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NANOTECHNOLOGY: AN OPPORTUNITY AND NEW CHALLENGE IN PSYCHOLOGY

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Abstract:-Nanotechnology is the manipulation of matter on an atomic and molecular scale typically between 1 to 100nm, at such dimensions materials can show significantly different physical, biological and or chemical properties leads to be the promising materials used in various applications. The growing investment in the field of Nanotechnology and Nano science is of more concerned today. Besides the countless beneficial applications including health and medicine concerns exists or adverse health consequences of unintended human exposure to Nanomaterials such as in pharmaceutical and medical applications, cosmetics and personal products, energy storageand efficiency, water treatment and air filtration, environmental remediation, chemical and biological sensors, military defense and explosives and in countless consumer products. This exposure can occur via inhalation, ingestion or skin absorption depending on the nanomaterial and the specific application. Moreover, determination of exposure matrix is the dire need of time. Furthermore, effective monitoring ofproduction, uses, exposures and overall health conditions among workers and the general population is the key in order to develop early warning systems that enable identification of unexpected effects. General technological awareness, continuous counseling for changing a paradigm shift in the mindset of a common man in understanding the possible applications and hazards of exposure to Nanomaterials are the challenges for the Psychologist in the present societal transformation in the age of nanotechnology. Psychology is embedded or connected in deep ways with the diverse array of other sciences. The powerful tools using the advancement in Nano engineering can be used in understanding the fundamental questions such as human cognition, perception and action to any psychologist researcher. The connections between nanotechnology and psychology are small but they are worth of drawing advancement in the field psychology.

Keywords: Nanotechnology, Nanomaterials, b Societal Transformation.

INTRODUCTION

A nanometer (nm) is one thousand millionth of a meter. A single human hair is o 80,000 nm wide, a red blood cell is approximately is 7,000 nm wide, a DNA molecule 2 to 2.5 nm and a water molecule 0.3 nm. The term nanotechnology was created by Norio Taniguchi of Tokyo University in 1974 to describe the precision manufacture of materials with nanometer tolerances, but its origins date back to Richard Feynman's 1959 talk “There's plenty of Room at the Bottom” In which he proposed the direct manipulation of individual atoms as a more powerful form of synthetic chemistry (R. Feynman 1959). Because of the relatively larger surface area-to-mass change in the nanomaterial the laws of classical physics give way to quantum effects, provoking different optical, electrical and magnetic behavior making them a very promising material for various applications as in manufacturing the computer chips, medical diagnosis and healthcare, energy biotechnology, space exploration, security and so on.

APPLICATIONS OF NANOTECHNOLOGY

Nano materials are making their way into all aspects of our lives; These materials are being increasingly used in pharmaceutical and medical applications, cosmetics and personal products, energy storage and efficiency, water treatment and air filtration, environmental remediation, chemical and biological sensors, military defense and explosives and in countless

consumer products and materials. In the area of food, nanomaterialcan be used to provide new tastes and flavours, functional foods, hygienic food processing and packaging; intelligent, lightweight and strong packaging, extended shelf-life, and reduced agrochemicals, colours, flavours and preservatives.(Chaudhry, 2012).

The Nanotechnology is expected to fundamentally change products in the next 10-15 years. An electronics and telecommunication field is entirely being changed using Nanolayers and Nano dots, flat-panel displays, huge data storage and processing circuits.In the field of chemicals materials new catalysts can be explored that increases the energy efficiency of chemical plants more smart materials by the use Nano engineering concepts. (e.g. Nanopowders use in sensors and some bio inspired materials and biostructures.)

The nanostructured drugs, gene and drug delivery systems targeted to specific sites in the body, biocompatible replacements for body parts and fluids, self-diagnostics for use in home, sensors for labs-on-a chip, material for bone and tissue regeneration.The new types of batteries clean energy some promising energy savers using lighter materials are possible using the nanotechnology.Detectors and detoxifiers of chemical and biological events, camouflage materials, light and self-repairing textiles, blood replacement etc. are the new application of nanotechnology in the field of national security.

ADVERSE HEALTH EFFECT AND RISK IN NANOTECHNOLOGY:

Although one cannot predict the future of any technology. Considering the enormous technical and economic potential in Nanotechnology it is necessary to identify the likely possibilities in order to anticipate ethical issues. A more differentiated approach is required in order to face the consequences of the technology. There are multiple possible primary and secondary exposure pathways stemming from current and potentialnanotechnology applications, leading to occupational and consumer exposure. This exposure can occurvia inhalation, ingestion or skin absorption depending on the nanomaterial and the specific application(for treated patients, injection is also relevant) (Hansen, 2012; Poland, 2012). Therefore, there is an urgentneed to assess the level of population exposure to nanomaterial, over time and for different populationsubgroups.Extensive data is required to complete a full exposure assessment including information aboutmanufacturing conditions, level of production, industrial applications and uses, consumer products andbehaviour, and environmental fate and distribution (Hansen, 2012). Unfortunately, such detailed informationis lacking for virtually every type of nanomaterial or group ofNanomaterials, and technical difficulties hamperaccurate measurement of Nanomaterials in the workplace as well as in the environment.It is well known that children are disproportionately more sensitive than adults when it comesto hazardous chemicals and that children have a larger relative body surface area (WHO, 2012). Inaddition, it is important to note that some nanoproducts are intended for use by specific subgroups, suchas children and the elderly, for example with baby bottles, pacifiers, and health-care products containingnanosilver for antimicrobial activity (Chaudhry, 2012).

