Ben-Gurion University of the Negev

Coronavirus Task Force

Project Descriptions and Updates

May 2020

אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev

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Efficient High Throughput COVID-19 Testing to Detect Asymptomatic Carriers

Expertise from: Dept. of Computer Science; National Institute for Biotechnology in the Negev (NIBN); and the Shraga Segal Dept. of Microbiology and Immunology

Additional Participation: Soroka Medical Center; Open University of Israel

Goal: Improved and efficient test focusing on asymptomatic carriers.

Innovation Aspects: Combinatorial pooling based on a specially developed algorithm; Liquid dispensing robot for high-speed processing.

Description: The method being developed features combinatorial pooling: every test checks samples from several individuals at once. The tests are run multiple times in different combinations. In fact, each individual's sample becomes part of six different pools. A new advanced liquid dispensing robot has been incorporated to both eliminate human error in creating the pools, to accelerate the process.

Milestones Achieved: Methodology finalized and experimentally validated and an ongoing clinical study at the Soroka Medical Center is underway. A patent application has been submitted, and discussions with the Israel Defense Forces (IDF) and Ministry of Health officials were initiated.

Project Potential: Achieving an 8-fold cost saving with added benefits of a faster test-to-result process with a negligible rate of false positives / false negatives.

Geospatial Distribution of Corona Virome *
Including Traces of COVID-19 in Urban Sewage Systems

Expertise from: Dept. of Biotechnology Engineering; Dept. of Industrial Engineering and Management; and the Zuckerberg Institute for Water Research (ZIWR).

Additional Participation: Sheba Medical Center; Technion

Goal: Surveillance and tracking of disease spread throughout geographic regions by examining wastewater and sewage for traces of COVID-19 (viral genetic material). Could be used to verify virus elimination, or alternatively, substantiate the need for more containment efforts.

Innovation Aspects: Using wastewater and sewage, *and not patients*, for the ongoing and constant population-based surveillance and tracking of transmission dynamics.

Description: Waterborne pathogens, including viruses, bacteria and protozoa are routinely shed into the urban water cycle via multiple sources, including leaking sewers, urban runoff, agricultural runoff, and wastewater discharges. One study found high concentrations of virus particles in wastewater treatment plants (WWTP), varying from 108 to 1010 viral particles per milliliter. This project will apply existing technologies and methodologies specifically to novel coronavirus (a.k.a. SARS-CoV-2) at selected locations in Israel.

Milestones Achieved: This method was validated using sewage samples collected from a COVID-19 isolation facility in Tel Aviv. The preliminary study provides a proof-of-concept for the detection of SARS-CoV-2 RNA in sewage, and a linear "dose-dependent" curve pivotal for surveillance from different localities in Israel, including from the Tel Aviv metropolis.

Project Potential: Early warning system capable of detecting viral traces prior to a spike in cases of people falling ill. Early warning provides public health officials with much improved means in combatting the "silent circulation" of COVID-19 via asymptomatic carriers.

* Virome refers to the assemblage of viruses characterized by their viral nuclei acids and associated with a particular ecosystem.

Identification of Human Neutralizing Antibodies Against Coronavirus (COVID-19)

Expertise from: Shraga Segal Dept. of Microbiology and Immunology

Goal: Identifying novel neutralizing antibodies against COVID-19.

Innovation Aspects: Generate a single-chain variable fragment (scFv) naïve library expressed on the surface of human cells. Leading scFv candidates will be engineered into fully humanized antibodies that will potentially mediate inhibition of viral entry in an animal infection model.

Description: The overall goal of this study is to identify novel inhibitors against COVID-19. The work plan is based on screening a diverse single-chain variable fragment (scFv) library isolated from COVID-19 patients in order to identifying novel scFv that disrupt viral entry into target cells.

Milestones Achieved: Project presented to the Israeli Ministry of Health who provided partial funding for this project.

