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COVID-19 DRUG AND DIAGNOSTIC DEVELOPMENTS

Monday, November 2nd 2020, 9:00am - 6:00pm CET

PROCEEDING BOOK

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ORAL PRESENTATIONS

A Virtual Conference

COVID-19 DRUG AND DIAGNOSTIC DEVELOPMENTS

Monday, November 2nd 2020, 9:00am - 6:00pm CET

Efficacy and safety of chloroquine or hydroxychloroquine in moderate type of COVID-19: A prospective open-label randomized controlled study

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Co-authors:Zhen-Yu Zhang, Jian-Guo Fu, Zhi-Peng Feng, Su-Zhen Zhang, Qiu-Ying Han, Xiao-Bin Zhang, Xiong Xiao, Hui-Min Chen, Li-Long Liu, Xian-Li Chen, Yu-Pei Lan, De-Jin Zhong, Lan Hu, Jun-Hui Wang, Xing-Hua Yu, Dan-Yang She, Yong-Hong Zhuand Zhen-Yu Yin

Abstract:
The outbreak of novel coronavirus disease 2019 (COVID-19) has become a pandemic. Drug repurposing may represent a rapid way to fill the urgent need for effective treatment. We evaluated the clinical utility of chloroquine and hydroxychloroquine in treating COVID-19.

Forty-eight patients with moderate COVID-19 were randomized to oral treatment with chloroquine (1000 mg QD on Day 1, then 500 mg QD for 9 days; n=18), hydroxychloroquine (200 mg BID for 10 days; n=18), or control treatment (n=12).

Adverse events were mild, except for one case of Grade 2 ALT elevation. Adverse events were more commonly observed in the chloroquine group (44.44%) and the hydroxychloroquine group (50.00%) than in the control group (16.67%). The chloroquine group achieved shorter time to clinical recovery (TTCR) than the control group (P=0.019). There was a trend toward reduced TTCR in the hydroxychloroquine group (P=0.049). The time to reach viral RNA negativity was significantly faster in the chloroquine group and the hydroxychloroquine group than in the control group (P=0.006 and P=0.010, respectively). The median numbers of days to reach RNA negativity in the chloroquine, hydroxychloroquine, and control groups was 2.5 (IQR: 2.0-3.8) days, 2.0 (IQR: 2.0-3.5) days, and 7.0 (IQR: 3.0-10.0) days, respectively. The chloroquine and hydroxychloroquine groups also showed trends toward improvement in the duration of hospitalization and findings on lung computerized tomography (CT). This study provides evidence that (hydroxy)chloroquine may be used effectively in treating moderate COVID-19 and supports larger trials.

Keywords:coronavirus disease 2019, COVID-19, SARS-CoV-2, chloroquine, hydroxychloroquine, time to clinical recovery

Current Perspectives on Covid19 Serology Testing

Tar Choon Aw
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Yong Loo Lin Medical School National University of Singapore

Abstract:
For COVID-19 testing RT-PCR remains the gold standard. However, it is exquisitely dependent on timing of samples as viral load peaks just before symptom onset and declines thereafter. However, sampling and pre-analytical factors may produce false negative results. While test specificity is >99%, the overall sensitivity for PCR tests is about 70%. Thus the predictive value of a positive PCR test (PPV) in situations where disease prevalence is less than 1% is below 50%. On the other hand antibodies begin to be detected with highly sensitive chemiluminescent immunoassays (CLIA) as early as 3 days after symptom onset. In a community setting a good antibody test may be detectable in 50% of diseased subjects. Thus SARS-CoV-2-Ab can complement PCR when used in an orthogonal fashion in low prevalence asymptomatic subjects. Two tests (antibody first then PCR or vice versa) can improve the combined PPV for COVID 19 detection from <10% for either test alone to 77.8% even when disease prevalence is 0.1%. Early detection of SARS-CoV-2 antibodies require CLIA and not point of care tests (POCT). While POCT tests are sufficiently sensitive to detect antibodies reliably 14 days after symptom onset, less than 50% of cases are ser-positive even with the newer generation of POCT tests in the first week of symptom onset. For patients presenting to the hospital the prevalence of COVID19 is likely to be upwards of 25%. As such PCR testing alone is likely to be adequate. However, PCR testing in the community is necessary but not sufficient.

