http://jmscr.igmpublication.org/home/
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v11i10.12

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

# Application Nanobiotech in Neurodegenerative Diseases

Authors
**Tukur Zayyanu[1], Karnawat Monika[2]**
[1]Career Point University, Alaniya, Kota, Rajasthan, India
[2]Career Point University, Alaniya, Kota, Rajasthan, India./Abdu Gusau Polytechnic Zamfara State Nigeria
Corresponding author
**Tukur Zayyanu**

**Abstract**

**Background:** *An early pathogenic role for mitochondrial dysfunction in affected neurons, which occurs before morphological and functional abnormalities, is being supported by expanding information from studies on neurodegenerative diseases. Age is the primary risk factor for numerous diseases that affect people, the degenerative disorders are characterized by an abnormal protein accumulation, progressive loss of neuron cells, and impaired motor or cognitive abilities. One of the fundamental characteristics of aging is mitochondrial malfunction, especially in organs that need a lot of energy, such the heart, muscles, brain, or liver. Small amounts of ROS are produced by natural cell functions such aerobic respiration and inflammatory response mostly in macrophages and hepatocytes.*

**Aims:** *This review's objective is to introduce a fresh, innovative nanobiotechnological approach to medical care and issues related to neurodegenerative diseases.*

**Method:** *The pathophysiological foundations of the neurological disorders have a number of characteristics. Similarities include oxidative stress (OS) and inflammatory responses. Unfortunately, treating these disorders is difficult. Searches in the databases PubMed, Web of Science, Scopus, and the Cochrane Library found up relevant research on neurodegenerative diseases. The systematic review, which was based on a literature search.*

**Result:** *The resultant oxidative stress and respiratory dysfunction contribute to neuronal toxicity and may make neurons more susceptible to continuous attack by aggregation-prone proteins.*

**Conclusion:** *The advancements in science and technology of newly evolved materials at the nanoscale is known as nanotechnology, which is a fast growing discipline. Nanobiotechnology approaches, such as Nano delivery-based methodologies, are currently being researched to solve limitation such as curcumin's stability bioavailability limitations.*

**Keywords:** *Nanobiotech, Oxidative Stress, Neurodegenerative and Mitochondria.*

**Introduction**

The word "neurodegeneration" refers to the death of neurons in the peripheral and central nervous systems. It causes conditions including Alzheimer's disease, Parkinson's disease, Huntington's disorders, amyotrophic lateral sclerosis, and other less common pathologies when it affects the central nervous system. The neurodegenerative disorders have a number of shared pathophysiological components. Oxidative stress (OS) and inflammatory reactions serve as common denominators. Unfortunately, it is challenging to treat these conditions. Therapeutic techniques that could target the interception of development of the neurodegeneration are currently being extensively researched due to the burden generated by the advancement of these diseases and the concurrent lack of effective treatment, (Rekatsina etal., 2019). Normal metabolic processes result in the formation of free radicals, which are then neutralized by endogenous antioxidants found in cells and tissue, preserving the redox balance. When this redox equilibrium is out of out of balance, it leads to oxidative stress, which is linked to a number of progressive neurodegenerative disorders. The cell membrane, proteins, and DNA are damaged by highly reactive free radicals, primarily reactive oxygen species (ROS) and reactive nitrogen species (RNS), which sets off a self-replicating inflammatory cascade of degenerative processes,

Reactive oxygen species are molecules with at least one oxygen atom and one or more unpaired electrons that are capable of existing independently. Free oxygen radicals such as the superoxide anion radical, hydroxyl radical, hydroperoxyl radical, singlet oxygen, as well as free nitrogen radicals are included in this group. Small amounts of ROS are produced by natural cell functions such aerobic respiration and inflammatory response mostly in macrophages and hepatocytes. Molecular signaling is the main function of reactive oxygen species. They also promote cell differentiation and death, which speeds up aging naturally. Because of the high concentration of lipids and a powerful oxidative metabolism which the brain and, more specifically, neurons rely on, they are susceptible to oxidative damage. The aging-related loss of functions and neurodegenerative diseases like Alzheimer's disease and Parkinson's disease have been linked to oxidative damages caused by a accumulation of misfolded proteins and a loss of antioxidant defenses, (Tauffenberger etal., 2021). The central nervous system's neurons express the largest levels of the intrinsically disordered protein known as Microtubule-Associated Protein Tau (MAPT), which has a relationship with microtubules (MT). When exon 4a and exon 6 are translated, respectively, higher molecular mass isoforms known as "big tau," which are expressed mostly in the peripheral nervous system, can also be seen in the spinal cord and skeletal muscle. Tau's ability to attach to MTs and facilitate their assembly and stability is one of its main roles; this binding activity can be adversely influenced by phosphorylation at specific locations. The abnormal aggregation and inclusion formation of the microtubule-associated protein tau is a significant pathogenic hallmark of many neurodegenerative disorders, including (AD), (Shinn etal., 2021): (Misrani etal., 2021): (Ashok etal.,2022).

