

Nanotechnology in Life Science
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Nanotechnology in Life Science is not so much about the science of manipulating matter on a nano-particles level, but most importantly is the science of using nanoquantities of biologically active substances in a very precise way to imitate physiological processes occurring in a living organism.

MD SCINCE/ BIONOVA's technological advancement is based not on nanoparticles, but on more sophisticated, more advanced and more natural for the Human Body approach- using a combination of biologically active substances in nano and pico quantities, targeted to the problem- specific biochemical pathway.

The outcome of nano-quantities modus operandi in Life Science Nanotechnology has a unique physiological impact to the normal biological information transfer, with strong and predictable results, without side effects.

The usage amount of substances in BIONOVA NANO- *NANO-COMPLEXES*TM is in absolute range with normal function of the Living System.

Key words: nanotechnology, science, nano-complexes, bionova.

WHAT IS EXACTLY NANOTECHNOLOGY IN LIFE SCIENCE?

High-tech companies are focusing their attention on Nanotechnology, which is described as Nano-Spheres, Nano-Particles and other related technologies. This important recognition of nano-particles will play in the future an enormous role in pharmaceutical, nutritional, and skincare industries.

Today we do not have a unified definition of Nanotechnology. This circumstance creates a lot of misinterpretation and misleads not only consumers, but professionals as well. Nanotechnology is a relatively new discipline that has multiple angles, which are based not so much on semantics, but on more significant difference, such as Nano-Particles and Nano-Quantities. Both are Nano, but belong to totally different entities.

There are several major definitions of Nanotechnology. The most common description states that Nanotechnology is manipulation of particles less than 100 nanometers. Another version states that Nanotechnology is the science of engineering on a molecular scale, effectively building matter atom-by-atom. In other words Nanotechnology involves the construction of a matter in billionth size of a meter - roughly the size of several atoms.

If such definition of Nanotechnology more or less serves the industrial field, it has very little to do with the Life Science Nanotechnology (Bio-Medical Science).

Let's once more remind ourselves that the prefix "nano" denotes a fraction of one-billionths of ... size, weight, volume, and other measurement units. While industrial Nanotechnology is focused on nano-sizes (nano-particles) manipulation, Bio-Medical researches focus its attention not so much on particle sizes of a matter, but on more important physiological element – quantity of biologically active substances used in products for specific biological effects.

Let's also remind another crucial for a Human Physiology fact – the usage amount of the majority of biological active substances in modern pharmaceutical, nutritional and skincare industries exceeds physiological level from several hundreds to several thousand times, thus creating multiple side effects and abnormal pathways of biological information transfer.

In that case what is the Real Nanotechnology in Life Science? Nanotechnology in a Bio-Medical field is not so much about the science of manipulating matter on a nano-particles level, but most importantly is the science of using nano-quantities of biologically active substances in a very precise way to imitate physiological processes occurring in a living organism. The outcome of such approach has a physiological impact to the normal biological information transfer with strong and predictable results, without any, or at least very little side effects.

Using modern instrumentation it is easy to manipulate with matter on the atomic level, but the real challenge of nanotechnology in the Life Science industry is to predict the final physiological results. For example: when a baker transforms dough into the bread he manipulates matter on a molecular level. Does that make him a Nanotech scientist? The answer is obvious - No. Than why using modern equipment and simply reducing particle sizes of a biologically active substances to a nano-level we call it Nanotechnology. Such a size reduction was also possible on the equipment that has been on the market at least for 30 years. Probably it has more marketing cliché than real scientific bases.

In comparison with the industrial and electronic engineers, Life Science Nanotechnology enjoys a special advantage of having God's and/or Evolution handiwork as a model. Just imitating physiological processes and by modeling Living System regulatory processes can bring incredible results in a bio-medical research.

MD SCIENCE, INC. current interests lay on more advanced stage of Nanotechnology – construction and successful imitation of bio-nutrients (bioactive NANO-COMPLEXES™) that exist in the Living Organisms. Scientific approach used by MD SCIENCE, INC. differs from the industrial nanotechnology, as well as from nanotechnological approach in health care industry, which is focusing today its attention only at the particle sizes of the matter.