Biography:
Dr Aw completed medical studies from University of Malaya, Malaysia. He trained in internal medicine in Singapore & Kings College London, UK and in laboratory medicine at the University of Pennsylvania, USA. He has specialist certifications in Internal Medicine from National University of Singapore and Royal College of Physicians UK as well as Chemical Pathology from Royal College of Pathologists of Australasia. Currently, Dr Aw is Director (Chemical Pathology) at Changi General Hospital, Singapore. He has published 178 original reports and delivered 362 lectures in 25 countries. He is on the editorial boards of several journals including Nature Scientific Reports.

Three-step microfluidic nano-scale qPCR enablesultra-sensitive detection of SARS-Cov2

Xin Xie
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Co-authors: Tamara Gjorgjieva, Zaynoun Attieh, Mame Massar Dieng, Marc Arnoux, Mostafa Khair, Yasmine Moussa, Fatima Al Jallaf, Nabil Rahiman, Christopher A. Jackson, Zyrone Victoria, Mohammed Zafar, Raghib Ali, Fabio Piano, Kristin C. Gunsalus, Youssef Idaghdour

Abstract:
A major challenge in controlling the COVID-19 pandemic is the high false-negative rate of the commonly used standard RT-PCR methods for SARS-CoV-2 detection in clinical samples. Accurate detection is particularly challenging in samples with low viral loads that are below the limit of detection (LoD) of standard one- or two-step RT-PCR methods. In this study, we implemented a three-step approach for SARS-CoV-2 detection and quantification that employs reverse transcription, targeted cDNA preamplification and nano-scale qPCR based on the Fluidigm 192.24 microfluidic chip. Using SARS-CoV-2 synthetic RNA and plasmid controls, we demonstrate that the addition of a preamplification step enhances the LoD of the Fluidigm method by 1,000-fold, enabling detection below 1 copy/µl. We applied this method to analyze 182 clinical NP swab samples previously diagnosed using a standard RT-qPCR protocol (91 positive, 91 negative) and demonstrate reproducible detection of SARS-CoV-2 over five orders of magnitude (< 1 to 106 viral copies/µl). Crucially, we detect SARS-CoV-2 with relatively low viral load estimates (<1 to 40 viral copies/µl) in 17 samples with negative clinical diagnosis, indicating a potential false negative rate of 18.7% by clinical diagnostic procedures. In summary, the three-step nano-scale RT-qPCR method can robustly detect SARS-CoV-2 in samples with relatively low viral loads (< 1 viral copy/µl) and has the potential to reduce the false negative rate of standard RT-PCR-based diagnostic tests for SARS-CoV-2 and other viral infections.

Biography: Dr. Xin Xie pursued a PhD degree in MRC-Laboratory of Molecular Biology, Cambridge University from 2012 to 2015. His PhD project focuses on the functional analysis of Foxp3 protein in gene expression control in regulatory T cells, molecular immunology perspective. Dr. Xie joined NYUAD as a postdoc in the biology program and has finished three years of research in the nuclear function of beta-actin in genome organization, gene expression control, and cell identity regulation. He is am currently working as a research scientist in the Center for Genomics and Systems Biology. and his current work is mainly focusing on the screening of novel compounds from marine bacteria and the repurposing existing compounds for novel biological function using high-content imaging analysis. Since the outbreak of COVID-19 pandemic, he started to coordinate laboratory setup and the implementation of a NYUAD COVID-19 cohort screening project to monitor NYUAD community.