**Neurodegenerative diseases**

The word "neurodegeneration" refers to the death of neurons in the peripheral and central nervous systems. It causes conditions including Alzheimer's disease, Parkinson's disease, Huntington's disorders, amyotrophic lateral sclerosis, and other less common pathologies when it affects the central nervous system. The neurodegenerative disorders have a number of shared pathophysiological components. Oxidative stress (OS) and inflammatory reactions serve as common denominators. Unfortunately, it is challenging to treat these conditions. Therapeutic techniques that could target the interception of development of the neurodegeneration are

currently being extensively researched due to the burden generated by the advancement of these diseases and the concurrent lack of effective treatment, (Rekatsina etal., 2019).

Age is the primary risk factor for numerous diseases that affect people, including neurological conditions like (AD), (PD), and (ALS), which affect a growing number of older individuals. These degenerative disorders are characterized by an abnormal protein accumulation, progressive loss of neuron cells, and impaired motor or cognitive abilities. One of the fundamental characteristics of aging is mitochondrial malfunction, especially in organs that need a lot of energy, such the heart, muscles, brain, or liver. The mitochondria, which generate the energy needed for the majority of cellular functions, such as synaptic plasticity and neurotransmitter production, are the only source of energy used by neurons nearly completely. Because of its high oxygen consumption, low antioxidant defenses, and high amount of polyunsaturated fats that are easily oxidized, the brain is particularly susceptible to oxidative stress and damage. It follows that maintaining neuronal integrity and survival requires the use of protective mechanisms, such as antioxidant defenses. Antioxidant research on the role of mitochondrial oxidative stress in the aging process is necessary, with a focus on neurological diseases, (Cenini etal,. 2019): (Shinn etal., 2021).

**Reactive Oxygen Species (ROS)**

Reactive oxygen species are molecules with at least one oxygen atom and one or more unpaired electrons that are capable of existing independently. Free oxygen radicals such as the superoxide anion radical, hydroxyl radical, hydroperoxyl radical, singlet oxygen, as well as free nitrogen radicals are included in this group. Small amounts of ROS are produced by natural cell functions such aerobic respiration and inflammatory response mostly in macrophages and hepatocytes. Molecular signaling is the main function of reactive oxygen species. They also promote cell differentiation and death, which speeds up aging naturally. Additionally, they control vascular tone, take part in muscle contractions, and assess the bactericidal and bacteriostatic activity. Excessive UV exposure, chronic stress, strenuous exercise, poor diet, and stimulant usage all lead to an increase in the creation of free radicals. Excessive UV exposure, chronic stress, strenuous exercise, poor diet, and stimulant usage all lead to an increase in the creation of free radicals. There is a balance between the body's production and removal of free radicals. Excessive free radical production contributes to oxidative stress, which harms cells and molecules at the molecular level. In vitro research it is found that reactive oxygen species damage proteins (aggregation, denaturation), lipids (peroxidation), carbohydrates, and nucleotides (changes in DNA structure) in addition to causing chemical changes, Many diseases caused by free radicals emerge as a result of these changes. The circulatory, pulmonary, and neurological systems are particularly vulnerable to the harmful effects of oxidative stress. ROS were essentially thought to be the cause of significant cellular damage that resulted in early aging and neurodegenerative diseases till recently. There has been a substantial amount of research into how ROS and reactive nitrogen species (RNS) influence disease progression since the 1950s and Harman's Freeradical hypothesis of aging, it is obvious that different concentrations of ROS have different effects on the cells. (Jakubczyk, etal 2020). Neurodegenerative diseases including (AD), (PD), and other conditions can develop if these charged species are not countered by antioxidants. Free radicals and charged species levels have been discovered to be higher in neurological conditions than in healthy individuals, this is associated with oxidative damage to neuronal cells. Antioxidants are frequently utilized in such circumstances to decrease oxidative stress and aid in neuroprotection

