In concluding my talk, I would like to specially thank the Council and Mr. Dayananda for giving me the opportunity of delivering the commemoration oration at the 76th Birth Anniversary and 5th Death Anniversary of Prof. J N O Fernando. I would also like to extend my sincere thanks Prof. Ramanee Wijesekera, Prof. Sujatha Hewage, Mr. Sahan,Jayasingha, Mr. N. I. N. S. Nadarasa and the library staff for helping me in the preparation of this talk. I am also thankful to the CCS students for making my teaching at CCS wonderful and to all the senior members of the Institute for giving their fullest support during my career. Last but not the least, I thank you all who are in the audience for listening to my talk.

Guest Editorial

Role of a Chemist in a Pandemic Situation

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The entire world is severely and adversely affected by the newly emerged Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection which was first discovered in the Wuhan Province of China in December 2019. The virus strain causes the disease which now called the coronavirus disease-2019 (COVID-19) that is contagious in humans where human-to-human transmission of SARS-CoV-2 was confirmed on January 20, 2020. The World Health Organization (WHO) has identified it as an ongoing pandemic. The total number of infected persons has now exceeded 3 million (3,083,453) with over 200,000 (212,498) deaths, as of today, 27th April, 2020, and both curves are still increasing exponentially (https://www.worldometers.info/coronavirus/). The respiratory droplets from coughs and sneezes of an infected person carry the virus and the virus is transmitted to another individual who is at a distance where these droplets usually travel in the air. This distance is usually about 1.8 m and hence keeping at least such a distance between people, avoiding crowded gatherings (social distancing), and wearing protective gear would be a way of controlling the transmission of the disease. A recent study published in the New England Journal of Medicine states that SARS-CoV-2 is viable for up to 72 h on plastics, 48 h on stainless steel, 24 h on cardboard, and 4 h on copper and 3 h in the air. However, the main mode of transmission of SARS-CoV-2 is through direct contact of respiratory particles of a patient in air. However, if a person touches a surface that has the virus on it and then touches nose, mouth or eyes, then he or she can pick the virus up and get infected. These surfaces can be disinfected using a suitable disinfectant or by washing with soap. In this scenario, chemist has a huge role to play in recommending most effective disinfectants, suitable usable concentrations, frequency of disinfection application, and their health effects. A simple disinfectant such as a mixture of ethanol (62-71%), hydrogen peroxide (0.5%) or sodium hypochlorite (0.1%) and water can break the delicate envelop that surrounds the virion. The use of soap to disable the virus is effective as it dismantles the lipid outer coating of the virus particles. In order to recommend such a simple yet effective way of destroying the virus, knowledge of the chemical structure and the 3-D arrangement of chemical components of the virus are required. Such a structural elucidation is a task of a chemist in collaboration with a biologist and the recommendation to use soap to disrupt the lipid outer coating is none other than simple chemistry of action of soap.

Since the virus can remain on various surfaces for hours to days, the surfaces of hospital COVID-19 wards where patients are treated require suitable disinfection mechanisms. An antiviral paint coating on walls and floors of such wards would drastically reduce the risk of virus spreaing out of the wards and would give some protection for the hospital staff who are working in such wards. In controlling the spreading of the virus, silver nanoparticle containing surface paint coating was used in the Wuhan Province hospitals. Silver nanoparticles are known antiviral agents as they are coordinated by S, O, N atoms found in viral enzymes and thereby deactivate the biochemical pathway catalyzed by the enzymes. Ag^{+}

ions present on the surface of silver nanoparticles can also electrostatically attract spike S proteins which are negatively charged in nature. Advancing this further, we developed an antimicrobial paint consisting of hematite and zinc oxide nanoparticles that has five modes of actions for destroying viruses. The paint thus developed has already been applied on the walls and floors of the COVID-19 designated wards of the Homagama Hospital. The attention of the relevant authorities is required to apply this surface coating on walls and floors of buildings that are acting as virus spreading surfaces. However, up until now, no attention has been paid by any responsible authority despite the fact that the paint was supplied free-of-charge. This is possibly due to the fact that there is no responsible chemist in the decision-making authorities such as the Presidential Task Force assigned to deal with COVID-19 in order to understand chemistry in action of this surface coating.

As protective gear is an important strategy for preventing the infection of the virus, we looked into the suitability of masks that are used particularly by the hospital staff and the officers of the forces. The 3M N95 mask is the best option since it is designed to filter at least 95% of the particles of size equal to or greater than 300 nm. The surgical masks used in this country do not satisfy this requirement and the best surgical mask filters up to 40% at 300 nm though some of them currently used has only 10% efficiency. There is a severe dearth in N95 masks throughout the world and in order to address this problem we have designed and developed a novel strategy where we have covered the pores of fabrics using suitable nano-to-micro-size particles in order to prevent particles of size 300 nm penetrating through them. The modified fabrics were observed through improved optical microscope and particle penetration study was performed. Having obtained required properties, the mask materials will be manufactured in the very near future.

Development of antiviral drugs mandatorily requires identification of biochemical pathways of the virus' life cycle. A group of German Biochemists, Virologists, Biophysical Chemists and Chemical Biologists has identified the X-ray crystal structure of the SARS-CoV-2 main protease (M^{pro}, also called $3CL^{pro}$); the enzyme that cuts the polyproteins translated from viral RNA to yield functional viral proteins (https://science.sciencemag.org/content/368/6489/409). The main protease enzyme is a very attractive drug target because this is the enzyme that is responsible for processing the polyproteins that are translated from the viral RNA. The researchers have reported he X-ray crystal structures of the bare SARS-CoV-2 M^{pro} and its complex with an α-ketoamide inhibitor. The pharmacokinetic characterization of the optimized inhibitor has revealed a pronounced lung tropism and suitability of the drug administration by the inhalative route. This is one such methodical approach for antiviral drug design to combat the current pandemic. Computational chemists also have a great role in drug design through molecular docking. Molecular docking is a kind of bioinformatic modelling which involves the interaction of two or more molecules to give the stable adduct. Depending upon binding properties of ligand and target, it predicts the three-dimensional structure of any complex (https://www.omicsonline.org/open-access/molecular-docking-approaches-types-applications-and-basic-challenges-2155-9872-1000356.php?aid=88070). This is the newest approach in drug design and most suitable inhibitor that inhibits enzyme action of the virus could be obtained through such computational chemistry technologies.

The above are some of the key areas where a chemist can help control the COVID-19 pandemic. There are many other areas where a chemist can actively get involved in these projects. There are claims that some ayurvedic preparations are active against SARS-CV-2. A qualified chemist can scientifically analyze the active component present in the formulation and even its right stereochemical structure, structure-property relation, biochemical action, and pharmaco-kinetic studies. What is required is the recognition of the important roles of a chemist in controlling this pandemic and taking appropriate actions to get their services in time before the pandemic goes out-of-control.

Cover Page

The cover image, adapted from gbcghanaonline.com, depicts the Coronavirus centered in an intriguing background of scattered Influenza virus molecules. The Global Pandemic, COVID-19, has brought the entire world to its knees and continues to take lives worldwide. "Combatting the Unseen" is an issue dedicated to the severe and life-threatening varieties of pathogenic diseases and to give an insight into tackling their disastrous effects. The name of the themed collection was proposed quite fittingly by level 4 GIC student, Binelka Siriwardane.