Going beyond clinical routine in SARS-CoV-2 antibody testing - A multiplex corona virus antibody test for the evaluation of cross-reactivity to endemic coronavirus antigens

Monika Strengert,
Helmholtz Centre for Infection Research, Germany

Abstract:
Given the importance of the humoral immune response to SARS-CoV-2 as a global benchmark for immunity, a detailed analysis is needed to monitor seroconversion in the general population, understand manifestation and progression of COVID-19 disease, and ultimately predict the outcome of vaccine development. In contrast to currently available serological assays, which are only able to resolve the SARS-CoV-2 antibody response on an individual antigen level, we developed a multiplex immunoassay, for which we included spike and nucleocapsid proteins of SARS-CoV-2 and the endemic human coronaviruses (NL63, OC43, 229E, HKU1) in an expanded antigen panel. Compared to three commercial in vitro diagnostic tests, our MultiCoV-Ab assay achieved the highest sensitivity and specificity when analyzing a well-characterized sample set of SARS-CoV-2 infected and uninfected individuals. Simultaneously, high IgG responses against endemic coronaviruses became apparent throughout all samples, but no consistent cross-reactive IgG response patterns could be defined. In summary, we have established and validated, a robust, high-content-enabled, and antigen-saving multiplex assay MultiCoV-Ab, which is highly suited to monitor vaccination studies and will facilitate epidemiologic screenings for the humoral immunity toward pandemic as well as endemic coronaviruses.

Biography:
Dr. Monika Strengert is an immunologist with interest in host-pathogen interaction. After completing her PhD in Infectious Diseases at Scripps Research Institute and University College Dublin which examined the role of Duox NADPH oxidases in mucosal respiratory immunity, she has worked as lead biologist and program lead at GlaxoSmithKline with the focus to develop novel medicines to prevent pathogen-driven COPD exacerbations. Since February 2020, she is head of the epidemiology laboratory at the Helmholtz Center for Infection Research. A main focus of the laboratory is the development of serological test systems which distinguish natural infections from vaccination responses.

Vitamin D and Covid-19: the daily intake option

Dr Patrick A. ZEMB
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A recent meta-analysis (Martineau et al, 2017) pointed out that vitamin D3 supplementation protects against acute respiratory infections (ARIs). In this analysis including 25 randomized controlled trials, the superiority of daily intake towards bolus doses appears clearly, and the benefit is substantial for individuals with initial vitamin D deficiency (VDD). It is well known that vitamin D stimulates innate immunity and modulates adaptive immunity. In Europe, the VDD (25OHD<12ng/ml) touches around 18% of the population in winter. Several observations incite to apply the vitamin D reasoning also to Covid-19: (i) the cold-season predominance of Covid-19 first and current second wave; (ii) the superposition of the risk factors of Covid-19 and VDD: advanced age, overweight, diabetes, chronic diseases, dark skin; (iii) the anti-inflammatory effect of vitamin D, reducing the Covid-19 cytokine storm. Usually, most of vitamin D prescriptions in Franceconsist in bolus doses, which are efficient in the bone field (rachitism, osteoporosis). The more physiologic daily intake is rarely prescribed, mainly because of a supposedly weak observance rate, a clearly questionable argument in the current Covid-19 pandemia context. Except for certain rare situations of vitamin D hypersensitivity (e.g. mutation in the CYP24A1 gene or sarcoidosis), daily supplementation with moderate doses of vitamin D (2000-4000 IU/day) has been shown to be safe. Moreover, doses of 1000 IU/day would be sufficient to prevent major VDD in the population. Thus, Health Authorities of countries affected by Covid-19 pandemia must consider vitamin D3 daily intakes more seriously.

Biography

Graduated 1986 as medical doctor and obstetrician gynecologist. Since 1992, physician in the Bretagne-Sud Hospital Group.Since 2009, several international publications in the obstetrical field.Since 2012, interest in preventive effects of an adequate vitamin D. Since 2017, daily intake prescription adapted to each case according to the "CléDSol" protocol, supported by - until now - around 1000 plasmatic levels after 4 months of intake. September 2020, first author of "vitamin D deficiency and the COVID-19 pandemic", co-signed by an international panel of referents, inciting the prescription of vitamin D daily intake.

Biology of SARS CoV-2: How is this different from SARS and MERS?

