Metadichol® a novel nano lipid formulation

Antibiotic resistance, and the emergence of novel viruses, such as COVID-19, both present major challenges to human health. Whilst there are ongoing investigations into vaccines and alternative approaches to antibiotics, a broad-spectrum agent, able to target both bacteria and viruses would be an additional tool to help manage infectious diseases.

What bacteria and viruses have in common is the structure of their cell membranes. The cell membranes of both bacteria and viruses are formed from a lipid bilayer. This lipid membrane is made up of two layers of lipid molecules (phospholipids, fat, waxes and sterols), facing in opposite directions. The membrane keeps molecules, such as proteins, within the organism and prevents them diffusing into regions of the cell where they are not required. However, molecules can still be moved from the inside of the cell to the outside, and vice versa, using pumps which transport the lipid bilayer. When the structure of the lipid bilayer is lost, for example in damaged or dying cells, immune cells can recognise this and eliminate the cell.

Dr P. R. Raghavan, CEO of NanoX Inc, works in the field of nanomedicine and his company aims to provide a solution that can be applied to a wide variety of settings, moving away from a ‘one drug one target’ approach.

**METADICHOL® AND VITAMIN D RECEPTORS**

In 2008, Dr Raghavan developed a product named ‘Metadichol®’ which has since obtained patents from the U.S., as well as worldwide. Metadichol® is made from an absorbable nano-emulsion of a type of lipid molecule called policosanol, normally found in foods such as peanuts, sugar cane, rice and wheat. Found in foods we eat every day, policosanols have been used as a dietary supplement for many years as they have been suggested to reduce cholesterol level in number of studies.

Metadichol® has now been made into a nano-emulsion, a delivery system frequently used for drug delivery which involves a mixture of two liquids, such as water in oil or oil in water droplets. This allows controlled or sustained release of substances such as drugs, genetic material or other biologically active ingredients; it also enhances the stability and bioavailability of substances. This nano formulation has unique effects on other various disease biomarkers not seen in non-nano formulations.

Metadichol® is thought to act on vitamin D receptors (VDRs) which can be found on many different tissues throughout the body, including immune cells. Dr Raghavan and his team have published work which shows that it acts as an inverse agonist on nuclear receptors, Thyroid A (THRA) and Thyroid B (THRB), Aryl Hydrocarbon receptor (AHR), Nuclear receptor ROR Gamma (RORC), and Estrogen related receptor alpha (ESRRA). Through this action it can activate all the other 48 nuclear receptors.

Bacteria and viruses often bind to VDRs, that are responsible for innate immunity to mount an effective response against invading pathogens. It is thought that Metadichol® competitively displaces the bacteria attached to the VDR and enables normal functioning of the innate immune response. If this is the case, this would make Metadichol® the only known inverse agonist of the VDR, meaning that it binds to the same site as the natural ligand of Vitamin D receptor (1,25 dihydroxy Vitamin D3) but induces a response very different from the Vitamin D3 agonist. Dr Raghavan hypothesises that Metadichol® may be a protean agonist, acting as both a positive and a negative agonist on the same receptor.

**VITAMIN C AND THE IMMUNE SYSTEM**

In addition to vitamin D activation, vitamin C is also required to maintain a healthy and effective immune system. For example, vitamin C has been shown to reduce severity of symptoms and length of illness in the common cold. It also functions as a cofactor in bile acid synthesis, facilitates thyroid hormone production and aids iron absorption, amongst other roles.

Whilst most people obtain sufficient vitamin C from their diet, some people may be deficient in the vitamin, increasing their risk of developing scurvy, as well as less severe issues such as lethargy, impaired wound healing and depression.

In a non-randomised study, Dr Raghavan supplemented with Metadichol® showed improvements in vitamin C levels threefold higher than what is achieved even with grams of Vitamin C intake. Metadichol® also increases expression of the Glut4 gene four-fold (@ 100 picogram/ml) in mouse adipocytes. This is needed for the pathway in the conversion of glucose to Vitamin C and this gene is dormant in humans. Dr Raghavan suggests that Metadichol® recycles vitamin C by increasing Glut4 gene expression, which is a dehydroascorbic acid transporters, 10 fold (@100 picogram/ml) that is needed for entry of oxidised Vitamin C to enter cells where they are then recycled. This occurs through antioxidant pathways, as Metadichol® binding to VDR increases glutathione levels. Glutathione is an antioxidant which is capable of recycling other antioxidants, including vitamin C and has been shown to be increased in rats supplemented with Metadichol®.

**COVID-19**

In a publication (awaiting peer review) Dr Raghavan has recently reported that Metadichol® may be a potential therapeutic against COVID-19, as he has successfully shown that under laboratory settings, the compound can prevent virus replication in a human cell line. Dr Raghavan proposes that Metadichol® can inhibit a protein TMPRSS2 used by the coronavirus to bind to its target cells, therefore blocking this route of infection effectively stops the cell entry mechanisms used by the virus.

**Metadichol® competes by binding to vitamin D receptors, displacing the bacteria or viruses and enabling normal functioning of the immune system.**
Metadichol® and Major pathways in Chromosomes

A cell culture experiment also showed Metadichol® was able to inhibit virus replication and, as discussed above, may also impact the immune response via the vitamin D pathway. Furthermore, known co-morbidities for COVID-19 infection, such as hypertension and diabetes may also benefit from Metadichol®.

Further cell culture studies have been done, focusing on a range of other viruses, including influenza, Ebola, and yellow fever. However, these findings have not yet been translated into rodent or animal models. A number of case studies, each investigating various disease, have also shown benefits of the supplement in viral diseases and other diseases, such as type 2 diabetes skin diseases and hypertension.

Studies conducted in India, the U.S. and Switzerland have suggested that Metadichol® is effective against bacteria, TB and Malaria. Dr Raghavan reports promising results from research exploring the effects of the compound in the fight against tuberculosis. The studies found that it was possible to inhibit the growth of drug resistant MDR as well as XDR in vitro. Clinical studies are ongoing in TB patients to investigate its potential as an immune booster against tuberculosis.

In 1903 Thomas Alva Edison said “The doctor of the future will give no medicine, but will interest his patient in the care of the human frame, in diet and in the cause and prevention of disease.” Metadichol® may fulfill his vision.

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