Project Potential: The identification of human neutralizing antibodies against COVID-19, a major milestone event in the development of a vaccine.
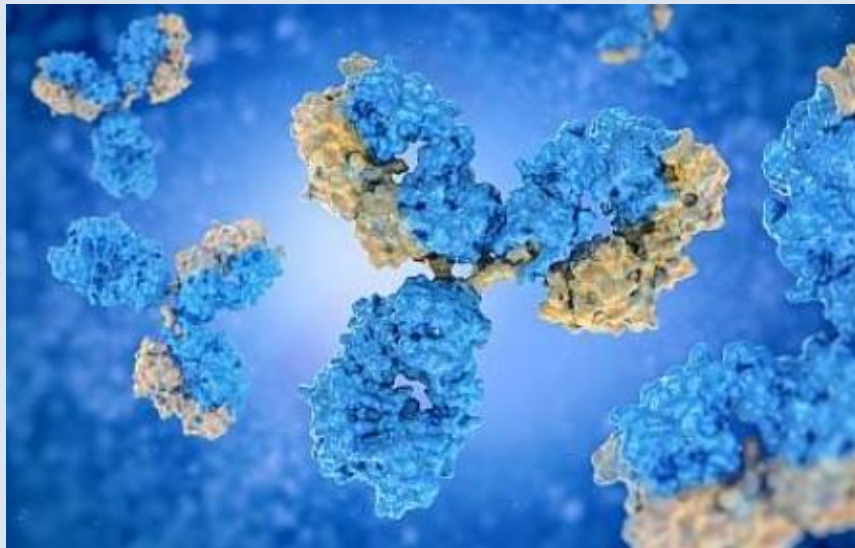
Treating COVID-19 using Microalgae and Plant-Derived Viral Protease Inhibitors

Expertise from: National Institute for Biotechnology in the Negev (NIBN); French Associates Institute for Agriculture and Biotechnology of Drylands; Dept. of Chemistry; and the Dept. of Life Sciences

Additional Participation: GenScript Biotech Company

Goal: The use of algae-based anti-viral compounds for the treatment of COVID-19.

Innovation Aspects: Exploring naturally-occurring anti-viral compounds in algae and plants as an alternative (or supplement) to traditional pharmaceutical treatments.

Description: The use of proteases cloning, purification, and quantification while establishing the proteolytic activity (the breakdown of proteins) using a cell-based Fluorescence Resonance Energy Transfer (FRET) sensor.

Milestones Achieved: An assay has been designed and work has commenced on establishing a novel library of metabolites.

Project Potential: Edible algae and plants containing inhibitors for the two proteases can be formulated into either pills or sprays, and be used early in infection lifecycle as a prophylactic agent.
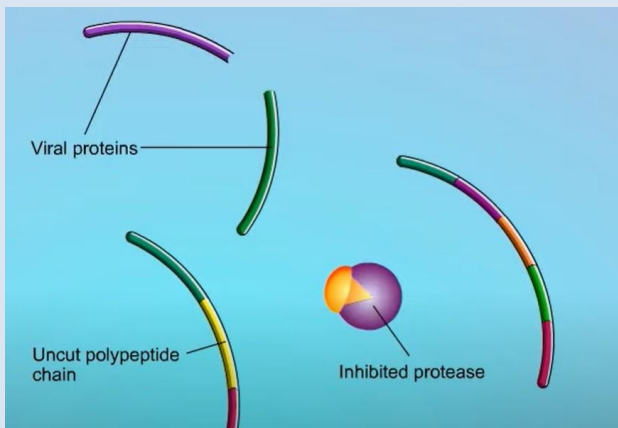
Saliva-based Detection for COVID-19 (An Important Screening Strategy and Triage Tool)

Expertise from: Dept. of Biotechnology Engineering

Goal: An initial screening system designed for large-scale testing and detection of COVID-19 across large groups of people.

Innovation Aspects: Saliva-based testing and the use of synthetic peptides for the future production of monoclonal antibodies.

Description: At peak moments in the trajectory of the virus, testing volume increases and backlog results. Initial research indicates the high probability of COVID-19 virions in human saliva. This project is designed to result in a convenient, quick, and non-invasive means of diagnostic testing. The lower accuracy of saliva-based testing is recognized, but potential for large-scale use results in efficacy as an initial screening strategy and important triage tool.

Milestones Achieved: The identification of epitope candidates was achieved. This provides the means for raising captured monoclonal antibodies. The synthesis of synthetic peptides will commence shortly.


Project Potential: The development of a saliva-based point-of-care (POC) immunoassay for COVID-19 detection (with longer-term potential for exploiting the testing data for the purpose of producing a synthetic vaccine).

Yeast Display of COVID-19 Antigens*

Expertise from: National Institute for Biotechnology in the Negev (NIBN); Dept. of Biotechnology Engineering; Faculty of Health Sciences (Immunodeficiency Research Laboratory).

