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DENTISTRY AND BIOTECHNOLOGY

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ABSTRACT

Molecular biology, with its applications, has ominously made the field of human cancer research innovative. With the advent of nanotechnology united with Nanomaterials, Biotechnology and Nanorobotics, it is one of the change and development in the field of dentistry. The Dietary supplements comprising of valuable bacteria or yeasts is called as Probiotics. Tissue engineering exhibits a novel field, aiming to re-create the efficient, fit tissues and organs as a substitute to unhealthy, dying, or deceased tissues. Biomimetics can be described as the study of those processes that are natural and structural, trying to simulate or imitate artificially in an effort to re-establish the same aesthetics or purpose. The most considered and most scrutinized area in the field of implantology is Osseointegration.

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INTRODUCTION

Biomedical technology is one of the principal key in the field of medical and dental research, denoting the biological knowledge and procedures application required for human health augmentation. Genome (genomics) assessment, the messenger RNA transliterated from the lively genes (transcriptomics), the proteins coded for and by this mRNA (proteomics) and the metabolites, which are the end products of gene countenance (metabolomics), all utilizing the procedures. (Nagpal *et al.*, 2011) "Nano" is taken from a Greek word, meaning "dwarf". Nano-materials are those substances comprising of less than 100 nm in at least one aspect, embracing clusters of atoms, grains of size less than 100 nm, fibres not less than 100 nm diameter in size, films having less than 100 nm in depth, the nano-holes and composites, both are assimilation of these. The word probiotic, signifies "for life" is attained from the Greek language. Lilly and Stillwell (1965) first used Probiotics. Gibson and Roberfroid, instigated the term "probiotic". Prebiotics is defined as a "non-digestible" foodstuff constituent, detrimentally affecting the host by selective growth

stimulation and/or commotion of one or a restricted number of bacteria present in the colon (Ford *et al.*, 2008; Malathi *et al.*, 2014) Computer-aided design (CAD) and computer-aided manufacturing (CAM) technology utilize computers to gather information, design, and manufacture a widespread variety of products. Over the last few decades, the arena of tissue engineering has progresses for recreating the efficient, healthy tissues and organs so as to supplant the unhealthy, dead tissues. (Uzun, 2008) Biomimetics is defined as the study of the creation, structure, or function of organically produced materials and biotic mechanisms and procedures specifically for the purpose of producing similar products by synthetic mechanisms, mimicking the natural ones. (Viswanath and Reddy, 2014) Nano-biotechnology is scrutinized to be an exceptional blend of biotechnology and nanotechnology by which traditional micro-technology can be assimilated to a molecular biotic approach. (Kumar and Lavanya, 2013)

Main Advances in the field of Biomedical Science and Technologies

Noteworthy triumphs in Biotechnology:

- 1990 Human Genome Project commenced

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- 1995 First complete genome sequence Haemophilus influenza. First use of microarray for gene expression profiling
- 1996 Affymetrix manufactured the first marketable gene chip. BRC Analysis diagnostic test for breast cancer predilection to detect BRCA1 and BRCA2
- 1998 Embryonic stem cells first grown
- 2001 Draft human genome sequence published
- 2002 Genomes of 125 organisms sequenced (Malathi *et al.*, 2014)

Molecular Foundation and Ecology of Human Oral Cancer

Carcinogenesis is a multifaceted, multi-step technique in which genetic trials within the signal transduction alleyways prevailing the normal cellular physiology are quantitatively or qualitatively reformed.

Nano Tissue Engineering

Employing the cellular and mineral components, there can be generation of a completely new tooth with the moralities of genetic engineering, tissue engineering and tissue regeneration at nanoscale. Chen et al in their study utilized nanorods like calcium hydroxyapatite crystals that were affiliated coarsely parallel to one another, and were capable to generate firmest tissue in the human body, i.e., dental enamel and mimic the natural and usual bio mineralization process.

Nanomaterials

These were arranged as zero, one, two and three dimensional nanostructures by Siegel et al. Numerous nanostructures comprise: Nanoparticles, Nanopores, Nanotubes, Nanorods, Nanospheres, Nanofibres, Nanoshells, Dendrimers & dendritic copolymers.

Nanodentistry

Continuousness of inclusive oral health by employing nanomaterials, biotechnology, comprising tissue engineering, and eventually, dental nanorobotics is made possible.

Nanodentistry encompasses:

- Nanorobotics
- Nanodiagnosics
- Nanomaterials

Local Anaesthesia

In dental practice, it is the most common method, to make oral anesthesia in which dental professionals will generate a colloidal suspension containing millions of active analgesic micron-sized dental nanorobot 'particles' on the patient's gingivae.

Hypersensitivity Treatment

Dentin hypersensitivity may be induced by changes in pressure transmitted hydrodynamically to the pulp of the teeth.⁵

Biomimetics in Dentistry

The most exciting venue for opinion on the nano-restoration of tooth structures is that of nanotechnology resemble processes that occur in nature (biomimetics), such as the formation of dental enamel.