Aparna Mukhopadhyay
Presidency University, India

Abstract:
SARS CoV-2 outbreak that stated in China in late 2019 and has enveloped the entire world and has brought upon major changes in social behaviour, economy, travel and how we work. However this virus although new comes from a family background of viruses that have been around for a long time. As the world races to develop a vaccine and new therapies against SARS CoV-2, it is also important to understand and know how SARS CoV-2 differs from its predecesors. What exactly is different in this particular variant? An attempt will be made to convey the viral biology and highlight the major changes so far known between SARS CoV-2, SARS CoV and MERS, as revealed by scientific literarture.

Biography:
Dr. Aparna Mukhopadhyay completed her PhD in 2007 from Albert Einstein College of Medicine, Bronx, NY and postdoctoral studies also from the same Institute. She is currently Assistant Professor, Department of Life Sciences, Presidency University, Kolkata. She has published more than 14 papers in reputed journals.

Hypertonic saline inhibits SARS-CoV-2 replication by an intracellular effect and does not affect its interaction with human ACE-2

Cristiane Rodrigues Guzzo
University of Sao Paulo, Brazil

Abstract:
The SARS-CoV-2 pandemic has already killed more than 1 million people worldwide. To gain entry, the virus uses its spike protein to bind to human angiotensin-converting enzyme 2 (ACE-2) receptors on the host cell surface and mediate fusion between viral and cell membranes. We performed experiments to test if hypertonic saline solution is capable to inhibit virus replication in vitro. Our data shows that 260 mM NaCl (1.5%) completely inhibits SARS-CoV-2 replication in Vero cells. Furthermore, our results indicate that the inhibition is due to an intracellular mechanism and not to the dissociation of the spike SARS-CoV-2 protein and its human receptor ACE-2 interaction. We propose that NaCl depolarizes the plasma membrane associated with the virus and led to inhibition of the SARS-CoV-2 replication cycle. This observation may encourage in vivo investigations, which might lead to simple, safe and low cost interventions at various stages of COVID-19 treatment, improving the prognosis of infected patients, thereby, mitigating the social and economic costs of the pandemic. In order to understand how spike-hACE-2 complex is affect by different ionic strength since in initial steps leading to virus entry involves significant changes in protein conformation as well as in the electrostatic environment in the vicinity of the spike-hACE-2 complex, we explored the sensitivity of the interaction to changes in ionic strength through computational simulations and surface plasmon resonance. We identified two regions in the receptor-binding domain (RBD), E1 and E2, which interact differently with hACE-2. At high salt concentration, E2-mediated interactions are weakened but are compensated by strengthening E1-mediated hydrophobic interactions. These results provide a detailed molecular understanding of spike RBD/hACE-2 complex formation and stability under a wide range of ionic strengths.

Biography: Cristiane Rodrigues Guzzo graduated in Chemistry Bachelors (2005), PhD (2010), post-doctorate (2011) in Biological Sciences (Biochemistry) in molecular biology and structural biology areas at University of São Paulo. Cristiane Guzzo did sabbatical work to improve her skills in structural biology involving protein nanomachines embedded in the bacterium membrane in the group of Dr. Gabriel Waksman at Birkbeck College in London (2015-2016). Currently Professor in the Institute of Biomedical Sciences of University of São Paulo (ICB-USP) with four main research goals: a) Structural and functional studies of bacterial Type II secretion system and the Type IV pilus machineries; b) Structural studies of the Type IV secretion system in gram positive bacteria; c) Structural and Functional studies of the c-di-GMP signaling in Leptospira interrogans and; more recently the d) study of SARS-CoV-2.

Pathophysiological Basis and Rationale for Early Outpatient Treatment of SARS-CoV-2 (COVID-19) Infection

Peter A. McCullough
Baylor University Medical Center, USA

Abstract:
It is becoming clear that randomized trials of single drugs will fail due to the complex and multifaceted nature of COVID-19 illness including viral mediated organ damage, cytokine storm, and thrombosis. Additionally, most patients endure long untreated periods of two weeks or more before succumbing to hospitalization for late treatment. Thus, administration of multiple drugs early is prudent as the next direction in randomized trials and advanced practice. Early therapy should include:1) combination antiviral therapy, 2) corticosteroids, 3) antiplatelet agents/antithrombotics, 4) supportive care including supplemental oxygen, monitoring, and telemedicine. Randomized trials are not delivering results quickly enough to impact the pandemic, thus as an emergency medical response to acutely ill patients, we must immediately institute combination therapy and a pivot to a research strategy where several drugs are used in sequenced combination. Future clinical trial results reported months to years will undoubtedly confirm and refine combination therapy, however, the current rates of hospitalization and death are unacceptably high under the present paradigm of watchful waiting and late hospitalization and death.

