nature has perfected the art of biology at the picoscale. Many of the inner workings of cells naturally occur at the picoscale. For example, hemoglobin, the protein that carries oxygen through the body, is only 5.5 nanometers in diameter. A strand of DNA, one of the building blocks of human life, is only about 2 nanometers in diameter, both of which are much larger than a picometer. Drawing on the natural picoscale of biology, many medical researchers are working on designing tools, treatments, and therapies that are more precise and personalized than conventional ones and that can be applied earlier in the course of a disease and lead to fewer adverse side effects. One medical example of Pico technology is the bio barcode assay, a relatively low cost method of detecting disease -specific biomarkers in the blood, even when there are very few of them in a sample. The basic process, which attaches "recognition" particles and DNA "amplifiers" to gold picoparticles, was originally demonstrated at Northwestern University for a prostate cancer biomarker following prostatectomy. The bio-barcode assay has proven to be considerably more sensitive than conventional assays for the same target biomarkers, and it can be adapted to detect almost any molecular target. Growing understanding of picoscale biomolecular structures is impacting other fields than medicine. Some scientists are looking at ways to use picoscale biological principles of molecular self assembly, self organization, and quantum mechanics to create novel computing platforms. Other researchers have discovered that in photosynthesis, the energy that plants harvest from sunlight is nearly instantly transferred to plant "reaction centers" by quantum mechanical processes with nearly 100% efficiency (little energy wasted as heat). They are investigating photosynthesis as a model for "green energy" picosystems for inexpensive production and storage of nonpolluting solar power. Picoscale materials have far larger surface areas than similar masses of larger-scale materials. As surface area per mass of a material increases, a greater amount of the material can come into contact with surrounding materials, thus affecting reactivity.

Picoparticles[5] have high surface area. A simple thought experiment at the nanoscale level (which is even much larger than the picoscale level and will show much less surface area then picoparticles) shows why nanoparticle has phenomenally high surface areas. A solid cube of a material 1 cm on a side has 6 square centimeters of surface area, about equal to one side of half a stick of gum. But if that volume of 1 cubic centimeter were filled with cubes 1 mm on a side, that would be 1,000 millimeter-sized cubes (10 x 10 x 10), each one of which has a surface area of 6 square millimeters, for a total surface area of 60 square centimeters about the same as one side of two -thirds of a 3" x 5" note card. When the 1 cubic centimeter is filled with micrometer-sized cubes a trillion (10^{12}) of them, each with a surface area of 6 square micrometers the total surface area amounts to 6 square meters, or about the area of the main bathroom in

an average house. And when that single cubic centimeter of volume is filled with 1 -nanometer-sized cubes of them, each with an area of 6 square nanometers their total surface area comes to 6,000 square meters.

In other words, a single cubic centimeter of cubic nanoparticle has a total surface area one -third larger than a football field! So if you extrapolate this surface area at the picoscale, the surface area increases dramatically much more then for nanoparticle. Illustration demonstrating the effect of the increased surface area provided by nanostructure materials one benefit of greater surface area and improved reactivity in picostructured materials is that they have helped create better catalysts. As a result, catalysis by engineered picostructured materials already impacts about one -third of the huge U.S. and global catalyst markets, affecting billions of dollars of revenue in the oil and chemical industries. An everyday example of catalysis is the catalytic converter in a car, which reduces the toxicity of the engine's fumes. Pico engineered atteries, fuel cells, and catalysts can potentially use enhanced reactivity at the picoscale to produce cleaner, safer, and more afford able modes of producing and storing energy. Large surface area also makes picostructured membranes and materials ideal candidates for water treatment and desalination, among other uses. It also helps support "functionalization" of picoscale material surfaces (adding particles for specific purposes), for applications ranging from drug delivery to clothing insulation.

Femtotechnology[6, 7]:
It is a hypothetical term used in reference to structuring of matter on the scale of a femto meter, which is 10^{-15} m. This is a smaller scale in comparison with nanotechnology and Pico technology which refer to 10^{-9} m and 10^{-12} m respectively.