**Sources of Reactive Species**

There are two major sources for reactive species. ROS can either be created during cellular reaction to xenobiotics or cytokines released as part of a defensive mechanism or they can be generated as byproducts of oxidative metabolism, primarily through mitochondrial respiration. The majority of the ROS in the cell are produced by the mitochondrial electron transport chain, which is involved in energy production. The reduced oxygen ion known as superoxide is produced by this proton leak, which results from the oxidation of Nicotinamide adenine dinucleotid Hydrogen (NADH) and FADH2 at complexes I (NADH dehydrogenase) and III (coenzyme Q and cytochrome c oxidoreductase) of the electron transport chain. The enzyme complex NADPH oxidase is the second main source of reactive oxygen species (ROS). Mammals have 7NADPH oxidases (NOX1–5 and DUOX1-2), which are responsible for the production of ROS in the cytoplasm in response to a variety of stimuli, (Tauffenberger etal., 2021)

**Impact of Reactive Species on the Brain**

Because of the high concentration of lipids and a powerful oxidative metabolism which the brain and, more specifically, neurons rely on, they are susceptible to oxidative damage. The aging-related loss of functions and neurodegenerative diseases like Alzheimer's disease and Parkinson's disease have been linked to oxidative damages caused by a accumulation of misfolded proteins and a loss of antioxidant defenses, (Tauffenberger etal., 2021).

**Oxidative Stress and Neurodegenerative Diseases**

Through mitochondrial malfunction, neuroinflammation, apoptosis, and tissue necrosis, cell damage sets off a series of degenerative events. Alzheimer's disease (AD), Parkinson's disease (PD), and Amyotrophic Lateral Sclerosis (ALS) are only a few of the neurodegenerative diseases that are characterized by oxidative stress-induced homeostatic instability. Stroke, spinal cord injury (SCI), peripheral nerve injury (PNI), and other conditions are examples of neurodegenerative disorders that are generated by injury, Oxidative stress, inadequate antioxidant defense, and mitochondrial dysfunction are the common factors that connect these neurodegenerative diseases**,**

**Mitochondria**

One of the primary structural and functional components of mitochondria is the mitochondrial respiratory chain, which is located in the inner mitochondrial membrane. It is composed of the complexes I, II, III, IV, and V. It transfers electrons between these five integrated complexes to catalyze the phosphorylation of ADP to ATP. Most studies indicate that mitochondria are the primary source of the majority of intracellular ROS generation since they convert 1-5% of oxygen in normal conditions into ROS. The two distinct locations of complex I (NADH) and complex III (ubiquinone-cytochrome c reductase) in the electron-transport chain are where the majority of mitochondrial superoxide radical production takes place. Complex III is the primary site of ROS production under normal metabolic settings, hence free radical attacks often take place at the mitochondrial respiratory chain complex. Superoxide and other reactive oxygen species are thought to form at the locations of complexes I and III, as indicated below, (Fields etal., 2023): (Tauffenberger etal., 2021).

**Hypothesis of Neurodegenerative Disease**

The pathophysiology of neurodegenerative disease and the wide range of its phenotypes are both explained by a hypothesis. The underlying assumptions that support the hypothesis are Multiple risk factors are associated with neurodegenerative disease; the most significant risk factor is age; the aging process affects neuroanatomical pathways differently; the development of pathogenic proteins results from the degeneration of these pathways; the spread of pathogenic proteins along anatomical pathways;

and the overall prevalence of neurodegenerative disease. The phenotypes of familial and sporadic disease are comparable, and neurodegenerative disease is characterized by heterogeneity, overlapping phenotypes, and numerous pathologies, (Armstrong, 2020).

**Neurodegenerative Disorders Characterized by Mitochondrial Involvement**

According to research, over the past 30 years, a growing body of data has pointed to the involvement of mitochondria in maintaining brain homeostasis and in the development of neurological disorders, where they may play a major role or be involved in a secondary event that exacerbates the damage to the neurons, (Fields etal., 2023).