Since the early 2000s, concerns have been raised about whether carbon nanotubes (CNTs) might behazardous. These concerns were initially based on the physical similarities with asbestos fibres, and indeedsince 2004 a series of experimental studies have indicated that some CNTs are able to cause asbestos-likeeffects (Poland et al., 2008). This was one of the factors, among others, that influenced the United StatesNational Institute for Occupational Safety and Health (NIOSH) to issue a recommended exposure level(REL) of 1 microgram (μg) per cubic metre of elemental carbon as a respirable mass 8-hour time-weightedaverage (TWA) concentration (NIOSH, 2011). For titanium dioxide nanoparticles it has been shown that20–30 nanometre (nm) particles are considerably more toxic when it comes to respiratory health than theirmicroparticle (>100 nm) counterpart (Vogel, 2012). For humans, it is known that nanoparticles depositin the alveoli, where they are predominantly cleared via normal macrophage mediated mechanisms. Aproportion of particles can translocate and this appears dependent on physicochemical properties; butwhether chronic exposure leads to sufficient particle accumulation to trigger disease is unclear (Howard,2012; Poland, 2012). For titanium dioxide, NIOSH has proposed an occupational exposure limit (OEL) of0.3 mg/m3 for nano-titanium dioxide, compared to 2.4 mg/m3 for fine titanium dioxide particles (Vogel,2012). In general, healthy skin is a better barrier than the respiratory tract, but further research is neededto assess the effect of formulations and coatings, as well as effects on damaged skin, (such as burnedor stretched skin). Transfer and systemic distribution of nanoparticles has been reported via the gutafter oral exposure in several studies, with accumulations typically in the liver and other organs of thereticuloendothelial system. Further research is needed on the dosimetry, as well as long-term effects ofsuch accumulations (Poland, 2012).

Teams of researcher at the University of Buffalo have discovered that the clusters of heated, magnetic nanoparticles targeted to cell membranes can remotely control ion channels, neurons, even animal behavior (Nature, 2010).

A PSYCHOLOGICAL APPROACH AND NANOTECHNOLOGY

Ethical, legal and societal aspects(ELSA) of nanotechnology have become important fields of research, in part because of the promises of revolutionary technology (Atmann 2006).A general recognition of the important of incorporating an ethical consciousness throughout the process of nanotechnology innovation needs to be deployed from the beginning. Work on the societal and ethical implications of nanotechnology faces major obstacles, But at the same time these obstacles present significant opportunities to re-conceptualize how societal and ethical concerns can work together that drive this technological change.(Davis Baird, 2003)As a scientific discipline psychology is embedded within rich nexus of other scientific traditions

that connects deeply in many ways. Along with an ethics education psychologists have to explore the use of nanotechnology and need to draw upon its theories and methods to enrich an area of computer science, cognitive science, neuroscience, economics and sociology. An interpersonal relationship can be developed using an explosive growth in mass media and communication technology that helps to create a new human machine interactions. Psychologists who are specialized in the study of diffusion of innovation, decision making and social influence should be immersing themselves in the rich field of nanotechnology. Moreover the powerful technologies can be extended to explore a complex behavior patterns in both human and inhuman tendencies. A psychologist has to play a role of moral agent who helps in imposing ethical use of technology. As nanotechnology is a very specialized interdisciplinary area that merges people collaborating from science, engineering and many other disciplines, Psychologists have a great role to play in coordinating the ethical use of nanotechnology and its exploration for the wellbeing of the society. The societal transformation takes place smoothly only in the presence of conscious psychologists.

Perhaps the connections between psychology and nanotechnology are small but they are worth knowing about and drawing upon for the advancement of our discipline.

CONCLUSION

Nanotechnology has the potential applications in many fields attracting many investors. It is the driving force behind industrial revolution. The Nanotechnology is expected to fundamentally change products in the next 10-15 years. Along with the discussion of an enormous technological and economic potential, a differentiated approach is needed regarding all the relevant risk in an exposure to the nanomaterial in general. An adverse health effect of over exposure to the nanomaterials has been recorded and a perfect dosimetrry and exposure metric is the need of time. Psychologists have a great role to play in coordinating the ethical use of nanotechnology and its exploration for the wellbeing of the society. The societal transformation takes place smoothly only in the presence of conscious psychologists.

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