MD SCIENCE Nanotechnological approach and its New Business Model are based on 25 years of fundamental scientific research and development in physiology, biochemistry and science of bioactive substances modeling. The bases of this research were conducted in a unique laboratory, which Dr. Danielov founded in Georgia, Tbilisi at the Institute of Experimental Morphology Academy of Science. As a result of this research it has been developed a new scientific “Concept of Biological Information Transfer”, which reshapes conventional approaches in medicine.

The basics of this scientific concept are that everything that human body needs has already been placed within and that our cells are programmed to fix themselves. This scientific concept was the first to reveal that the best approach to the 21st century medicine would be using substances that naturally exist within the body, instead of creating and administering new substances that are foreign to the body.

The developed technological platform makes possible to create most physiological and most natural approach to treat multiple human dysfunctions, and as a result to create absolutely new product categories. Development and production of a new generation of

Biologically Active products based on newly developed Nanotechnological processes is licensed by MD SCIENCE, INC. to BIONOVA, INC.

MD SCIENCE / BIONOVA products do not contain any engineered nano-materials. BIONOVA's products are a combination of many ingredients (ordinary produced by a Human Body). Usually, these ingredients are presented in "nano and pico-amounts" (physiological amounts) - at a level that is typical for healthy body production. This is the distinctive technology that today is utilized only by BIONOVA.

The distinctive difference of MD SCIENCE / BIONOVA technological approach is that only presenting Nanotechnological processes can combine multiple tiny amounts ["nano and pico- amounts"] of ingredients into NANO-COMPLEXES™, which can be used as substrate to restore physiological self-healing processes.

Nanotechnological approach and subsequently developed technological processes for Life Science industries have been used by MD SCIENCE / BIONOVA only as a tool to imitate physiological processes.

- *Nanotechnology in Life Science is not so much about the science of manipulating matter on a nano-particles level, but most importantly is the science of using nano-quantities of biologically active substances in a very precise way to imitate physiological processes occurring in a living organism.*
- *MD SCIENCE / BIONOVA's technological advancement is based not on nanoparticles, but on more sophisticated, more advanced and more natural for the Human Body approach – using a combination of biologically active substances in nano (10^{-9} ; one billions of a gram), and pico (10^{-12} ; one trillions of a gram) quantities, targeted to the problem-specific biochemical pathway.*
- *The outcome of nano-quantities modus operandi in Life Science Nanotechnology has a unique physiological impact to the normal biological information transfer, with strong and predictable results, without side effects.*
- *The usage amount of substances in BIONOVA NANO-COMPLEXES™ is in absolute range with normal function of the Living System.*

NANOTECHNOLOGICLA PLATFORM

The presenting nanotechnological platform has been based on multiple years of fundamental scientific research of inter- and intracellular signaling of hormones and biologically active substances. The phenomenal volumes of data of inter- and intra-cellular signaling of living organisms under extreme conditions brought Michael Danielov, MD., Ph.D. to a new scientific concept "The Concept of Biological Information Transfer in Living Organisms".

The basic idea of this concept is to re-establish normal physiological processes already existing in the Living System by restoring the genetically determined chain of information transfer. This new scientific concept reshaped conventional approaches in medicine and was a first step in development of technological platform oriented toward establishment of new products for activation of Self-Healing Processes.