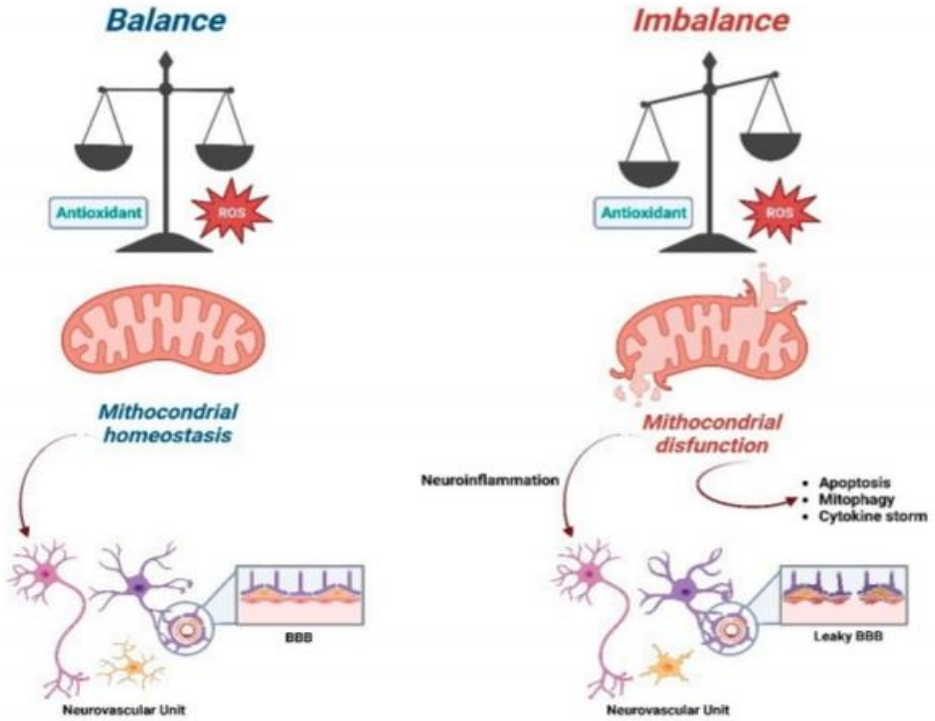


**Figure 4**. Exhibit Mitochondrial Homeostasis Adopted from (Fields etal., 2023).

**Reactive Oxygen Species in Mitochondria and Neurodegenerative Diseases**

Multiple morphofunctional changes, such as changes to mitochondrial membranes and their cristae, an accumulation of mutated mtDNA genes and proteins, a decrease in ATP production, and an increase in ROS production, are caused by pathologic conditions at the mitochondrial level, which results in an alteration of cellular homeostasis. The significance of ROS appears to constitute a primary trigger that determines the domino effect in the modification of mitochondrial function, as highlighted by the literature. Therefore, when treating oxidative stress-induced diseases, the development of efficient antioxidant systems and treatments becomes essential. MTAs have been demonstrated to be able to halt the intramitochondrial cascade that is brought on by oxidative stress and results in cellular apoptosis. High ROS concentrations in the pathologic context of Alzheimer's disease cause neurons to overproduce lipids, which can then be attacked by ROS, leading to the generation of lipid peroxides that are harmful to cell health. In AD models, several MTAs have shown to be successful at restoring neuronal functions, Once

more, the antioxidants' ability to lower ROS relieves cellular stress and damage, restoring the flow of energy and lipids to the microglia. Consequently, if the brain can eliminate too much ROS, it will mitigate the negative effects of A aggregates and also improve their clearance. Instead, the imbalance between the production of new mitochondria and the removal of damaged ones by mitophagy stands out as a crucial factor in the etiology of Parkinson's disease. In reality, just a small percentage of hereditary cases (10–15%) have causative disease genes that encode for proteins implicated in the mitophagy process. As a result, this may be a major factor in PD neurodegeneration, leading to the accumulation of faulty mitochondria that impair neurons, (Fields etal., 2023).