Biography:
After receiving a bachelor's degree from Baylor University, Dr. McCullough completed his medical degree as an Alpha Omega Alpha graduate from the University of Texas Southwestern Medical School in Dallas. He went on to complete his internal medicine residency at the University of Washington in Seattle, cardiology fellowship including service as Chief Fellow at William Beaumont Hospital, and master's degree in public health at the University of Michigan. Dr. McCullough is an internationally recognized authority on the evaluation of medical evidence concerning contemporary issues in medicine and has published widely with > 1000 publications and > 500 citations in the National Library of Medicine. Dr. McCullough has been a leader in the medical response to the COVID-19 disaster and has published the first guidance for the medical treatment of ambulatory patients infected with SARS-CoV-2. Finally, he has published a widely read OPED series on COVID-19 in TheHill.

Insight to the immune response in Multiple Sclerosis after COVID-19

Lorna Galleguillos
Clínica Alemana de Santiago, Chile

Background:
The severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) is a novel disease that has spread abruptly over the world, allowing the development of countermeasures an urgent global priority. It has been speculated that elder people and patient with comorbidities may be at risk of developing complication. On the other hand, it has been seen that immunosuppressed patients could develop a mild presentation of the disease. Based on this hypothesis, several immunosuppressant agents are currently being tested as potential treatment for coronavirus 2019 (COVID-19). Methods: report a patient treated with alemtuzumab (Humanized monoclonal antibody against the lymphocyte and monocyte surface antigen CD52, which depletes B and T cells) (Thompson et al., 2018) for recurrent remittent multiple sclerosis (RRMS) who developed mild COVID-19. Results: Despite complete B and T cell depletion, patient symptoms abated few days with no need for hospitalization due to COVID-19 and no clinical evidence of disease activation regarding her MS. Discussion: This report shows that MS patients with mild depletion of B and T cells can mount an antiviral response against COVID-19 and produce IgG

Biography:
She completed her neurology studies at Universidad de Chile, after that she went to Hospital Carlos Haya, Malaga, Spain to train with multiple sclerosis patients. To complete basic science training and complement the knowledge obtained in Spain, she went to McGill University, Canada, where she did her neuroimmunology fellowship. Today, she is the chief of the neuroimmunology unit at clinic Alemana de Santiago, where her main interest are inmune responses in clinical setting for multiple sclerosis patients.

Chakras Energies Deficiencies as the Cause of Dyspnea Post Coronavirus Infection Treatment

Huang Wei Ling
Medical Acupuncture and Pain Management Clinic, Brazil

Abstract:

Introduction: There are cases report in literature showing patients with dyspnea symptoms after the treatment of coronavirus. In traditional Chinese medicine (TCM), symptoms of dyspnea may be associated to the energy deficiency in other organs (Kidney, Heart, Spleen or Liver).

Purpose: To demonstrate that patients with dyspnea post coronavirus infection treatment can be related to the energy deficiencies on the chakras meridians, possibly induced by the initial treatment. The correction and replenishment of the chakras energy is the main principle to correct dyspnea in this kind of patient.