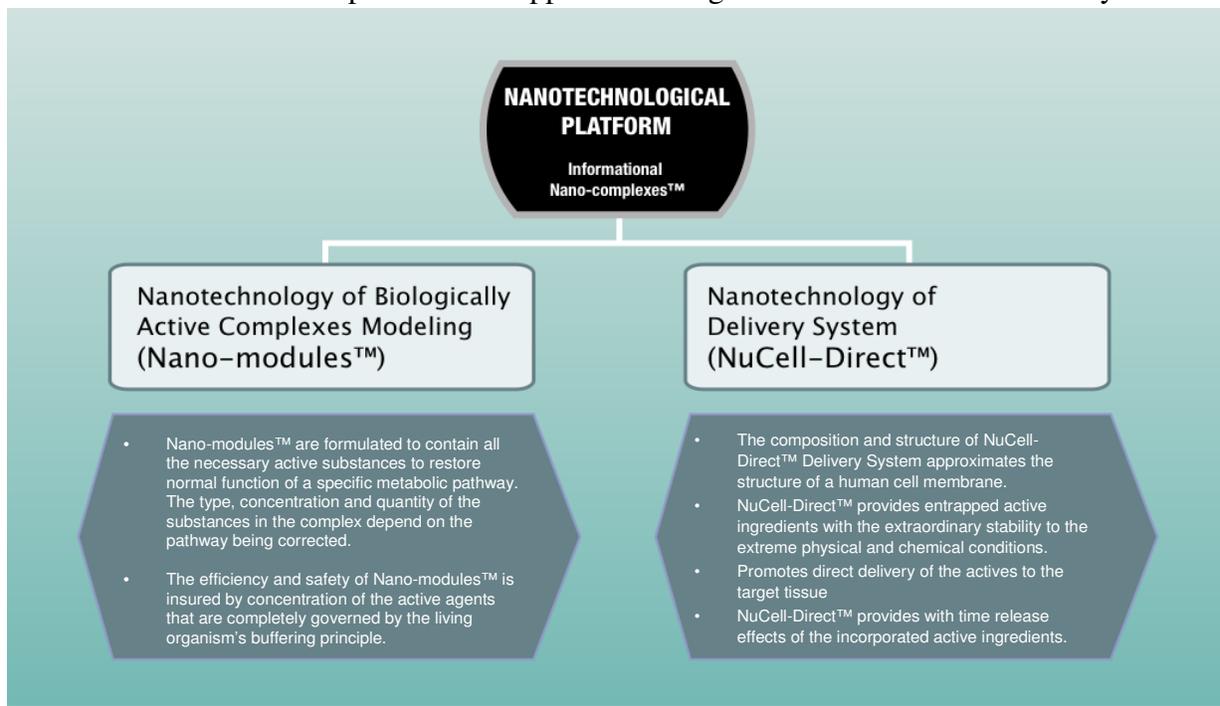
Stability in the functional activity of living organisms and its adaptation to newly developing situations is only possible with the permanent communication of internal biological informational systems, i.e., only with the informational stability of a living

organism. The transfer of biological information and realization of its effects in living organisms has a complex multi-step character and includes vertical and horizontal links with a multitude of feedbacks at various stages¹.

Practical implementation of the discovered scientific concept required development of new, non-existing technologies able to control and successfully use nano- and pico-quantities of active substances, which are precisely within the physiological range in a Living Organism. To create multiple products oriented toward enhancement of self-healing processes with specific curative effects it was necessary to develop four (4) new technological processes, which today is the foundation of MD SCIENCE / BIONOVA Nanotechnological Platform:

- **Opti-Path™** - a method of imitation of a composition of multiple bio-nutrients (Nano-Modules™) that exists in the Living System. This technology belongs to bioactive nano-complexes modeling. Usually, each NANO-COMPLEX™ contains multiple Nano-Modules™. Major features of Nano-Modules™ are:
 - Nano-Modules™ are formulated to contain all the necessary bioactive substances to restore normal function of a specific metabolic pathway. The type, concentration and quantity of the substances in the complex depend on the pathway being corrected.
 - Nano-Modules™ contains all the necessary substances for imitation of biological information transfer existing in a living organism.
 - The efficiency and safety of Nano-Modules™ is insured by concentration of the active agents that are completely governed by the buffering principle of the living organisms.

For more information about Opti-Path™ see separate article (1).
- **NuCell-Direct™ Delivery System²** - technology of a Cell Membrane Imitation. NuCell-Direct™ Delivery System has dual functions: (a) incorporates multiple bioactive substances (active ingredients) into one integral delivery system, thus allowing their synergistic effects; (b) powerful stabilizer of unstable substances. Major features of NuCell-Direct™ Delivery System are:
 - The composition and structure of the NuCell-Direct™ Delivery System imitates the structure of a human cell membrane.
 - NuCell-Direct™ provides entrapped active ingredients with the extraordinary



- stability to the extreme physical and chemical conditions.
- Promotes direct delivery of the actives to the target tissue
- NuCell-Direct™ provides with time-release effects of the incorporated bioactive ingredients.