Why Pico technology[8, 9]**:**
The ability to utilize materials on the atomic level and the use of the unique phenomena that occurs on that small scale, give a huge amount of possibilities for almost every field. Pico technology is one of the key technologies that will change our lives in the future. With Pico technology we will be able to dive into structures on a pico-molecule level. Pico technology is a technology based on the manipulation of single atoms and molecules, to structure and re-structure complex atomic formations. The scale of a pico molecule relates to a basketball compared to the size of the earth. When molecules that normally bustle about unorganized in materials, these are structured in a way that each atom stay where it should be, the impossible becomes possible. Materials get new powers when the atoms are controlled and closely arranged. Pico technology manipulates molecules through current, magnetism and chemistry, so that they organize themselves. Nature serves as the model for that: the cell and its function. The aim of Pico technology is making molecules organize themselves without the help of a human. It has been speculated since long by futurists that Pico technology will revolutionize virtually every field of our lives, medicine making no exception. Pico technology focuses on the engineering of materials and devices at a picoscale, by using building blocks of atoms and molecules.

Pico Technology[10, 11]**:**
It is a UK-based manufacturer of high-precision PC-based oscilloscopes and automotive Diagnostics equipment, founded in 1991. Their product range includes the Pico Scope line of PC-based oscilloscopes, data loggers, automotive equipment, and most recently, handheld USB-based oscilloscopes. Since their inception in 1991, Pico Tech has been researching and developing PC-based oscilloscopes, when the market standard was analogue storage oscilloscopes. Pico Technology is one of two European scope manufacturers, and competes in the low to middle end of the instrumentation market.

POLY PICO TECHNOLOGY APPLICATIONS IN LIFE SCIENCES AND INDUSTRY[12]**:**
Poly Pico provide versatile ultra high precision dispensing solutions for both Life Science and Industrial applications. Example applications where Poly Pico technology has been used include

Dispensing low viscosity UV curable adhesives: PolyPico technology can be used to dispense low viscosity UV curable adhesives with ultra high precision.

DNA amplification:
PolyPico technology can be used in real-time PCR, and dPCR applications, where various quantities of DNA are amplified /quantified.

Dispensing Living Cells:
PolyPico dispensing technology can be used to dispense living cells. The first image below provides an example, where Chinese Hamster Ovary (CHO) cells were dispensed using PolyPico technology into micro-well plates. The second image below shows stem cells which were dispensed onto slides and into well-plates, while maintaining their viability.

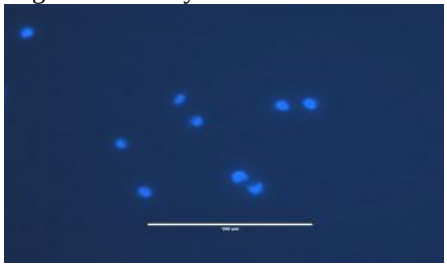

Fig 1: where Chinese Hamster Ovary (CHO) cells were dispensed using PolyPico technology into micro-well plates

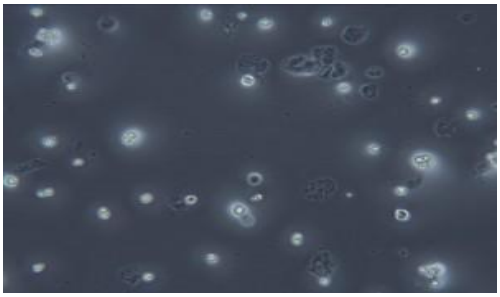

Fig 2: stem cells which were dispensed onto slides and into well-plates, while maintaining their viability.

Printing protein/antibody microarrays[12]:

The first image was obtained from scanning an antibody arrays which was dispensed using PolyPico technology, in order to obtain results regarding reproducibility and for statistical analysis. The spots are clearly visible, uniform and reproducible. This demonstrates that the technology is ideally suited for generating high content antibody (and protein) arrays. In the second image, spot analysis shows the protein density in each spot. The scans A-F represent '50 drops' through to '1 drop'. These images clearly indicate that in particular F (1 spot) produces excellent results; note the absence of the traditional 'coffee ring' or 'doughnut effect'.