Methods: A clinical case report of a 58-year-old female patient, obese. She searched for treatment after performing a baryatric surgery and feeling of fullness and tension on the epigastric region. Endoscopy and magnetic ressonance (MR) were all negative. In TCM the diagnosis was Kidney-¬Yang deficiency. She was submitted to a radiesthesia procedure, to measure the energy of the chakras, and the results shown that her chakras 1 to 6 were in the minimum level (1), with the seventh chakra normal. It was found that the patient had had coronavirus one month ago, and was treated by a different infectologist, staying quarantined in her house for 14 days, and making use of the hydrochloroquine and azitromicine, not requiring hospitalization. The symptoms of dyspnea started after the coronavirus treatment. Treatment was started with homeopathy medications, to replenish the energy of the chakras, according to the theory of the author entitled Constitutional Homeopathy of the Five Elements based on Traditional Chinese Medicine, on concentration of 30CH of the homeopathy, (1. Natrium muriaticum, 2. Phosphoros, 3. Sulphur, 4. Calcareacarbonica, 5. Silicia). She was oriented to take the homeopathies in single doses every day, one different single dose per day, on the sequence proposed. After, she repeated the treatment with the homeopaties with increased potencies (200CH) Chinese dietary counseling was also recommended, the patient reported to consume tangerines daily, and it was recommended to withdrawn this fruit, because in traditional Chinese medicine, the consumption of this fruit would worse the energy of the Kidney, that was the cause of the dyspnea for this patient. It was also recommended for the patient to avoid dairy products, cold water, matte tea, soda and coffee. Auricular acupuncture and apex ear bloodletting were also performed.

Results: The patient presented improvement on the fullness on the epigastric region, and the dyspnea symptoms disappearead with the proposed treatment, without the necessity of hospitalization.

Conclusion: In patients with chakras energy deficiencies, that receive treatment with high-concentrated medications for coronavirus infection, there may be propension to dyspnea post-treatment, as the high-concentrated medication treatment will harm the vital energy of these patients, that is already low, as demonstrated on the case report. The use of high-dilluted medications is important to be able to replenish the energy of the deficient chakras, so the cause of dyspnea is treated on its root.

Biography: Huang Wei Ling, born in Taiwan, raised and graduated in medicine in Brazil, specialist in infectious and parasitic diseases, a General Practitioner and Parenteral and Enteral Medical Nutrition Therapist. Once in charge of the Hospital Infection Control Service of the City of Franca's General Hospital, she was responsible for the control of all prescribed antimicrobial medication and received an award for the best paper presented at the Brazilian Hospital Infection Control Congress in 1998. Since 1997, she works with the approach and treatment of all chronic diseases in a holistic way, with treatment guided through the teachings of Traditional Chinese Medicine and Hippocrates.Researcher in the University of São Paulo, in the Ophthalmology department from 2012 to 2013.

Discovery of SARS-CoV-2 antiviral synergy between remdesivir and approved drugs in human lung cells

Julia Schaletzky
University of California – Berkeley, USA

Abstract:
The SARS coronavirus 2 (SARS-CoV-2) has caused an ongoing global pandemic with currently 29 million confirmed cases and close to a million deaths. At this time, there are no FDA-approved vaccines or therapeutics for COVID-19, but Emergency Use Authorization has been granted for remdesivir, a broad-spectrum antiviral nucleoside analog. However, remdesivir is only moderately efficacious against SARS-CoV-2 in the clinic, and improved treatment strategies are urgently needed. To accomplish this goal, we devised a strategy to identify compounds that act synergistically with remdesivir in preventing SARS-CoV-2 replication. We conducted combinatorial high-throughput screening in the presence of submaximal remdesivir concentrations, using a human lung epithelial cell line infected with a clinical isolate of SARS-CoV-2. We identified 20 approved drugs that act synergistically with remdesivir, many with favorable pharmacokinetic and safety profiles. Strongest effects were observed with established antivirals, Hepatitis C virus nonstructural protein 5 A (HCV NS5A) inhibitors velpatasvir and elbasvir. Combination with their partner drugs sofosbuvir and grazoprevir further increased efficacy, increasing remdesivir's apparent potency 25-fold. We therefore suggest that the FDA-approved Hepatitis C therapeutics Epclusa (velpatasvir/sofosbuvir) and Zepatier (elbasvir/grazoprevir) should be fast-tracked for clinical evaluation in combination with remdesivir to improve treatment of acute SARS-CoV-2 infections.