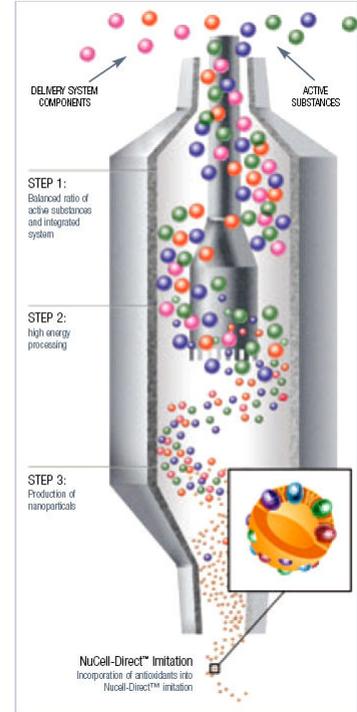
For more information about NuCell-Direct™ see separate article (2).

- **CDP™** - Custom Designed Process – technology of a Modular Production Process. It is the fast and accurate manufacture of finished products depending on the market necessity and on individual customer profile. This modular production process is based on combining of pre-existing Nano-Modules™ into a singular NANO-COMPLEX™ of biologically active ingredients.

CDP™ puts together information from the individual formulation and permits production of custom formulated products.

CDP™ technological process allows production and shipment of unlimited quantities of individual products within 48 hours after ordering.

- **Inter-View Software™** - Automation Software, translating personalized survey responses into a custom product formula.



WHAT EXACTLY ARE NANO-COMPLEXES™?

Based on the fundamental scientific research in area of pathogenesis of shock processes and the mechanisms of thanatogenesis it has been discovered that the restoration of the malfunctioning biological information transfer was only possible by creating Biologically Active Complexes (NANO-COMPLEXES™) containing all the necessary information (substances) ensuring normal biological information transfer within the Living Organism.

NANO-COMPLEX™ is a complex of physiologically existing in the Living System biologically active substances composition, which are stabilized and incorporated into the specially developed NuCell-Direct™ Delivery System² by means of Nanotechnological processes.

Presented Nanotechnological process and appropriate algorithms allow manipulating not only with Nano (10^{-9}), but also with Pico (10^{-12}) quantities of active substances, targeting the problem-specific biochemical pathway. Usage amounts of bioactive substances in NANO-COMPLEXES™ are precisely within the physiological range of a Living Organism.

Usually, Nano-Complexes™ imitate composition and concentration of bioactive substances existence in healthy, human bodies. They contain vital First and Second Degree Messengers together with a Cellular Signaling Substances necessary for the re-establishment of inter- and intra- cellular communication. All informational Bioactive Substances are incorporated and stabilized into the special NuCell-Direct™ Delivery System, which allows all ingredients to act synergistically as one integral unit.

Minute quantities of carefully selected substances that naturally occur in the human body were sufficient to give living cells what they need in order to restore its physiological function and "get back in touch".

The developed Nanotechnological platform makes possible to create most physiological and most natural approach for any treatment of multiple human dysfunctions.

Technology Overview: Nanotechnology of bioactive NANO-COMPLEXES™ modeling relates to methods of correction biological information transfer in an organism where various metabolic disruptions have occurred. Using this technology, restoration of the biological information transfer is possible by creating physiologically existing Biologically Active NANO-COMPLEXES™, containing all necessary information to ensure normal biological information transfer.

NANO-COMPLEXES™ are based on the naturally existing bioactive substances which are equivalent to those that are physiologically produced in the Living Systems. NANO-COMPLEXES™ are 100% physiological to the human organism. Generally, they contain substances that human body produces, but for different reasons cannot be accepted at the cellular level. All MD SCIENCE / BIONOVA NANO-COMPLEXES™ are non-toxic and physiologically innocuous. Bellow are some types of Bioactive NANO-COMPLEXES™:

• **Opti-Path MBAC™: Multicomponent Biologically Active Nano-Complexes Module**

Opti-Path MBAC™ represents an absolutely new generation of active ingredients which, rather than creating new physiological ways of informational transfer, restores the body's own biological information transfer system. Opti-Path MBAC™ technology is based on the correction of biological information transfer in organisms where various metabolic disruptions have occurred.