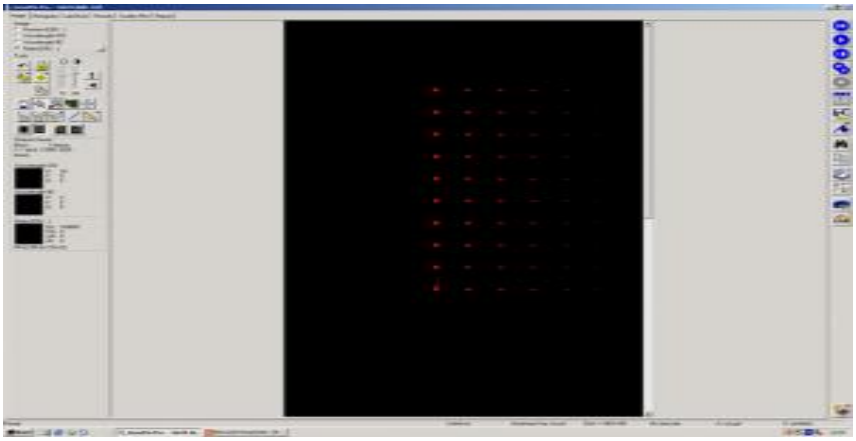

Fig 3: scanning an antibody arrays which was dispensed using PolyPico technology

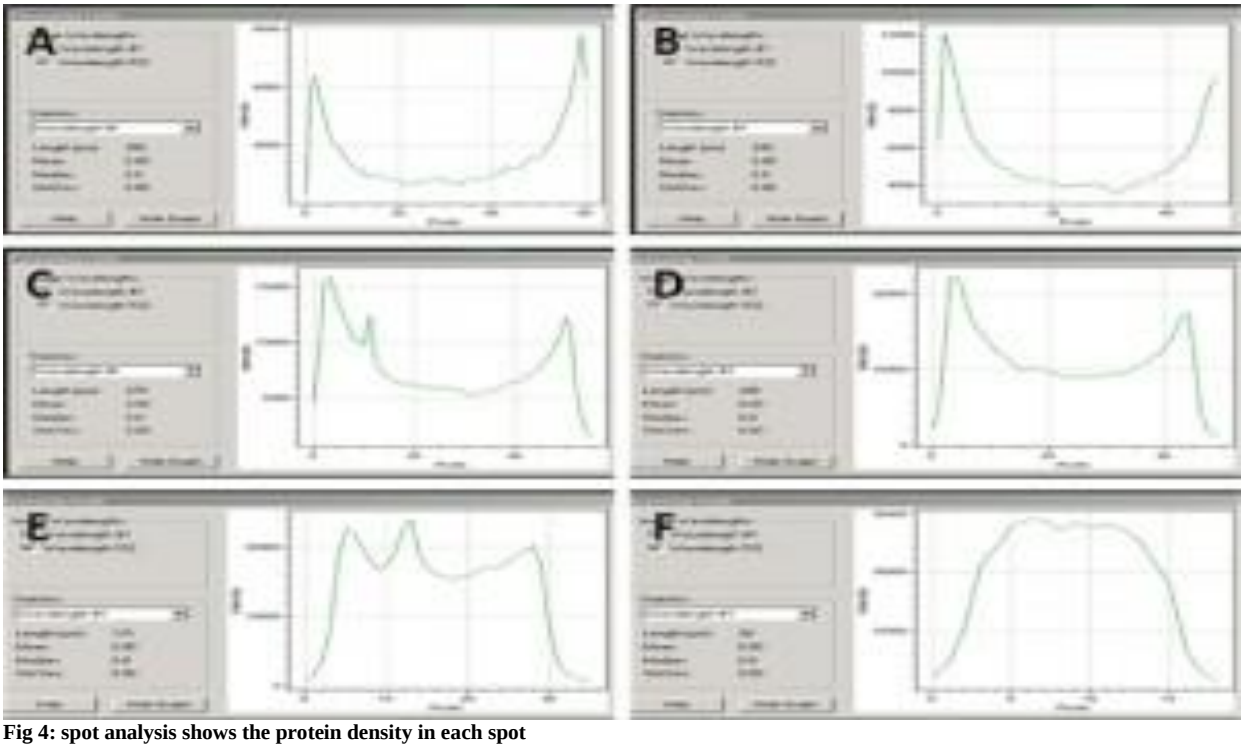

Fig 4: spot analysis shows the protein density in each spot

Printing Nano-materials: It is possible to precisely print nano-materials using PolyPico Technology. The below images show 0.04% W/V TiO2 printed using PolyPico technology.