Goal: Using the natural antibody response of recovered patients for the purpose of diagnostics and possible mass-immunization
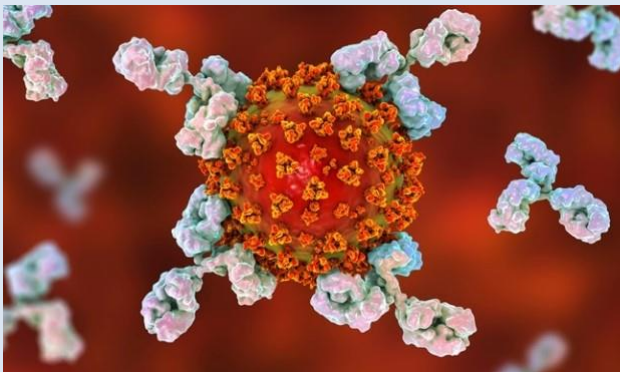
Innovation Aspects: Utilizing yeast display, a method by which specific proteins are expressed on the surface of yeast-cells; cell-surface presentation of defined antigens.

Description: Individuals infected by COVID-19 generally develop effective natural immunization hallmarked by a robust antibody response. Utilizing yeast-display, a method by which specific proteins are expressed on the surface of yeast-cells, will enable the researchers to develop a platform for the expression of COVID-19 antigens.

Milestones Achieved: A research team has been assembled and an agreement with the Soroka Medical Center is being finalized which will provide for serological tests and blood samples of recovered patients.

Project Potential: This project offers potential for the fast and efficient diagnosis of individuals who have natural-immunization, while providing an option for developing mass-immunization of the population.

* Antigen is a term for substance, such as an immunogen, foreign to the body, that evokes an immune response.

Zinc as a Co-Treatment Modality for COVID-19

Expertise from: Dept. of Physiology and Cell Biology; Faculty of Health Sciences (Units for Internal Medicine and Infectious Disease); Dept. of Health Systems Management

Goal: An investigation into the role of zinc as a co-treatment modality for COVID-19, especially as concerns quinone-based drugs.

Innovation Aspects: Enhancing the interaction between hydroxychloroquine and zinc, to increase cellular zinc levels.

Description: Zinc is known to be a mineral element with a documented role in the inhibition of viral replication. This research project will investigate the potential of quinone-based drugs in serving as a carrier that can facilitate zinc permeation into the cells, thus enhancing the cells' capacity for viral inhibition.

Milestones Achieved: In vitro analysis was launched to determine the efficacy of hydroxychloroquine as a zinc ionophore in several cell lines that are most susceptible to the virus, focusing on cells that are targets for COVID-19.

Project Potential: Hydroxychloroquine is **not** an efficient drug against COVID-19 while zinc (which inhibits viral replication) cannot naturally penetrate the cell membrane as an anti-viral agent. Combined treatment has the potential to allow zinc permeation into the cell and stop viral replication.

COVID-19 from a Social Science Perspective

Anxiety Levels of Israeli Public During the Coronavirus Pandemic Health Emergency

Expertise from: The Stress, Self & Health (STREALTH) Lab; Recanati School for Community Health Professions; Dept. of Health Systems Management; Dept. of Psychology

Additional Participation: Israeli Ministry of Health; Google Health; Malone Quantitative & Statistical Services, Ltd.

Goal: An investigation into the behavior and response of the Israeli public prior to, and throughout, the COVID-19 crisis using an interdisciplinary approach and team.

Innovation Aspects: The use of an interdisciplinary approach and team.

Description: The use of weekly assessments (incorporating a true-baseline) to accurately gauge the general anxiety level of the Israeli public, with specific findings for both younger (aged 18 -30 years old) and older (60+ years old) cohorts.

Milestones Achieved: Significant data collection and detailed data analysis evidencing emotional volatility among the younger, and a more emotionally-balanced response among the older.

Project Potential: Recommendations for the Ministry of Health (applicable to other government agencies) for proactive steps designed to cultivate a positive and competent image of the Ministry resulting in the general reduction of the overall societal anxiety level, with special reassurance to those citizens prone to anxiety.
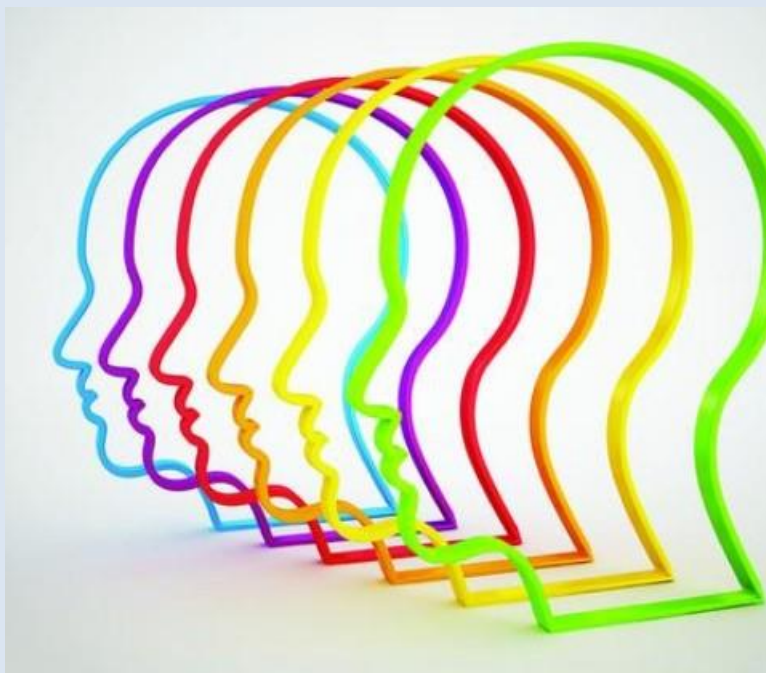
Assessment of Voice Markers and Speech Patterns – Determining the Internal State of Medical Staff