**Microtubule (MT)-Associated Protein Tau (MAPT)**

The central nervous system's neurons express the largest levels of the intrinsically disordered protein known as Microtubule-Associated Protein Tau (MAPT), which has a relationship with microtubules (MT). When exon 4a and exon 6 are translated, respectively, higher molecular mass isoforms known as "big tau," which are expressed mostly in the peripheral nervous system, can also be seen in the spinal cord and skeletal muscle. Tau's ability to attach to MTs and facilitate their assembly and stability is one of its main roles; this binding activity can be adversely influenced by phosphorylation at specific locations. The abnormal aggregation and inclusion formation of the microtubule-associated protein tau is a significant pathogenic hallmark of many neurodegenerative disorders, including (AD). These conditions are frequently referred to as tauopathies due to the pathological The most convincing evidence that tauopathy plays a causative role in neurodegeneration comes from frontotemporal dementia with parkinsonism linked to chromosome 17 (FTDP-17), which is caused by mutations in the MAPT gene that encodes tau. However, there are still a lot of unknowns about how different FTDP-17-linked tau mutations encourage tau aggregation and neurodegeneration, (Strang, etal., 2018).

**Tauopathies**

Tauopathies are a broad category of phenotypically diverse diseases, including (AD), progressive supranuclear palsy (PSP), corticobasal degeneration (CBD), Pick's disease (PiD), chronic traumatic encephalopathy (CTE), and frontotemporal dementia with parkinsonism linked to chromosome 17 (FTDP-17), characterized by the aberrant aggregation of tau in neurons and/or glia. Initially identified in 1975 as a protein associated with MTs, tau was later determined to be the main component of neurofibrillary tangles (NFTs), hyperphosphorylated proteinaceous inclusions associated with AD and other tauopathies. The fact that some types of FTDP-17, now known as FTDP-17t, are caused by autosomal dominant mutations in the tau-encoding MAPT gene in 1998 demonstrated that tau malfunction alone is sufficient to induce widespread central nervous system neurodegeneration. For people with FTDP-17t, the disease pathology is defined by the presence of filamentous tau inclusions in neurons and occasionally in glia across the frontal and temporal lobes, along with atrophy and ventricular dilation in these areas. The average age of start for these MAPT mutations is 49 years, and the typical disease duration is 8.5 years. These mutations may result in a number of cognitive, behavioral, and motor impairments, (Strang, etal., 2018).

**Antioxidant systems in mitochondria**

The term "antioxidant" refers to any substance that, when present in small amounts compared to an oxidizable substrate, considerably slows down or stops that substrate from oxidizing. In living things, there are two ways that antioxidants might reduce oxidative damage: (i) direct scavenging of the oxidizing radical, and (ii) regeneration of the damaged biomolecules. An advanced antioxidative system found in cells is made up of a variety of antioxidant enzymes and low molecular

weight antioxidants that are widely dispersed throughout numerous compartments. In mitochondria, both types of substances are abundant, (Wu etal., 2018). One of the main mediators of progressive neurodegeneration is thought to be dysfunctional mitochondria under oxidative stress conditions. Antioxidant exogenous administration has the potential to reduce oxidative stress and restore redox equilibrium. Antioxidants, both natural and artificial, have been examined in this area. The problems may be their low bioavailability, instability, limited transport to the target tissue, and/or poor antioxidant capacity, necessitating frequent and high doses that cannot be given to humans due to dose-limiting toxicity. Studies on antioxidant enzyme delivery using nanoparticles need to be conducted in order to solve some of the problems mentioned above. in addition to nano drug encapsulations, (Ashok etal.,2022).

**Role of Antioxidants on Mitochondrial Homeostasis**

Studies have largely demonstrated and characterized the significance of antioxidants as molecules with the ability to mitigate the negative effects of free radicals, preserving cellular integrity. By removing or inhibiting oxidizing agents, these molecules stop or at least slow down oxidation. In addition, they help stop damaging oxidation once it has begun by converting free radicals into nonreactive chemicals. Antioxidant molecules play a critical function in the treatment of neurodegenerative disorders. They do, however, also contain low concentrations of antioxidant molecules, which predisposes them to harmful ROS accumulation and oxidative damage, enhancing cellular and tissue damage, neuroinflammation, and blood-brain barrier permeability. As a result, it is hypothesized that abnormal mitochondrial activity is essential in the etiology of neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, multiple sclerosis, and huntington's disease, (Fields etal., 2023).

**Mitochondrial Antioxidants in Central Nervous System Pathology**

A high relative oxygen requirement 20% of the overall body's consumption for every 2% of an adult's weight. The brain is particularly vulnerable to oxidative damage due to an abundance of easily oxidizable lipids and redox-active metals (iron, copper). The sensitivity is made worse by the brain's relative lack of ROS scavengers compared to other organs (and especially in neurons compared to atrocities). One of the main pathogenic factors in neurodegenerative diseases like Alzheimer's disease, Parkinson's disease, or amyotrophic lateral sclerosis is ROS/RNS toxicity. Most of the conditions mentioned earlier share the trait of mitochondrial malfunction, if not all of them; mitochondrial antioxidant defense mechanisms play a crucial role in the development of the diseases, (Ruszkiewicz etal., 2015).