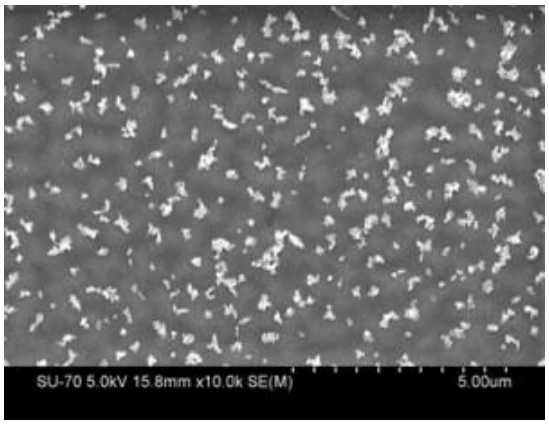

Fig 5: 0.04% W/V TiO2 printed using PolyPico technology

Fig 6: 10nl deposit of protein crystals

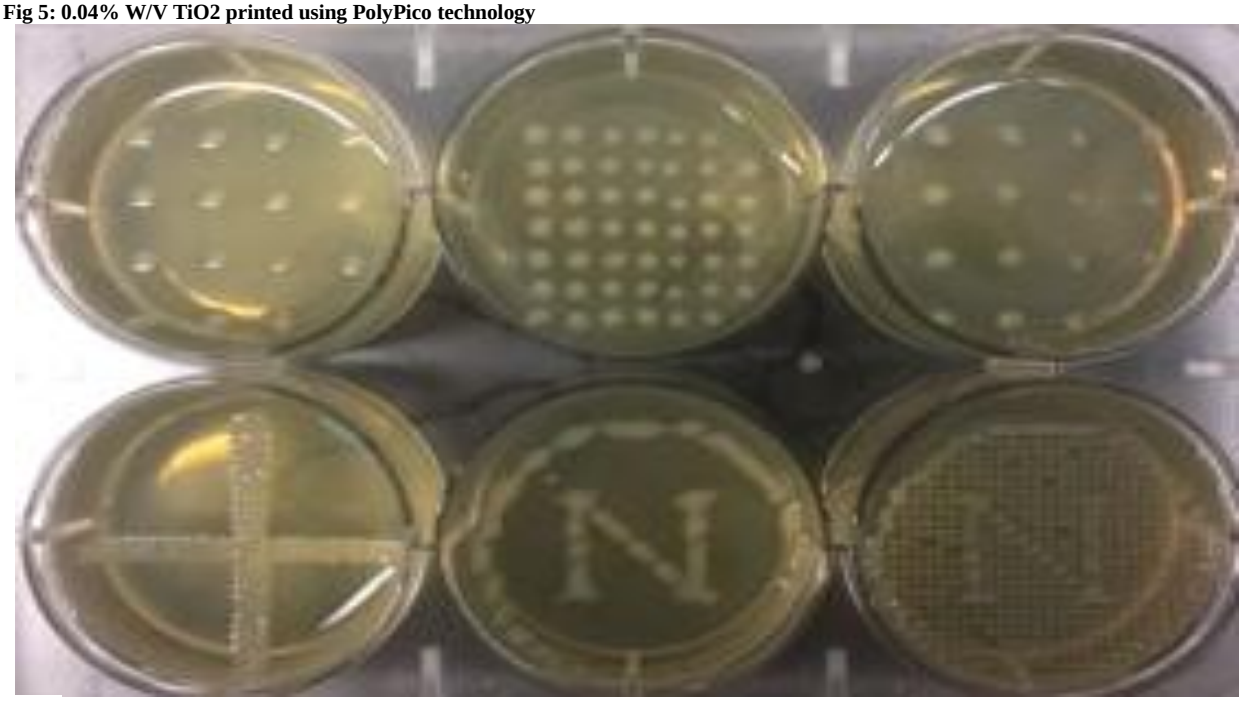

Fig 7: Bacteria Colony Patterns

Pico technology to Increase Tissue Growth and Reduce Bacterial Infections[13]:

Inspired from biological systems, nanotechnology (and more recently, Pico technology) is beginning to revolutionize medicine including improving the prevention, diagnosis, and treatment of numerous diseases. This talk will emphasize novel tunable properties of nano and pico-technology derived coatings such as mechanical, magnetic, electrical, and optical, which have made these advanced materials good candidates for medical devices. This presentation will also summarize efforts over the past decade that has synthesized novel nano particles, nano tubes, and other nanomaterials to improve medicine. Efforts focused on the use of nanomaterials to minimize inflammation, inhibit infection, and increase tissue growth will be especially emphasized. Tissue systems covered will include the nervous system, orthopedics, bladder, cardiovascular, vascular, and