Expertise from: Dept. of Social Work; Dept. of Communication Systems Engineering

Additional Participation: Soroka Medical Center

Goal: The identification of indicators which serve as verbal manifestations resulting from mental distress, chronic fatigue, high levels of stress, depression, and pervasive anxiety.

Innovation Aspects: The use of machine learning applied to speech patterns to reveal worrisome indicators of an individual's mental and emotional state.

Description: The project is based on the application of machine learning to the "voice markers" and speech patterns of medical staff facing heavy workload and trying conditions. The speech of the workers will be evaluated and analyzed. Relationships between verbal and non-verbal manifestations will be examined. The project seeks to develop new methods for unobtrusive differential diagnosis, while creating innovative technologies for recognizing mental states.

Milestones Achieved: A cooperative arrangement has been finalized with the Soroka Medical Center and the participation of the corona ward has been finalized, along with the additional involvement of the Dept. of Obstetrics and Gynecology.

Project Potential: The timely identification of mental and emotional distress of medical staff based on objective evaluation and analysis of speech patterns. The project seeks to ensure both the personal health of medical staff, and the resultant effectiveness of the overall healthcare delivery system.

Giving and Volunteering During the Coronavirus Crisis

Expertise from: Dept. of Business Administration

Additional Participation: Institute for Law and Philanthropy (Tel Aviv Univ. Law School)

Goal: Examining the effects of a pandemic on the patterns of donating money and volunteering time to non-profit organizations.

Innovation Aspects: The exploration of important social matters outside the realm of the medical and financial aspects of the global pandemic.

Description: The global pandemic has resulted in a dramatic decrease in pro-social behavior, such as donations of time and money, thus weakening the capacity of the non-profit sector which relies on this very same support.   In terms of Israel, significant reduction in both giving and volunteering were documented. Volunteering decreased by 35% as restrictions were mandated, while donations dropped by 18% (despite various appeals for support). Results showed that the effect of the coronavirus crisis was stronger than that of other public-wide events (e.g. the national elections for the Knesset, the Passover holiday).

Milestones Achieved: National weekly surveys were conducted and data was collected and analyzed. Comparative results were achieved. The project was found meritorious by the Israeli Ministry of Science and Technology (MOST), and partial funding was awarded (allowing continuation until October 2020).

Project Potential: A better understanding of the less visible social impacts (particularly giving and volunteering) of a pandemic, leading to ideas for mitigative measures.

Increasing Social Competence of Health Professionals Coping with the Coronavirus Crisis

Expertise from: Medical School for International Health (MSIH); Dept. of Education

Goal: The Development of an on-line education program (with special culturally-informed characteristics) to make health professionals more sensitive to individuals from different ethnic, cultural, and racial backgrounds.

Innovation Aspects: Customized training for health professionals in recognition of the cultural differences of the sub-population groups they treat. (The on-line training program will be based on extensive input from both medical professionals and the relevant population groups: Bedouin, Arabs, Druze, Ethiopian immigrants, immigrants from the former Soviet Union, and ultra-orthodox Jews.)

Description: The project is based on receiving input from health professionals on the one hand, and ethnic minority groups on the other hand. The goals is increased sensitivity on the part of health professionals to individuals from different ethnic, cultural, and racial backgrounds. The underlying premise is that increased "social competence" will lead to increase professional competence: the health professional will engender the trust and cooperation of the patient being treated (and by extension, his/her family). The project will culminate with a randomized, controlled study to ascertain the level of efficacy of the intervention program.

Milestones Achieved: Interviews with professionals were held, and the research team contacted academic and health organizations, with most agreeing to incorporate an intervention program in their work practice. This program will be formalized as an on-line unit within the near future.

Project Potential: Increased social competence, and therefore increased and improved professional capabilities, of medical staff in treating different ethnic, cultural, and racial population sub-groups (often considered to be the source of "hot spots" in the outbreak of COVID-19).