Dental Permanence and Cosmetics

Synthetic materials like the “sapphire” or diamond are used for increasing there silience and tooth appearance, which have the toughness and failure strength 20 to 100 times like that of the natural enamel or the existing ceramic veneers, as well as good biocompatibility.

Renaturalization Techniques

Renaturalization of the dentition may become a well-known and note-worthy count in the imminent dental practice through the esthetic dentistry. Such procedure is most commonly used in those patients, who desire the removal of old dental amalgam restorations by the inherent biological resources and materials.

Nanodiagnosics

Nanoscale Cantilevers

These are the malleable beams alike a row of diving sheets that can be organized to attach to those molecules that are associated with cancer.

Nanopores

These are infinitesimal holes that facilitate the DNA to permit through one strand at a time, resulting in the better organization of the DNA sequencing.

Nanotubes

These are carbon rods that partial the DNA molecule diameter. They have the ability of ascertaining and exhibiting changed genes, thus helping the researchers to exactly locate those changes.

Quantum Dots

These are those type of nanomaterials when enhanced by the UV light, glimmer very luminously. Quantum dots are attach themselves to the proteins that are distinct to cancer cells and display tumours to light. (Viswanath and Reddy, 2014)

Nano Electromechanical Systems (NEMS)

Nanotechnology based NEMS biosensors are the ones that reveal flawless sensitivity and specificity for analytic recognition and down to single molecule level are being established.

Dentistry and Nanomaterials

Nanocomposites

These are non-agglomerated distinct nanoparticles that are equivalently spread into the resins or coatings. The nanofiller

comprise of an aluminosilicate powder abtaining a mean particle size of 80 mm and a 1:4 M ratio of alumina to silica and a refractive index of 1.508.

Nanosolution

Nanosolutions produce individual and dispersible nanoparticles, which can be added to various solvents, paints & polymers in which they are dispersed homogenously.

Nano-optimised Moldable Ceramics

- Nanofillers
- Nanopigments
- Nanomodifiers

Nanoneedles

These are needles comprising of assimilated nano-sized stainless steel crystals in them.

Implants

Surface variation of dental implants is done by using nanotechnology, because the surfaces properties like chemistry and irregularities play an elemental role in accomplishing and maintaining their long-term strength in bone tissue. (Shankarram *et al.*, 2014)

Genomics

In 1990, Human Genome Project (HGP) originated.

Proteomics

Proteomics is the study of the products of the 2% or less of the human genome which is transcribed - that is, protein coding. These proteins experience significant post-translational modification (proteolysis, glycosylation etc.) resulting in a number of different products from a single gene; 30000 human genes code for 400000 or more proteins. (Moezizadeh *et al.*, 2013)

Biomaterials

Researches on biomaterials, describe it as altering from trying of "artificial biomaterials" to developing and trying the "biological biomaterials". In this kind of framework, two research ways will select the forthcoming education and clinical techniques.

Biomimetics in Restorative Dentistry

The functional presentation of integral teeth is the consequence of intimate and well-adjusted associations between automatic, natural, practical and appealing considerations. (Kumar and Lavanya, 2013)

Biomimetics Endodontics

By solicitation of tissue engineering, biomimetic methodology for restoring the tooth structure is recognized on regenerative endodontic techniques. (Chug *et al.*, 2013)

Prebiotics and Symbiotic

Prebiotics are the dietary constituents that take care of a particular group of microorganisms living in the gut.

Mechanisms of Probiotic in Oral Cavity

- (a) Regularization of abdominal micro biota
- (b) Intonation of immune reaction
- (c) Metabolic possessions

Imminentperceptions

Forthcomings solicitations of Probiotics

1. Genetic engineering of previously acknowledged probiotics.
2. Biotherapy using antibiotic-sensitive bacteria for dislocating the resistant strains.
3. Micro biota exclusion
4. Passive immunization
5. Intervention with signaling mechanisms including Competence Stimulating Peptide (CSP) as the signaling particle.

Solicitations of bioactive materials and molecules dentistry

Root Canal Therapy

Portland cement or Mineral trioxide aggregate (MTA) is a bioactive material that is used for preservation of pulpal and periodontal tissue vivacity as a part of pulp capping and perforation repair techniques.

Tooth Reparation and Regeneration

Tooth healing and pulp regeneration developed by the growth factors by dentin extracellular matrix proteins (ECMPs). ECMPs has the ability to motivate the dental pulp stem cell propagation, distinction and immigration to injury locations. (Reddy *et al.*, 2010)

Conclusion

Currently, molecular biosciences and technologies are the upcoming fields in dentistry. Nanodentistry, is facing many imperative trials in identifying its mammoth potentiality. Probiotics play a key role in averting the matters concerned with overuse of antibiotics and antimicrobial confrontation. CAD/CAM systems have raised the standards of dentistry by giving superior quality restorations. Genetic engineering, nanotechnology and ozone therapy will transform dentistry, healthcare, and humanoid life into a new phase. Osseointegration is a very multifaceted process. The face of Dentistry has changed with the advent of newer technologies.

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