the bladder. Materials to be covered will include ceramics, metals, polymers, and composites thereof. Self-assembled nano-chemistries will also be emphasized. Toxicity concerns of nano particles will be covered.

Pico technology to increase tissue growth: a summary of in vivo studies[14]:

A potentially less toxic method that is used to increase tissue growth and create the next generation of tissue

engineering materials is to use Pico technology. Pico technology[15] is a new term used to describe the control of electron distribution around atoms, so as to provide desirable properties given in fig 8 .Having controls over electron distribution may greatly change surface energy and, thus, the way that proteins adsorb onto a material. Therefore, through the excitement or rearrangement of electrons around atoms, one has the ability to influence many cellular functions including cell movement, intracellular transport to organelles, adhesion, growth, and ECM formation.

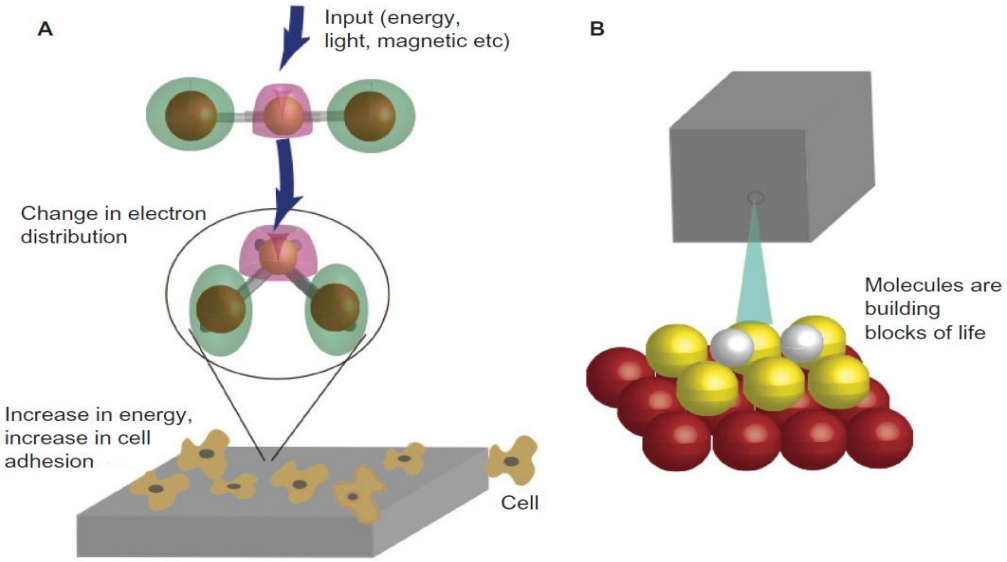

Fig 8: A, B describe the control of electron distribution around atoms so as to provide desirable properties