Culturally-adapted Messaging: Increasing Compliance among the Ultra-orthodox and Arabs

Expertise from: Dept. of Multidisciplinary Studies; The Conflict Management & Resolution Program; Dept. of Public Policy and Administration

Goal: Direct questioning of ultra-orthodox and Arab communities as to how to customize the communication and messaging of health guidelines for increased effectiveness and compliance on their part.

Innovation Aspects: The use of a diverse and "culturally compatible" research team for work with Bedouin, Arab, and ultra-orthodox Jewish communities.

Description: Pilot surveys were conducted in ultra-orthodox Jewish and Arab communities to accurately ascertain key parameters for effective communication: 1) authority figure (e.g. government official, health expert, religious leader, etc.); 2) nature of the health message (e.g. risk to self, risk to relatives, widespread disease among the community, etc.) 3) mode of communication (e.g. television, radio, social media, preferred language, etc.).

Milestones Achieved: Pilot surveys were conducted and definitive findings were achieved. For the ultra-orthodox: authority figure should be a "combined model" of religious leader together with medical expert; megaphones should be used to broadcast instructions in the confines of the community; Yiddish should be the language of the guidelines; and the risk of endangering the elderly population should be heavily emphasized. For the Arab community: authority figure should be an expert in infectious disease; the family physician should further endorse the guidelines; television should be used, but with Arabic subtitles; and the heightened risk to elders should be stressed.

Project Potential: Recommendations for the Ministry of Health for culturally-appropriate and value-based messaging to result in significantly increased compliance with health guidelines.

Monitoring Public Adherence to Social Distancing in the COVID-19 Era via Sophisticated Data Mining of Social Networks

Expertise from: Dept. of Health Systems Management; Dept. of Software and Information Systems Engineering

Goal: Social networks provide a rich source of raw data which can be mined and utilized to infer levels of compliance with social distancing guidelines as issued by the government and health authorities.

Innovation Aspects: The use of social networks ostensibly serving social purposes (Tweets on Twitter; hashtags on Instagram, etc.) to analyze change in behavior in terms of social distancing.

Description: The project is based on mining data from social networks (Tweets on Twitter, posts on Instagram) by making use of relevant keywords: COVID-19; corona; nCoV2; virus; etc. The overall number of posts will be analyzed and compared. Analysis will also include images, text, hashtags, and comments. Face detection will be utilized to infer social distancing.

Milestones Achieved: Initial findings from Israel, based on studying face and object detection in images, revealed a decrease in the overall number of posts on social networks dating from the second/third week of March 2020, when social distancing guidelines were mandated by the government. An increase in the proportion of images containing indoor objects suggests less travel and more indoor-based activity.

Project Potential: Data from social networks can be used as a tool to monitor adherence to social distancing guidelines, and to correlate the level of adherence to the changing nature of the guidelines.

Insights from Social Media and Textual Analysis: Health-related Communication as a Prism for the Experiences and Wellbeing of Healthcare Professionals

Expertise from: Medical School for International Health (MSIH); Dept. of Software and Information Systems Engineering; School of Public Health

Goal: To understand the mutual influence of social media communication on the efforts to manage the COVID-19 crisis on the one hand, while examining the effect of the crisis on people tackling it on the "frontlines" on the other hand.

Innovation Aspects: The analysis of social media in the face of the COVID-19 pandemic to: 1) Evaluate the informational efforts of health and governmental agencies in terms of risk communication to the general public; 2) Understand the unique personal experiences of emergency workers in the face of the COVID-19 outbreak, thereby achieving an in-depth and multi-dimensional profile of the wellbeing of healthcare professionals (well beyond the results captured by standard performance indicators from the workplace).

Description: Modeling of the pandemic language by using text-processing methods as well as expert analysis to identify the primary keywords used by health and governmental agencies to communicate the crisis management messages to the public.

The researchers will analyze the topic distribution of both formal and informal social media communication of healthcare professionals, stressing the differences between risk communication and informal communication related to COVID-19. They will also investigate the sentiment of healthcare personnel from social media discussions. Insights from the analysis will be validated through a series of interviews with the communication officials and healthcare workers.

Milestones Achieved: A detailed work plan including four primary stages and clearly defined objectives and milestones has been formulated and data collection has commenced. The project will be based on: 1) Identification of Twitter accounts which will encompass healthcare organizations, health officials, and professional associations of healthcare workers; 2) Data extraction and correlation to a timeline of the COVID-19 outbreak; 3) Processing of data based on both topic analysis and sentiment analysis; and 4) Interpretation of results focusing on: [a] messaging by government and health agencies and public reaction to same; [b] wellbeing and sentiment of healthcare professionals via language used and distress signals present.