Opti-Path MBAC™ modules restore the genetically determined cell metabolism by reconstructing the normal transfer of biological information by means of simultaneous action on all the levels of multilevel information transfer.

Generally speaking, Opti-Path MBAC™ represents a complete nano-system consisting of Three Informational Modules, enclosing Six Informational Complexes and imitates structure of biological informational transfer in Living Organisms.

• **Opti-Path VCB™: Vitamin & Coenzyme Biocomplexes Nano-Complexes Module**

• **Opti-Path AX™: Extracellular and Intracellular Antioxidants & Anti-Free Radicals Scavengers Nano-Complexes Module**

Opti-Path VCB™ and Opti-Path AX™³ represent a new technology that markedly increases the efficiency of the functional ingredients on a cellular level because all the ingredients in the NANO-COMPLEXES™ act simultaneously. Thus to increase multiple cellular effects of Water Soluble and Oil Soluble substances it is necessary

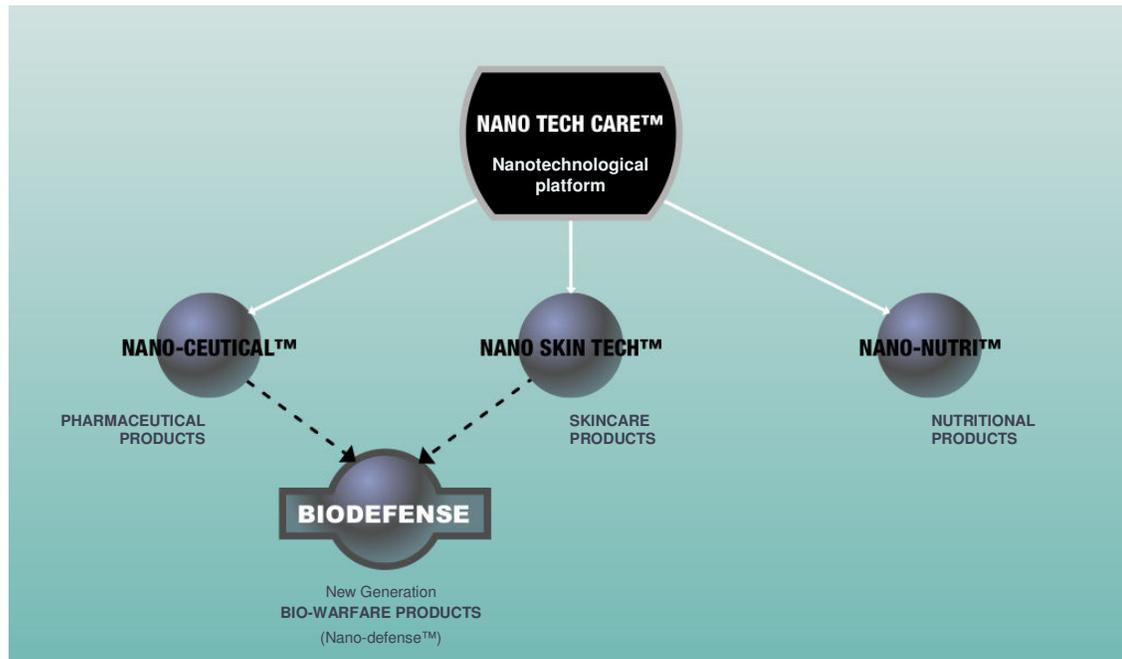
to achieve their synergistic action, otherwise there are only very limited effects from either Vitamins or Antioxidants usage. Such a synergism is only possible by incorporation of Oil & Water soluble active substances into one unified system, such as NANO-COMPLEXES™.

- **Opti-Path LBC™: Lipoprotein Bioactive Complexes Nano-Complex Module**

Opti-Path LBC™ is a new type of biologically active system that increases efficiency of the functional ingredients on the cellular membrane and extra-cellular levels. The body responds to the administration of Opti-Path LBC™ by restoring intercellular biological information transfer and stabilizing the internal information bonds between the cells. As of today it was developed four types of Lipoprotein NANO-COMPLEXES™.