Despite the promise of Pico technology[15], relatively little research has been conducted in this field. The control of cellular microtubules (MTs) through Pico technology is extremely interesting to consider. MTs are cylindrical cellular formations 25 nm in diameter, and they are made out of tubulins. Dynamic instability due to MT plus end-binding proteins, also called "plus end-tracking proteins", are able to "surf" the dynamic ends of MTs. According to recent reports, when tips are expressed as green fluorescent proteins, the fluorescence is the brightest at the MT and decreases in intensity toward the minus end of the MT, forming a comet tail. It is envisioned that one could use external stimulation to excite the MT and end-binding proteins to promote the movement of cells using Pico technology. This may be a less toxic manner through which to alter surface energy to increase tissue growth since electron distributions can be changed for numerous macro-, micro-, or nanomaterials.

APPLICATIONS OF PICO AND FEMTOTECHNOLOGY[16]:

Pico technology was described as involving the alteration of the structure and chemical properties of individual atoms, typically through the manipulation of energy states of electrons within an atom to produce metastable (or otherwise stabilized) states with unusual properties, producing some form of exotic atom. Analogous transformations known to exist in the real world are redox chemistry, which can manipulate the oxidation states of atoms; excitation of electrons to metastable excited states as with lasers and some forms of saturable absorption; and the manipulation of the states of excited electrons in Rydberg atoms to encode information. However, none of these processes produces the types of exotic atoms described by futurists. Alternatively, Pico technology is used by some researchers in nanotechnology to refer to the fabrication of structures where atoms and devices are positioned with sub-nanometer accuracy. This is important where interaction with a single atom or molecule is desired, because of the strength of the interaction between two atoms which are very close. For example, the force between an atom in an atomic force microscope probe tip and an atom in a sample being studied varies exponentially with separation distance, and is sensitive to changes in position on the order of 50 to 100 picometers (due to Pauli exclusion at short ranges and van der Waals forces at long ranges). Practical applications of femto technology are currently considered to be unlikely. The spacings between nuclear energy levels require equipment capable of efficiently generating and processing gamma rays, without equipment degradation. The nature of the strong interaction is such that excited nuclear states tend to be very unstable (unlike the excited electron states in Rydberg atoms), and there are a finite number of excited states below the nuclear binding energy, unlike the (in

principle) infinite number of bound states available to an atom's electrons. Similarly, what is known about the excited states of individual nucleons seems to indicate that these do not produce behavior that in any way makes nucleons easier to use or manipulate, and indicates instead that these excited states are even less stable and fewer in number than the excited states of atomic nuclei.

Future Applications[16]:

Possibilities for the future are numerous. Pico technology may make it possible to manufacture lighter, stronger, and programmable materials that require less energy to produce than conventional materials, that produce less waste than with conventional manufacturing, and that promise greater fuel efficiency in land transportation, ships, aircraft, and space vehicles. Pico coatings for both opaque and translucent surfaces may render them resistant to corrosion, scratches, and radiation. picoscale electronic, magnetic, and mechanical devices and systems with unprecedented levels of information processing may be fabricated, as may chemical, photochemical, and biological sensors for protection, health care, manufacturing, and the environment; new photoelectric materials that will enable the manufacture of cost -efficient solar -energy panels; and molecular -semiconductor hybrid devices that may become engines for the next revolution in the information age. The potential for improvements in health, safety, quality of life, and conservation of the environment are vast. Medical Pico technology may be able to extend our lives in two ways. It can repair our bodies at the cellular level, lengthening the telomeres; reverse aging and providing a certain version of the fountain of youth, and it can help the medical community to eradicate life -threatening diseases such as stroke, heart attack, HIV or cancer. By curing life -threatening disease, pico tech can extend the average lifespan far beyond the remarkable achievements of the last century. For instance, the Pico technology applications in healthcare are likely to minimize the number of deaths from conditions such as heart disease and cancer over the next decade or so. There are already many research programs in place working on these techniques. Curing cancer could finally become reality, thanks to medical Pico technology. Magnetic picoparticles attaching to cancer cells present in the bloodstream could also allow the removal of cancer cells before they establish new tumors. Similar research projects are in place for studying ways of fighting heart disease, another major killer in our time. Several efforts are going on in this area. For example, researchers at the University of Santa Barbara have designed a nanoparticle able to deliver drugs to the wall arteries plaque. Extending the average lifespan by repairing cells is another area of interest for medical Pico technology. This is perhaps the most exciting application. Our bodies can be repaired at the cellular level by pico technology.