Biography: Julia Schaletzky is the Executive Director of the Center for Emerging and Neglected Diseases at UC Berkeley. Trained as a biochemist at Bayreuth University, LMU Munich and Harvard University/HHMI, she holds a PhD in cell biology. Dr. Schaletzky joined a biotechnology company, Cytokinetics, and focused on discovering and developing novel, first-in-class medicines against heart failure and neurodegenerative disorders such as ALS, which are currently in Phase III clinical trials. She also founded the UCB Drug Discovery Center, which opened just in time to make an impact in the Covid-19 pandemic. Julia is passionate about treating neglected and emerging diseases, establishing effective collaboration between academia and industry and about translating basic science into new companies and ultimately cures.

The Build-Up of Aerosols Carrying the SARS-CoV-2 Coronavirus, in Confined Spaces

Björn Birnir
University of California, USA

Abstract:
A model of the distribution of respiratory droplets and aerosols by Lagrangian turbulent air-flowis developed and used to show how the SARS-CoV-2 Coronavirus can be dispersed by the breathing of an infected person. It is shown that the concentration of viruses in the exhaled cloud can increase to infectious levels with time (grow linearly),in a confined space where the air re-circulates. The model is used to analyze the air-flow and SARS-CoV-2 Coronavirus build-up in a restaurant in Guangzhou,China, see Lu et. al. 2020 and Li et al. 2020. It is concluded that the outbreak of Covid-19 in the restaurant in January 2020, is due to the build-up of the airborne droplets and aerosols carrying the SARS-CoV-2 Coronavirus and could not have been prevented by standard ventilation.A comparison with standard models for aerosol concentration shows that, in the absence of ventilation, the decay of the aerosol concentration is controlled by the decay time of the virions in aerosols, that is very long. Thus a steady state in not achived in the time-frame of the contagion.

Biography: Björn has been Professor in Mathematics at the University of California in Santa Barbara since 1993. In 1998, he became Director of the Center for Complex and Nonlinear Science (UCSB). In 2010, he was elected Fellow of the American Association for the Advancement of Science. In 2013, he became Editor in Chief of the International Journal of Nonlinear Science and Numerical Simulations. Björn's research centers on nonlinear and stochastic modelling for complex dynamical systems. This includes: Mathematical seismology and geomorphology, erosion and landslides, statistical turbulence, nonlinear phenomena in quantum systems, migration of school of fish, swarms of bacteria, angiogenesis and global change. He is the author of a large number of publications.

Wastewater Surveillance of SARS-CoV-2 and its Applications

Fuqing Wu
Massachusetts Institute of Technology,USA

Abstract:
Current estimates of COVID-19 prevalence are largely based on symptomatic, clinically diagnosed cases. The existence of a large number of undiagnosed infections hampers population-wide investigation of viral circulation. Here, we use longitudinal wastewater analysis to track SARS-CoV-2 dynamics in wastewater at a major urban wastewater treatment facility in Massachusetts, between early January and May 2020. SARS-CoV-2 was first detected in wastewater on March 3. Viral titers in wastewater increased exponentially from mid-March to mid-April, after which they began to decline. Viral titers in wastewater correlated with clinically diagnosed new COVID-19 cases, with the trends appearing 4-10 days earlier in wastewater than in clinical data. We inferred viral shedding dynamics by modeling wastewater viral titers as a convolution of back-dated new clinical cases with the viral shedding function of an individual. The inferred viral shedding function showed an early peak, likely before symptom onset and clinical diagnosis, consistent with emerging clinical and experimental evidence. Finally, we found that wastewater viral titers at the neighborhood level correlate better with demographic variables than with population size. This work suggests that longitudinal wastewater analysis can be used to identify trends in disease transmission in advance of clinical case reporting, and may shed light on infection characteristics that are difficult to capture in clinical investigations, such as early viral shedding dynamics.

Biography: Fuqing Wu is a postdoctoral associate in the Department of Biological Engineering at MIT. His work includes wastewater surveillance of infectious diseases in the population and human gut microbiome engineering. He completed his Ph.D. in Biomedical Engineering, working in synthetic biology and systems biology, from Arizona State University. His Ph.D. work was focused on engineering synthetic gene networks in microbes to understand the fundamental mechanisms of cellular decision-making and bacterial collective behaviors. He received several awards including American Heart Association Predoctoral Fellowship. He is broadly interested in microbiology and microbiome engineering at the interface of environment and human health.

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