ViralInfections:CurrentTreatment Options

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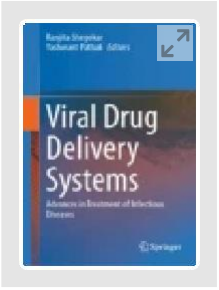
Abstract

Viruses are small tiny droplets of microbes and mostlycauseandalsocreateapandemicsituationin the world such as COVID-19. Numerous viruses are reporteduptodate,andstillnewonesarecoming, which leads to continuous research on finding new diagnostic tests with a novel treatment option. Numerousbioinformaticssitescontinueupdating virus genomes with their cell member structure protein to assist the drug developer in finding the



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NovelFormulationApproachesfor Treatment of Ebola Virus

Sankha Bhattacharya, Shambhavi Singh, Sambuddha Chakraborty, BhupendraG.Prajapati, MahavirChougule & Jayvadan K. Patel

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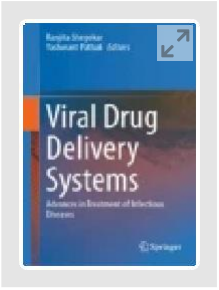
Abstract

The segment of the United Nations that deals with the medical aspects of all the different parts of the world,theWorldHealthOrganization,onthe3rdof May2021,professedtheongoingEbolaoutbreakto be over. Ebola virus is acknowledged to be the causativeagentofEbolaviraldisease(EVD)orEbola fever, which is of an hemorrhagic nature, a viral hemorrhagicdiseasefoundinhumansinadditionto



ViralDrugDeliverySystemspp295–309

Nano-DrugDeliverySystemsfor COVID-19 Drug Delivery

Komal Parmar&Jayvadan PatelChapter

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Abstract

Currently,SARS-CoV-2(COVID-19)isthedominant disease in the globe. It has resulted into major economic disruption and social disturbance all aroundtheworld.Manyantiviralsareundertrialfor the treatment of the infection. However, efficacy of drugs is often limited due to certain factors associatedwiththedrug.Suchproblemscanbe overcome by using novel drug delivery systems employing nanotechnology. These delivery systems canbemanipulatedforthedesiredsiteofactionand

NanotechnologyinMalariaDiagnosis

AnitaPatel,JayvadanPatel,RutvikPatel,andVidhyutPatidar

AbstractMalariahasbeenaccountablefortheutmostmortalityinthemajorityof malaria-endemiccountries.Evenafterdecadesofmalariacontrolcampaigns,itstill continues as a disease of high mortality owing to inappropriate diagnosis and fast-evolving drug-resistant malarial parasites. For well-organized and economical malariamanagement,WHOsuggeststhatallmalaria-suspectedpatientsmustgetan appropriate diagnosis before administering drugs. In malaria-endemic countries, routine diagnosis is stuck with technical and infrastructural challenges to laboratories. These laboratories are deficient in standard facilities, expertise, or diagnostic supplies; therefore, therapy is administered based on clinical or self-diagnosis. Traditionalmethodsfordiagnosingmalariaremainproblematic;so,itisthusimperativetodevelopfast,effective,economical,andaccuratetechniquesforthediagno- sis of malaria both in symptomatic and asymptomatic individuals. Nanotechnology-based diagnostics methodologies can boost up detection of malaria at lower parasite levels while presenting a speedy, accurate, sensitive, and easy method. As a result, nanotechnology-based diagnosis tool is fascinating lots of research interest, and a small number of researchers have proposed prospective nanotechnology-basedtoolsformalarialdiagnosticswhichcanconquersomeofthe difficultiescurrentlyfacingamalarialdiagnosis.Futureinnovationwillbeessential to make possible the appliance of more sensitive and affordable nanotechnology-based methods for malaria diagnosis in resource-limited settings. Finally, the level of malaria endemicity, the necessity of diagnosis, the experience of the general practitioner, the efficiency of healthcare workers, and budget resources are all factors influencing the choice of malaria-diagnostic technique.

KeywordsMalaria·Mortality·Diagnosis·Nanotechnology-baseddiagnostics

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NanotechnologyinTBDiagnosis

JayvadanPatel,AnitaPatel,andNisargPatel

AbstractTuberculosis(TB),causedbythebacterium*Mycobacteriumtuberculosis* (Mtb),isstillasignificantworldwidehealthissue,anditisthesecondlargestcause ofmortalityamongallinfectiousdiseases(Mtb).TBismostusuallyassociatedwith the lungs, although it can also damage the kidneys, brain, and spine.The detection oflatenttuberculosisinfection(LTBI),extrapulmonarytuberculosis(EPTB),drug-resistanttuberculosis(DR-TB),Humanimmunedeficiencyvirus(HIV)-associated tuberculosis (TB), and pediatric tuberculosis remains difficult in poor countries. This ismostly dueto tuberculosisthat hasbeen delayedor misdiagnosed,which is feedingtheglobalepidemic.Becauseanadequatescreeningtestiscurrentlyunavail-able,tuberculosismustbediagnosedusingtraditionalmethods,despitetheirlimited diagnosticcapacity.Nanoparticleshaveexhibitedpromisingfeaturesinimproving pharmaceutical distribution, reducing treatment frequency, and improving disease diagnosis. Scientific world believe that nanotechnology has proposed new ways to address residual scientific concerns for TB. Nanotechnology-based concepts have significant potential for diagnosing, treating, and preventing tuberculosis.The cre-ation of antigen/antibody nanocarriers is an intriguing new frontier in the field of diagnostics,withthepotentialtopavethewayforbetterTBdiagnostics.Thischap-terreviewsthecurrentdiagnostictechniquesfortuberculosisandemphasizesrecent advancesinnanotechnology-based*Mycobacteriumtuberculosis*detectionmethods.