Medicine[17]:

Researchers are developing customized picoparticles the size of molecules that can deliver drugs directly to diseased cells in your body. When it's perfected, this method should greatly reduce the damage treatment such as chemotherapy does to a patient's healthy cells.

Emerging Trends of Pico technology[18]:

In nature, metal oxide particles display their existence at the level of picomolecules in solution state and bioactive states in the body. We put evidence of picomolar behavior of molecules different than nanomolar behavior of particles. These particles can be encapsulated in polymers and can be functionalized with protein, nucleotides, and drugs to develop as smart intracellular targeting pico-devices. The preparation technique and physiological conditions decide the size and functionality of these pico-carrier devices. Their usable success rate, feasibility and potentials are yet to be proven or we donot know. The major difference between nanodevices and pico-devices is their intermolecular and intramolecular thermodynamics in medium and their molecular conformational interaction with molecular assembly in cytoarchitecture of the body. Pico-carrier device can be presumed as potential spears without interacting with host signal transduction and immune protection. In conclusion, ultrafine size of newer pico technology products may be better suited and easy to functionalize them for design of particle based pico drug, pico chemicals, pico-targeting molecules. When we reach the picoscale, though, everything will change, including the gold's color, melting point and chemical properties. The reason for this change has to do with the nature of the interactions among the atoms that make up the gold, interactions that are averaged out of existence in the bulk material, Nano gold doesn't act like bulk gold.

The fundamental science behind the picotechnology[19]:

Electrons: The electron was discovered early in 20th Century. Electrons are very light (2,000 times lighter than the smallest atom, hydrogen) and have a negative charge. Protons, which make up the rest of the mass of hydrogen, have law. This force can be expressed by a simple equation that is sometimes called Coulomb's law.

ATOMS AND IONS:

The simplest picture of an atom consists of a heavy nucleus with a positive charge surrounded by a group of electrons that orbit the nucleus and that (like all electrons) have negative charges. Since the nucleus and the electrons have opposite charges, electrical forces hold the atom together in much the same way that gravity holds planets around the sun. The nucleus makes

up the vast majority of the mass of the atom - it is around 1,999/2,000 of the mass in hydrogen, and an even greater percentage in other atoms.

MOLECULES:
When atoms are brought in a fixed structure, they form molecules. This construction resembles the way the parts are put together in children's building sets.

The promising application fields for the energy sector are Photovoltaic, Hydrogen production and conversion, Thermoelectricity, Rechargeable batteries, Super capacitors, Hydrogen storage.

CONCLUSION:

The concept of pico scale of measurement in physics, environment, biology and chemistry is highlighted with examples of metal ions, climatic conditions, and bio assemblies. The integrated monitoring using pico scope and monitoring oscilloscope for use in proteins linked with metals in supra molecular macromolecules is described with potentials of picomolar science. The temperature, humidity and electricity and their regulatory factors play a significant role in biomedical, automotive actions of bio molecules in the environment. The proteins and their regulatory metal cofactors play a significant role in structural-functional actions of bio molecules in the body. Pico devices have paved the way to determine minute amounts of metabolites, hormones, nucleotides. Pico chips and pico-inspired biological applications remain further attraction in future. Overall pico technology remains to see as most powerful computation device in data simulation in physical, biological, engineering and environmental applications. Future strategies may also include the use of picotechnology instead of nanotechnology to reduce the toxicity since electrons can be excited in any macro, micro, or nonmaterial.

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