Project Potential: Understanding and insights gained from this research can contribute to:

1) improving the effectiveness of risk communication to the public, with the result of improved effectiveness of pandemic mitigation measures;

2) the development of appropriate support services for healthcare professionals, enabling them to better cope with their own experiences on the "frontlines," while providing improved care for their patients despite the severe healthcare challenges.

"Modern" Communication Skills for the Elderly: Increasing Social Inclusion and Connectedness

Expertise from: The School of Public Health; Dept. of Communication Studies; Dept. of Social Work, Faculty of Health Sciences (Unit for Geriatric Care)

Additional Participation: Municipalities of Beer-Sheva and Lehavim (Social Services and Welfare Units)

Goal: Developing the (basic) computer and communication skills among the elderly to allow them the benefits of readily available services and products, particularly membership in virtual groups and communities.

Innovation Aspects: (Based on a Process of Progression): Identify those lacking the requisite technical skills; Practical instruction in the basic skills needed; Direct assistance in having the participants join groups and communities; and Follow-up to ensure success.

Description: University students will contact the potential participants based on lists provided by the municipalities noted above. Students will confirm: 1) willingness to participate in the project; 2) Possession of a compatible device and functioning Internet connection (e.g., computer and/or smartphone); 3) minimal ability to operate the device (i.e., the ability to turn it on and off and

choose a program). Then, each participant will be paired with a student, and together they will embark on the training process. The student will ensure adequate user skills and inclusion in appropriate on-line groups and communities.

Milestones Achieved: The project is well underway and the training phase is progressing with the original group (while expansion plans are being formulated).

Project Potential: Practical and effective remedial solutions for the elderly who were previously lonely, isolated, and incommunicado. The use of readily available platforms and services (WhatsApp, Skype, Zoom, etc.) to overcome loneliness and isolation.

Searching the Internet for Information on Coronavirus – An Analysis of Google's Results

Expertise from: Dept. of Software and Information Systems Engineering

**Additional Participation:** Applied Science Communication Research Group (Technion)

Goal: This project maps the quality of Google's online COVID-19 related search results as experienced by a global audience, and works to improve them.

Innovation Aspects: The use of recruited participants who will then use crowdsourcing platforms to execute a Google search query in a country, language, and location they choose.

Description: Participants will be asked to use a query term, in the language of their choice, that a non-expert in that country would use, and then report on various aspects of the results page. Special attention will be paid to: the number of links to various sources (e.g. governmental, health, news, Wikipedia, etc.); the order of page elements (news on top, etc.); and whether the results appear in the language chosen for the search. Additionally, participants will evaluate the overall quality of the results, flag any issues, and suggest ways to improve the results.

Milestones Achieved: Surveys were conducted to evaluate the quality of Google search results in 39 different languages. Results show that the quality is good but not excellent. Furthermore, high-quality assessments tend to be linked to official sources of information (e.g. health agencies, government ministries, etc.), and are less likely to be linked to the news media.

Project Potential: In times of global pandemic, Internet searches are a primary source of information about current affairs. High-quality information can guide individuals' behavior in a positive and effective manner contributing to overall mitigation efforts.
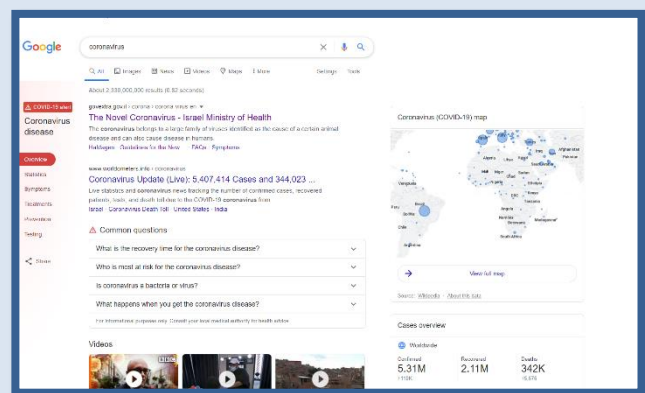
COVID-19 from an Engineering Perspective

Safe, Automated System for the Efficient Removal of Mucus Secretions

Expertise from: Dept. of Environmental Engineering

Additional Participation: Soroka Medical Center

Goal: Development of a system to automatically help patients with respiratory diseases clear mucus secretions from their airways.

Innovation Aspects: The use of acoustic pulses (disintegration) and air pressure (clearing of airways).

Description: Blockages are formed both due to the virus, and containing the virus, and must be cleared for the proper functioning of the respiratory process. The technology works by introducing acoustic pulses into the airway and lungs over a low-pressure airstream. The mucus is disintegrated into pieces and then removed.

