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Editorial Overview: Hot Topic: COVID-19 Colloid and Interface Aspects of COVID-19

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First detected in December 2019 in Wuhan, the SARS-CoV-2 virus spread quickly over the world. On 11th March 2020, the World Health Organization declared the virus infection worldwide as a pandemic, from which we still suffer today.

A mix of factors has made the current corona virus disease 2019 (COVID-19) a dramatic difference compared to other recent virus epidemics, such as the specificities of the viral transmission, the presence of a large number of asymptomatic carriers — particularly among the younger population, the high mobility characterizing the modern society, and the deadly effects on a significant part of the elder people.

Many measures have been undertaken by governments around the world to limit the transmission and impact of the virus, among which social distancing and wearing of facemasks in public were most frequently proposed.

It became, however, clear from the beginning that the only effective solution would be the vaccination of the whole population. The first vaccine, developed and produced by Pfizer and BioNTech, was approved by the European Union on 21st December 2020 and others became available within subsequent weeks. Since then, a large percentage of people, mainly in the developed industrial countries, has been vaccinated, while in other parts of the world people still seriously suffering from the infection by this SARS-CoV-2 virus. Such a situation creates serious problems, with new mutations in the virus emerging that could weaken vaccination protection. In that respect, it becomes increasingly clear that all measures to protect people against the virus need to be adopted worldwide, including the production and distribution of vaccines.

Fighting the COVID pandemic requires joint efforts from medical doctors, scientists, politicians and society in general, addressing different issues, biomedical sciences, biotechnologies, pharmaceuticals, environmental and engineering issues, management/organisation of public services, just to mention the most important few.

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Reinhard Miller: Reinhard Miler Studied Math in Rostock and Colloid Science in Dresden, Germany. Worked until 2019 at MPI of Colloids and Interface in Potsdam and now at TU Darmstadt. Main scientific interests are dynamics and thermodynamics of adsorption of surfactants, proteins, polymers, particles and their mixtures at liquid interfaces, 2D rheology, formation of foams and emulsions.

Colloid and interface science, at the border between nano and macroscales, can make important contributions to understand the mechanisms associated with the viral spreading and infection through aerosols, develop effective drugs and vaccines, and improve the performance of passive and active countermeasures, such as wearing facemasks and providing air filtration devices indoors.

The editorial team of the journal Current Opinion in Colloid and Interface Science believes that the scientific community would appreciate publications with the aim to improve the overall understanding of the COVID and other future pandemics. This article collection provides contributions discussing possible insights into this pandemic taken from the perspective of colloid and interface science. Thus, the contributions encompass various aspects of the infection, including the routes of airborne and surface-mediated transmission, respiration of droplet and their size distribution, the evolution of exhaled air and the resulting probability of infection, the interaction of the penetrating virus with pulmonary surfactants, the development of therapies and vaccines, and the effectiveness of facemasks. In this article collection, the authors discuss all these aspects based on theoretical and/or experimental approaches.

The first issue of a pandemic is to find reliable testing methods. The evaluation of testing platforms for identifying viruses is presented by Aziz et al. [1], while Saatçi and Natarajan [2] characterize nanotechnology-based test methods. The development of new therapeutics and diagnostics is also the subject of the contribution by Farouq et al. [3].

To find out how the COVID-19 virus penetrates the lungs and creates the infection, various ways for the physicochemical characteristics of the SARS-CoV-2 virion are described by Adamczyk et al. [4].

A number of contributions are dedicated to the molecular aspects of the interaction between the virus and other system compounds. Various experimental methods for the characterization of viruses and other particles interacting at fluid interfaces with pulmonary surfactants are summarized by Ravera et al. [5]. Simon et al. [6] give an overview of the basic properties of classical surfactants for combatting viruses in general and the Corona virus in particular. The interactions between coronavirus-specific proteins with different types of nanoparticles as the basis for the analysis of therapy issues are the subject of the contribution by Ghati et al. [7].

The first measures to prevent people from an uncontrolled spreading of the pandemic were distancing and wearing facemasks; in the early stage, there was not a clear view of when vaccines would be available worldwide. Liao et al. [8] analyze aspects of wearing facemasks and the impact of their design on its effectiveness against infections.

For medical treatments, carriers for drugs and vaccines are required. Sampath et al. [9] show that nanoemulsion droplets can serve as promising carriers for antiviral drugs and vaccines. According to the review presented by Huang et al. [10], lipid nanoparticles can also be used as a vaccine delivery system.

Distancing and facemasks are still effective measures to keep the pandemic within certain limits. To help understand the viral transmission via respiratory droplets, the contact of virions with the epithelium is discussed on the theoretical basis in the article by Zhdanov [11] and on experimental findings by Sosnowski [12]. The simulations of the infection risk from airborne respiratory droplets performed by Rezaei and Netz [13] also give in addition deeper insights into the infection process and how it can be avoided. Chaudhuri et al. [14] propose a theoretical holistic approach to model the process of infection and its prevention, including sub-models for several steps supported by experimental verifications.

Maintaining a high hygiene standard is also defined as essential to fight the COVID-19 pandemic. In this respect, the interaction of viruses with solid surfaces as a potential issue to limit the spreading of the disease is discussed by Hosseini et al. [15]. Furthermore, questions of coating, food packaging, and textile materials, which are of great relevance in this respect, are reviewed by Mallakpour et al. [16].

There are, of course, many more aspects of the COVID-19 Pandemic. The presented contributions are essentially written from the viewpoint of colloid and surface scientists.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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