**Alzheimer ’s disease’s Neuropathology**

Alzheimer disease (AD) pathogenesis factors associated to oxidative stress and mitochondrial damage include the accumulation of amyloid-β-peptide (Aβ) and poor cholesterol homeostasis, Strong Cu-reductase activity in A generates $H_2O_2$, and $H_2O_2$ accumulation in excess leads to mitochondrial malfunction, (Ruszkiewicz etal., 2015). The progression and symptoms of AD are indicated by two kinds of neuropathological changes which include: positive lesions (caused by accumulation), which can be identified by the accumulation of neurofibrillary tangles, amyloid plaques, dystrophic neurites, and neuropil threads. While the other deposits discovered in the brains of AD patients, , (Breijyeh and Karaman, 2020).

**Pathogenesis**

The cause of AD pathogenesis and neuronal loss is yet unknown. Although substantial study on the functions of Aβ and tau has been done in recent years, it is still unclear how these proteins relate to disease. The pathophysiology of AD has been explained by a number of different pathways, (Sheppard and Coleman, 2020).

**Neuropathology**

Synapse loss is an essential characteristic of AD, which is then followed by neuronal shrinkage across the cerebral cortex, with the medial temporal lobe being the most seriously affected. The entorhinal and hippocampal regions are where pathology seems to begin, spreading laterally to the fronto-temporal cortices. With the cerebellum typically spared, it spreads as far as the striatum and thalamus, These areas have shrunk, according to MRI scans (84). Pyramidal cells in the CA1 region of the hippocampus are particularly susceptible to changes in morphology and cell death, consistent with the primary sign of memory loss, The occurrence of Aβ plaques and NFTs precede clinical symptoms, indicating that by symptom onset,(Sheppard and Coleman, 2020).

**Parkinson's disease**

The primary hallmark of Parkinson disease (PD) disease is characterized by the gradual degradation of dopaminergic neurons in the midbrain substantia nigra (SN), notwithstanding the complexity of the neuropathological presentation. Clinically speaking, Parkinson disease is characterized by a variety of motor and non-motor symptoms, including bradykinesia, stiffness, rest tremor, and postural instability. PD is characterized by intracellular aggregates of proteins that are primarily made alpha-synuclein (α-syn) which are frequently referred to as Lewy bodies (Monzio etal.2020).

**Neuropathology of Parkinson's Disease**

Macroscopically, the brain in idiopathic PD is frequently unremarkable, with minor frontal cortex atrophy and, in some instances, ventricular dilatation. Transverse regions of the brainstem show the primary distinctive morphological change in the PD brain. where almost all cases exhibit loss of the darkly pigmented region in the substantia nigra pars compacta (SNpc) and locus coeruleus. The death of noradrenergic neurons in the locus coeruleus and dopaminergic (DA) neuromelanin-containing neurons in the SNpc is directly correlated with this pigmentation loss. The majority of cell death in the SNpc is restricted to a subset of neuromelanin-containing dopaminergic neurons, known as the A9 neurons, whereas other neuronal and glial cell types are mostly spared, (Kouli etal., 2018); (Dickson 2019).

**Nanotechnology**

The advancements in science and technology of newly evolved materials at the nanoscale is known as nanotechnology, which is a fast growing discipline. This is an interdisciplinary field that applies techniques from several fields. Electronic robotics, biology, chemical engineering, and other fields have many uses for nanotechnology. The size, shape, and surface morphology of nanoparticles determine their physical, chemical, optical, and electrical properties. The two basic techniques used for making nanoparticles are top-down and bottom-up. In the top-down method, nanoparticles are generated from bigger particles, whereas in the bottom-up method, nanoparticles are formed from molecular components that are chemically assembled by recognizing comparable molecules. In the chemical and biological synthesis of nanoparticles, the bottom-up technique is frequently applied, (Tukur and Karnawat 2021). Nanoparticles have received a great deal of attention due to their potential uses in medicine, including the transportation of active ingredients, the investigation of DNA structure, protein detection, tissue engineering, pathogen detection, the elimination of cancer cells, and the research of phagocytosis kinetics. The development of drug delivery systems using nanoparticles is the primary use of nanotechnology in medicine. Nanoparticles have a lot of surface area, regulated particle size, accurate placement, high bioavailability, stability, biodegradability, and controlled drug release. Copper, silver, gold, platinum, and other metal nanoparticles have all been synthesized and employed in healthcare applications. But these metallic nanoparticles will persist and accumulate