NANOTECHNOLOGICAL APPLICATION IN LIFE SCIENCE INDUSTRIES

MD SCIENCE developed a group of proprietary Nanotechnologies in Life Science and associate to this technology products, collectively known as NANO-TECH-CARE™:



- **NANO-CEUTICAL™ – new generation of pharmaceutical products**

A new generation of pharmaceutical products targeting the restoration of body's own biological information transfer system, including products for parenteral application for various acute conditions, like shock as well as for chronic diseases.

A new generation of pharmaceutical and over-the-counter products, including substances, which has very low, if any penetrating ability through the skin (for example Insulin, Growth Hormone, etc.).

- **NANO-NUTRI™ – new generation of nutritional products**

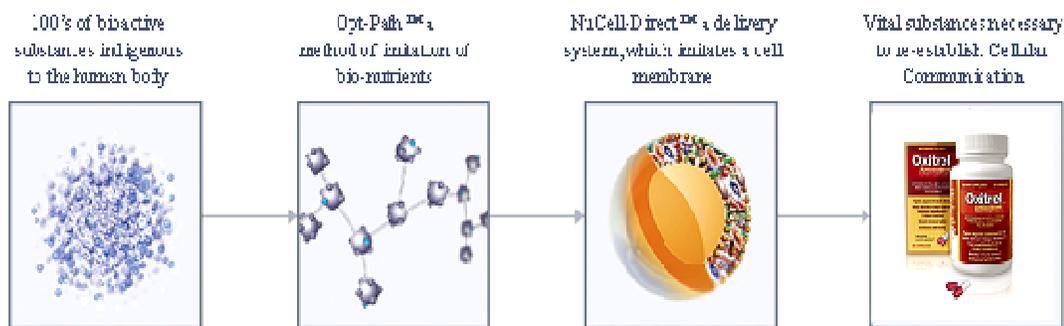
NANO-COMPLEXES™ of Antioxidants, Anti-Free Radical Scavengers, Bioflavonoids, and Nucleosides (OXITREL™).

Targeted NANO-COMPLEXES™ for Prostate Treatment, based on a unique composition of naturally existing Antioxidants, Caratenoids, Amino Acid Derivatives, Phytosterols and specific Unsaturated Fatty Acids.

Targeted NANO-COMPLEXES™ of Vitamins along with their Coenzymes, Bioflavonoids, Minerals and Trace Elements.

Highly efficient, well-balanced Food Supplements.

Nanotechnological Approach that Restores Communication Within and Between Cells of the Organism



- **NANO-SKIN-TECH™ – new generation of skin care products**

Custom Designed Cosmeceutical Products: BIONOVA developed a range of Customized and Ready-to-Use nanotechnological solutions that enable a customer to obtain correct skincare treatments based on his/her budget, gender, age, ethnic background, personal profile, environmental and skin conditions. BIONOVA's NANO SKIN TECH™ brand has changed the concept of the skincare, as it is currently known.

For more information, please visit www.bionovalab.com

- **NANO-DEFENSE™ – new generation of bio-warfare products**

Bacterial Invasion Control NANO-COMPLEXES™. This product is based on the most potent proprietary antibacterial nanocomplex, BactoStat™. Helps defend against Biological Warfare Agents. It creates a protective barrier on the skin. Increases skin anti-bacterial resistance. Enhances self-healing processes.

For more information, please visit www.biodefender.com

Based on BactoStat™ technology it was developed whole family of highly specialized personal care products (QurFamily™) for civilian use, such as:

QurNail – multi-component nail treatment. Contains six (6) Anti-microbial and five (5) Antioxidants in one personal care formula.

QurSkin – the most powerful Anti-microbial & Anti-inflammation product. For effective treatment of general skin infections, bedsores, skin lesions (diabetic, etc.), skin itchiness, skin cuts and scrapes, minor burns.

QurBurn – Powerful Anti-Burn Formula. For effective treatment of skin burn accompanied with infection and pain.

Sun Burn Formula - Anti-Inflammatory Spray. Relieves Pain Sensation. Protects the skin from the Sun burn inflammation.

Folliculitis Bikini - alleviates skin inflammation, relieves burning and itching sensation, and prevents ingrown hair.

Athletes Foot - for effective treatment of Athletes Foot and alleviation of symptoms caused by Tinea Pedis.