Milestones Achieved: A key component of the system was already developed in a joint initiative between BGU and the Cincinnati Children's Hospital. The customization of the system for adult patients with COVID-19 is underway.

Project Potential: Mucus secretions are disintegrated and cleared, and then safely stored - all in a controlled and automated procedure. Relief is provided to patients and risk is reduced for the attending medical staff.

Drone Use for Public Health Emergency Scenarios

Expertise from: Dept. of Emergency Medicine; Dept. of Industrial Engineering and Management
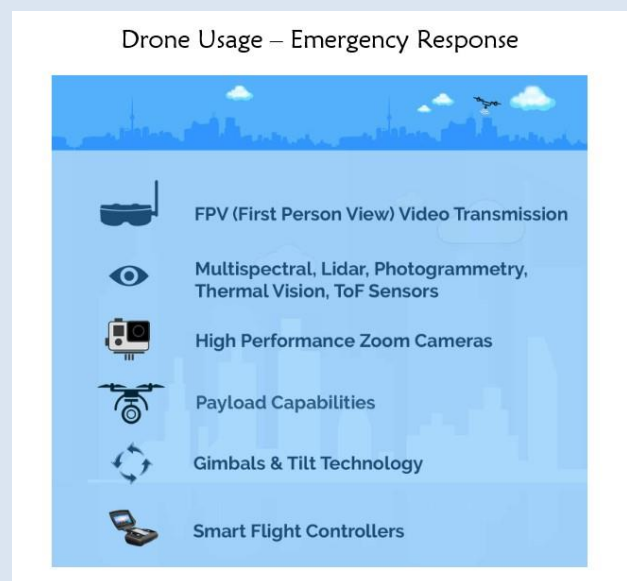
Goal: Development and exploitation of drone use for public health emergency and disaster scenarios, especially to: 1) offer low-risk alternatives; 2) provide relief to the highly vulnerable.

Innovation Aspects: The adaptation of drone use (until now, primarily oriented for commercial and for-profit use) for emergency scenarios and the provision of urgently needed relief.

Description: Drones are often perceived as threatening, and people (especially the elderly and those whose lifestyle is less technologically-based) are reticent to interact with them, and may even refuse to do so. To realize the nearly unlimited potential of drones to deliver food, medicine, provide the means for remote communication, and conduct surveillance and assessment, human-drone interactions must be carefully designed in a culturally-sensitive manner.

Milestones Achieved: A survey has been commenced which will investigate the perceptions of: 1) mainstream society; 2) the frail and elderly; 3) Bedouin in villages; and 4) ultra-orthodox Jewish communities.

Project Potential: Guidelines for the design and customization of human-drone interactions (to be further tailored to needs of specific population groups) to maximize the role and contribution of drones in emergency relief efforts.

Drone Usage – Emergency Response

FPV (First Person View) Video Transmission

Multispectral, Lidar, Photogrammetry, Thermal Vision, ToF Sensors

High Performance Zoom Cameras

Payload Capabilities

Gimbals & Tilt Technology

Smart Flight Controllers

Self-Sterilizing Face Masks using Anti-Viral Laser-Induced Graphene (LIG) with Electrical Charges

Expertise from: Dept. of Desalination & Water Treatment

**Goal:** Converting advanced anti-bacterial water filtration for use against COVID-19.

Innovation Aspects: The use of laser-induced graphene (LIG), together with electrical charges.

Description: Expertise gained in LIG as an anti-bacterial agent in water filtration and water purification systems will be applied to a special anti-viral air filter for use in either personal face masks or full-scale air systems. The use of laser-induced graphene, together with electrical charges (2.5 voltage) will result in a filter material with extraordinary anti-viral (and anti-bacterial) properties – capable of deactivating 99.9% of infectious particles.

Milestones Achieved: An air simulation system has been established in the research laboratory, with preliminary testing evidencing very favorable results. The Israeli Ministry of Science and Technology (MOST) provided partial support for further experimentation.