up in the body, causing negative side effects (Cridge etal., 2013). Utilizing biological sources for making nanoparticles allows us to move beyond these limitations. It has been established that nano-biomaterials are harmless and cannot accumulate up in the body, (Tukur and Karnawat 2021). To improve a medicine's solubility, stability, and bioavailability, a nanoparticle drug delivery system is used. Researchers have developed a variety of nanoforms of curcumin in recent years, including nano suspensions, nano emulsions, solid lipid nanoparticles, hydrogel nanoparticles, etc. Numerous studies have demonstrated the potential of curcumin nanoparticles as therapeutic agents for a range of diseases, (Tukur and Karnawat 2021).

**Curcumin Bioavailability and Nano Biotechnology in Neurodegenerative Diseases**

The most common causes of cognitive decline in people are Alzheimer's and Parkinson's diseases, which primarily affect the elderly & result in clinical signs such a progressive loss of memory, reasoning, and cognitive ability. These medical conditions are brought on by oxidative stress, which comes on by the generation of reactive oxygen species like singlet oxygen (O2), hydroxyl radicals (•OH), and superoxide ions (O2•). Antioxidants are therefore helpful in the prevention of neurotoxicity carried on by oxidative stress. The bioavailability of curcumin will depend on the final particle size and stability, which might be improved by adopting the most recent nanoparticle technology. Nanocurcumin may be able to penetrate the blood-brain barrier, which is important in treating neurodegenerative disorders including Parkinson's and Alzheimer's. As a result, nanotechnology applications offer a novel therapeutic platform for neurodegenerative diseases. Developing a successful Nano medicine will result in the treatment of age- related neurodegenerative diseases like Alzheimer's and Parkinson's disease, (Tukur and Karnawat 2021). Due to its chemical similarity to human tissues, calcium phosphate is an important inorganic mineral with great biocompatibility. It represents a significant advancement in nanobiotechnology for the treatment of neurological disorders like Parkinson's and Alzheimer's. The drawbacks of curcumin, such as its poor chemical stability and bioavailability, are the focus of this effort.

**Application of Encapsulated Nano Curcumin in Neurodegenerative Diseases**

In the elderly, neurological conditions form a major global public health concern, but there are few effective treatments. The hydrophobic polyphenol curcumin, which is derived from the dried rhizomes of *Curcuma longa L*., has excellent potential for treating brain cancers and neurological conditions. As a result of curcumin's anti-amyloid, anti-oxidant, and anti-inflammatory characteristics, it may have neuroprotective effects. According to reports, it lowers nitric oxide levels, which protects the brain from lipid peroxidation, (Askarizadeh etal. 2020).

Curcumin has been demonstrated to have positive benefits in inhibiting the production of amyloid Aβ1-42 oligomers and the disaggregation of the fibrils that are already produced. Due to its antiproliferative and apoptotic action, curcumin is also said to have therapeutic effects against brain cancers in studies that are still in the phase of investigation. Due to its poor brain bioavailability caused by poor absorption and stability at physiological pH, high rate of metabolism, quick systemic elimination, and limited blood-brain-barrier (BBB) penetration, curcumin has limited neuroprotective activities, As a result, novel Nano biotechnology approaches, such as Nano delivery-based methodologies, are currently being researched to solve curcumin's present bioavailability limitations, (Tukur and Karnawat, 2021).

**Conclusion**

In several preclinical and clinical studies, the invo lvement of oxidative stress in the etiology of neur odegenerative disorders has been well established. However, there is ongoing debate regarding the ef

fectiveness of antioxidant treatment for treating ne urological conditions in people. Problems may be their low bioavailability, instability, limited transport to the target tissue, and/or poor antioxidant capacity, necessitating frequent and high doses that cannot be given to humans due to dose-limiting toxicity. Studies on antioxidant enzyme delivery using nanoparticles need to be conducted in order to solve some of the problems mentioned above. in addition to nano drug encapsulations.

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