FUTURE OF THE NANOTECHNOLOGY

Life Science Nanotechnology has high barriers of entry in the way of:

- Deep requisite knowledge base
- Strong intellectual property platforms
- Very high equipment cost

Realistically speaking only government-funded institutions can afford long-term Research & Development in such new area of science as Life Science Nanotechnology. Today not too many companies have the ability to present themselves as a real nano-science company.

MD SCIENCE / BIONOVA's proprietary knowledge was obtained under special socio-economical circumstances, which allowed the Company to be a real leader in the area of Life Science Nanotechnology

COMMENTS

NANO-PARTICLES

Nano-Particles - or nano-powder is a microscopic particle with at least one dimension less than 100 nm. Nano-particle research is currently an area of intense scientific research, due to a wide variety of potential applications in biomedical, optical, and electronic fields.

NANO & PICO

Nano - international scientific unit, from Greek nanos - one billionth (10^{-9}) part of matter.

Nano [gram] = 1 billionth [of a gram]

Pico - international scientific unit, from Spanish one trillionth (10^{-12}) part of matter.

Pico [gram] = 1 trillionth of a gram

NANOTECHNOLOGY / NANOTECHNOLOGY IN LIFE SCIENCE

Nanotechnology is an extremely multidisciplinary field - from applied physics, materials science, colloidal science, bio-medical science, device physics, chemistry, mechanical and electrical engineering. Much assumption exists as to what new science and technology may result from these fields of research. Nanotechnology can be seen as an extension of existing sciences into the nano-scale level, or as a reintroduction of existing

sciences using a newer, more modern term.

Two main approaches are used in nanotechnology:

- materials and devices are built from molecular components which assemble themselves chemically by principles of molecular recognition
- nano-objects are constructed from larger entities without atomic-level control.

Nanotechnology as the science of manipulating on an atomic or molecular scale should be distinctively divided into two fields:

Industrial Nanotechnology is a field of applied science and technology covering a broad range of topics. The main unifying theme is the control of matter on a scale smaller than 1 micrometer, normally approximately 1 to 100 nanometers.

Live Science Nanotechnology (Bio-Medical field) is not so much about the science of manipulating matter on a nano-particles level, but most importantly is the science of using nano-quantities of biologically active substances in a very precise way to imitate physiological processes occurring in a living organism.

NANO-COMPLEXES™

NANO-COMPLEXES™ - complex of naturally existing in Living System biologically active substances stabilized and incorporated into specially developed NuCell-Direct™ Delivery System by means of Nanotechnological processes. Usually, Nano-Complexes™ imitates composition and concentration of bioactive substances existence in healthy, human bodies. They contain the vital substances necessary to re-establish cellular communication.

NANO-SPHERES

Nano-Spheres - at the small end of the size range, nanoparticles are often referred to as clusters. Nanospheres, nanorods, and nanocups are just a few of the shapes that have been grown.

**ნანოტექნოლოგია მეცნიერების სამყაროში
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(Bionova and MD Science Inc.ნიუ იორკი, აშშ.)**

რეზიუმე:

ნანოტექნოლოგია ახალი მიმართულებაა მეცნიერებაში. მისი საფუძვლები შექმნილი იქნა გასული საუკუნის 80-90-იან წლებში. მის წარმოშობას ხელი შეუწევს ფუნდამენტურმა გამოკვლევებმა ფიზიოლოგიის და ბიოქიმიის დარგში. აგრეთვე გამოკვლევებმა ბიოაქტიური სუბსტრატების მოდელირების სფეროში. მოტანილია „ბაიონოვას“ წვლილი ამ მიმართულების შექმნასა და ჩამოყალიბებაში, რომელიც ერთ-ერთი პიონერი იყო ამ სფეროში. მითითებულია, რომ „ბაიონოვას“ ნანო-კომპლექსებში ნანო-პროდუქტები არ არიან ხელოვნურად სინთეზირებული კომპონენტები და ისინი იმავე ნანო და პიკო განზომილებებში ისედაც მოიპოვებიან ორგანიზმში. ახსნილია „ნანო-კომპლექსების“ და გადამტანი სისტემების ბუნება. მითითებულია შემდგომი განვითარების პერსპექტივები.

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