Project Potential: A new air filter material capable of deactivating 99.9% of infectious particles which can then be incorporated into personal face masks or ventilations systems for buildings and vehicles.
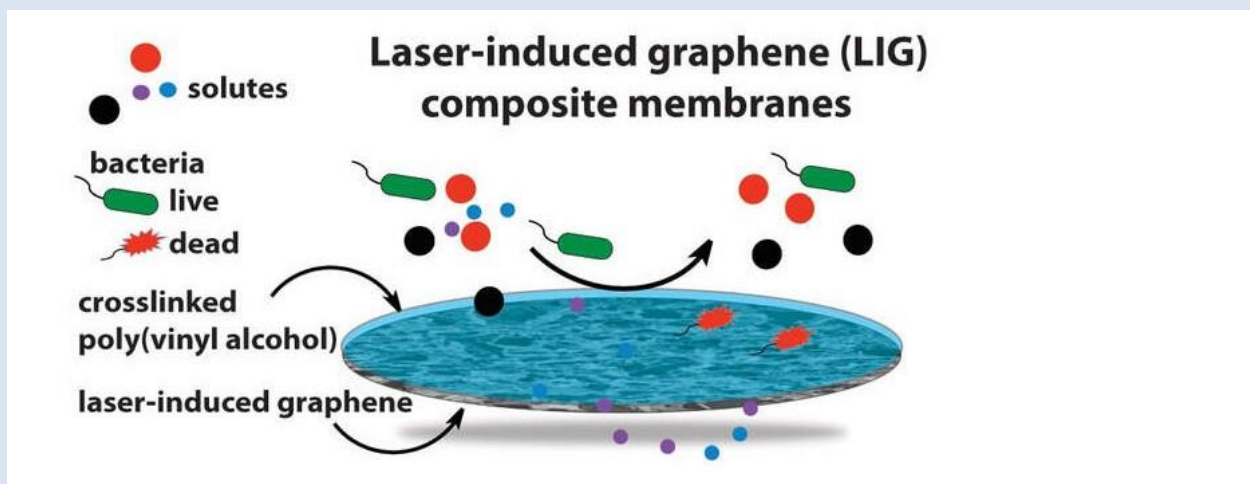
Particle Grouping Resulting in "Virus Capture"

Expertise from: Unit for Environmental Engineering; Dept. of Mechanical Engineering; Dept. of Public Health (Epidemiology)

Goal: Enhanced capability for "virus capture" resulting in efficient air filtration.

Innovation Aspects: Particle grouping (size manipulation) to result in high-efficiency air filtration / air purification system.

Particles grouped on a filter, original size in the micron and sub-micron scale
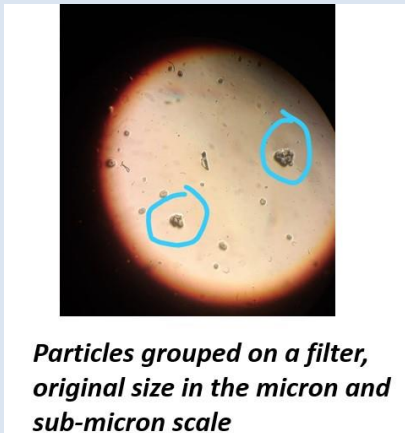
Description: Air is filled with ambient particles which can potentially include the novel coronavirus. Viral material is extremely small and is comparable to nano-particles. A special pumping system will be developed resulting in particle grouping, or size manipulation. The increased size of the "particle groups" will allow for their capture by air filtration systems.

Milestones Achieved: A preliminary system has been established in the research laboratory, with promising initial results. The Israeli Ministry of Science and Technology (MOST) provided partial support for further experimentation. Israel Aircraft Industries (IAI) have taken an interest and they agreed to explore collaborative efforts.

Project Potential: A new and efficient method for efficient virus filtration well suited for airplanes, as well as large-sized work places, and medical centers.

Immediate Detection of COVID-19 Asymptomatic Carriers (A Coronavirus Breathalyzer)

Expertise from: School of Electrical and Computer Engineering; Unit for Electrical-Optical Engineering.

Goal: A unique combination of the advanced technical capabilities culled from physics, photonics, electrical engineering, and nanotechnology to produce a highly advanced chip which forms the basis for a coronavirus breathalyzer (see prototype below).

Innovation Aspects: The use of advanced technology (nano-gap antennas and THz spectroscopy in a specialized configuration) together with machine learning techniques to achiever near-100% accuracy.

Description: This project offers a fast and easy-to-use testing technique: the patient breathes into a breathalyzer. The capsule with the chip from the breathalyzer is removed and checked with a spectrometer to detect the presence or absence of the coronavirus.

Milestones Achieved: Methodology was experimentally validated via a clinical trial at the Sheba Medical Center. Five hundred COVID-19 infected individuals were tested and the results revealed an accuracy rate of over 93% - as validated by polymerase chain reaction (PCR) testing. Three specific patent applications were submitted. Discussions with various parties concerning commercialization are underway.

Project Potential: An ingenuous testing modality based on point-of-care (POC) immediate results with extremely high accuracy and low costs. The system can be deployed in hospitals, at ports of entry, or large-scale events. The device can also record and share data findings to facilitate virus tracking.