KeywordsNanotechnology·Diagnosis·Tuberculosis

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NanotechnologyBasedVaccination Approach in Malarial Infection

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AbstractMalaria afflicted an estimated 219 million people in 2017, killing 435,000peopleworldwide.Thismorbidityandmortalityburdenistheconsequence ofmorethanacenturyofworldwideeffortandresearchaimedatimprovingmalar- ial prevention, diagnosis, and treatment. Malaria is the most frequent illness in AfricaandcertainAsiannations,accountingformanyindigenouscases.Theglobal malaria fatality rate ranges from 0.3% to 2.2%, and in cases of severe malaria in tropicalclimaticzones,theraterisesfrom11%to30%.Malariaiscausedbyatiny protozoonbelongingtothePlasmodiumspeciesgroup,whichincludesvarioussub- species.Plasmodiumspeciescancauseillnessinhumans.Plasmodiumisakindof amoeboid intracellular parasite that accumulates malaria pigment (an insoluble metabolite of haemoglobin). Parasites are present in several animals; some in red bloodcellsandothersintissues.FivePlasmodiumspeciescaninfecthumansoutof 172 species.These are *Plasmodium malariae*, *Plasmodium falciparum*, *Plasmodium vivax*,*Plasmodiumovale*,and*Plasmodiumknowlesi*.Thezoonoticmalaria *P. knowlesi* has been identified in South-EastAsia. Malaria symptoms often occur 10daysto1monthafterinfection.Mildsymptomsarepossible.Somepeopledonot feelillforuptoayearafterbeingbittenbyamosquito.Parasitescansurviveinthe body for years without creating any symptoms. Malaria treatment should begin as soonasfeasible.Tocuremalaria,yourdoctorwillprescribemedicationsthatdestroy theparasite.Malariamedicationsarenoteffectiveagainstsomeparasites.Thekindof medicationanddurationoftherapyisdeterminedbytheparasitecausingyoursymp- toms. Due to the shortcomings of conventional malaria therapy, a nanotechnology approachhasbeenimplementedwithvaccinedevelopmentinvariousphasetrials.

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Inflammation and the Gut Microbiome in Depression and Anxiety

Komal Parmar, Sai Patel, and Jayvadan Patel

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7.1 Introduction

7.1.1 Focus on Depression and Anxiety

The prevalence of common mental diseases including depression and anxiety has increased over the past few decades, raising concerns about mental health on a global scale (Friedrich 2017, Tariku Seboka et al. 2022). The prevalence of depression in the world increased significantly after the 2020 Covid-19 pandemic (Abbott 2021), markedly even in children and adolescents (Wang et al. 2022). There are considerable negative effects on health due to the growing burden of mental diseases. Up to 25% of patients in general practice have co-occurring depression and anxiety disorders. Approximately 85% of people with depression experience considerable anxiety, and 90% of people with anxiety disorders experience depression (Tiller 2013). Depression is characterized by short-term emotional reactions that hinder daily functioning and are accompanied by symptoms including sadness and frustration, guilt-related sensations, numbness, and loss of interest (Wahed and Hassan 2017). The term "anxiety disorders" refers to a set of mental disorders that are characterized by unpleasant feelings of unease, worry about the future, or

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Polyphenolic Nutraceuticals to Combat Oxidative Stress through Microbiota Modulation

Aaishwarya B. Deshmukh and Jayvadan K. Patel

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Gut Microbiota with Functional Food Components and Nutraceuticals

Vivek Patel, Dhara Patel, and Jayvadan Patel

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17.1 Introduction

The term "microbiota" applies to the entire population of microorganisms in a given location (1). The largest population of microorganisms is the microbiota of the human gut, which is comprised of approximately 100 trillion microorganisms (most of them bacteria, but also fungi, viruses and archaea) (2–7). The collection of genes found in intestinal microorganisms forms a genetic repertoire that is one level above the human genome. (8). The microbiota offers a great deal of help to the host with a variety of physiological functions such as strengthening gut integrity or intestinal epithelium (9), harvesting energy (10), protecting against pathogens (11) and regulating host immunity (12). The human gut microbiota is complex, lively and unique to each individual and influenced by various factors such as diet, age, antibiotic intake, xenobiotics, early life microbiota exposure, changes in hygiene practices, pollution and socioeconomic status (13).

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Interplay between Nutraceuticals and Gut Microbiota: Some Clinical Evidence

Aaishwarya B. Deshmukh and Jayvadan K. Patel

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ManishP.Patel,RutviV.Patel,MehulR.Chorawala,Avinash K.Khadela,SandipP.DholakiaandJayvadanK.Patel

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EPIDEMIOLOGYOFCANCER

Theearliestknownstatementofcancerwaswritteninan Egyptianpapyrusaround1600BC.Itwas thoughttobeuntreatableuntilthelate1700s,whenanaesthesia,betterprocedures,andpathological controlimprovedtheremovaloftumours.[1]Cancerisasignificantglobalhealthissue.Ariseincan- cer in the coming decades is foreseen by observing global demographic features; around 420 mil- lion new cancer cases will be encountered by 2025. Viewing GLOBACON data, 14.1 million new cancer patients were seen and 8.2 million patient deaths owing to cancer were estimated in 2021. According to a 2008 study by the International Agency for Research on Cancer, there could be 13–17milliondisease-relateddeathsworldwideby2030,vastlyincreasingsince1975.[2]Themajor

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18 Subcellular Targeting of Nanoparticles for Cancer Theranostics

Vivek Patel, Ajay J. Khopade and Jayvadan K. Patel

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18.1 INTRODUCTION

Traditional treatments of cancer such as radiation and chemotherapy therapy are frequently limited by side effects due to a lack of targeted delivery for carrying anticancer drugs to the neoplastic tissues and low drug concentration at the site. To overcome these limitations, subcellular organelle-targeted nanoformulations of anticancer drugs are required. Current developments in nanoformulation-based organelle-targeted drug delivery systems have demonstrated that they can transport drugs to pathological tissues via cell-membrane targeting and release drugs in the cytoplasm (1–3). To be effective, drug nanoparticles (NPs) must enter the cytoplasm of the targeted cell and gain access to a specific organelle such as endosome/lysosome, endoplasmic reticulum (ER), mitochondrion, nucleus, nucleolus, Golgi apparatus (GA), proteasomes and peroxisomes. (4). Organelle-specific delivery has emerged as a key strategy for targeted drug delivery research for cancer theranostics (5).

Organelles are critical for cell function (6–15). Mitochondria are known as the powerhouse of the cells: they are in charge of the adenosine triphosphate (ATP) synthesis from food, calcium ion cycle and apoptosis regulation. The lysosome is involved in digestion, autophagy and cellular defense. Protein synthesis and transportation are facilitated by the endoplasmreticulum and Golgi apparatus.

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21 Commercialization Challenges of Tumor Microenvironment–ResponsiveNanoplatforms

SnigdhaDasMandal,DevanshuJPatel, SurjyanarayanMandalandJayvadanPatel*

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21.1 INTRODUCTION

Nanomedicines are multifaceted engineered nanoscale structures and are extensively used in the treatment and targeting of diseases because of their numerous therapeutic benefits (1). Since the lastdecade,nanotechnologyhasbeenconsideredarevolutionarytechnologyduetoitsapplicability in multiple fields, including medicine. Due to numerous anticipated beneficial effects, nanomedicines have attracted attention from scientists around the globe. These benefits include protectionof the active entity from degradation, enhanced solubility and bioavailability, superior pharmacokinetics, reduced toxicity, enhanced therapeutic efficacy, decreased drug immunogenicity and, most importantly, capability of delivering the drug at the target site (2). Due to exhaustive pharmaceutical research, an increasing number of products containing nanomaterials with different applications,especiallywithtumors,havesurfaced.Theuseofnanotechnologyinthedevelopment of new medicines is now part of research around the globe which is capable of providing new and innovativemedicalsolutionstoaddressunmetmedicalneeds(3).However,thedefinitionofnanomaterials has been controversial among various scientific and international regulatory corporations(4).Severalopinionscomeouttoagreeonaconsensualdefinitionofnanomedicineswhichin turn based on the fact that nanomaterials possess different physicochemical properties than thoseof their conventional equivalents, due to their small size, charge and stability (5). These physicochemical properties provide a set of opportunities in the development of drug products; however, their safety issues are still major concerns. The physicochemical properties of the nanomedicines which usually alters the pharmacokinetics of drug moiety like absorption (potential to cross biologicalbarriers),effectivedistribution,eliminationandmetabolismandtheirtoxicpropertieswhich may help in establishing the concerns over the application of the nanoformulations (6). Several nanomedicine products have been approved by the European Medicines Agency (EMA) and the US Food and Drug Administration (FDA) for various therapeutic indications (7). In general, high therapeuticefficacyandsafetyarethetwoprimaryfactorsforaproductinordertoqualifyascommerciallysuccessful.Butmostnanomedicinesfailtomeettheserequirements;hencetheirsuccessfulcommercializationishamperedtoalargeextent.Thelimitedclinicalsuccessof nanomedicines

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