USF TASK FORCE FOR

COVID-19 RESEARCH FUNDING

OVERVIEW

April 1, 2020

INTRODUCTION

USF's mission statement asserts that the university "in partnership with our communities, serves the people of Florida, the nation, and the world by fostering intellectual inquiry and outcomes that positively shape the future – regionally, nationally and globally."

Accordingly, one of the key ways we meet this mission is "to conduct high-impact research and innovation to advance frontiers of knowledge, solve global problems and improve lives." Indeed, our USF Research Strategic Plan is already focused on "issues where society urgently needs innovation and change," and emphasizes interdisciplinary collaboration to get there.

USF's fundamental commitment to solving global problems, positively shaping the future, and improving (and saving) lives clearly resonates with great urgency at this very moment. Fortunately, we are uniquely positioned to leverage our research strengths, scholarly expertise, and extensive experience in collaborating with internal and external partners to quickly respond to the current COVID-19 crisis as well as future pandemics.

Colleges and departments across the university are already working on a wide variety of pandemic responses with local partners (including city and county leadership, hospitals and companies); state health agencies; national organizations; and global networks (such as the Global Virus Network, led by USF Health's Dr. Christian Brechot).

USF Research & Innovation has marshalled all of its units including Sponsored Research, Technology Transfer, Compliance, and Corporate Partnerships to expedite proposals, partnerships and responses. We've created a website for faculty that features government, foundation and corporate funding opportunities for coronavirus research, and have been working closely with USF's Government Relations team to match the latest federal funding opportunities in the C.A.R.E.S. Act and its supplements, as well as DoD and other agency funding, to areas of USF research strength (see Appendix).

In fact, many grant applications have already been submitted by faculty who are rapidly responding to state and federal funding calls with very short deadlines. On March 31, for example, USF was able to successfully deliver more than ten submissions to the DoD's VULCAN SOF COVID-19 call for innovative capabilities addressing the impacts of COVID-19 on public safety and national security processes, systems, and resources. These submissions represent collaborations between 16 researchers from different USF colleges and departments (including Microbiology, Physics, Computer Science, ISDS, Marketing and Mechanical Engineering).

In fact, USF's strengths in translational research, innovation and entrepreneurship make the university ideally suited to quickly translate discoveries, innovate solutions, and partner with government agencies, companies and manufacturers during this crisis.

For example, research faculty in the College of Engineering's Design for X Lab and the Morsani College of Medicine have already been mass producing face shields for healthcare workers and 3D-printed COVID-19 swabs for COVID-19 testing, respectively. Distinguished University Professor of Engineering Yogi Goswami has also quickly developed an electrostatic facemask to minimize the exposure of healthcare workers to infectious aerosols.

But in order to attract the major resources that we need to truly maximize the potential impact of USF research responses to the pandemic, we need to coordinate our efforts across the entire university, working strategically and swiftly together in key areas. It is for this reason that President Currall asked Senior Vice President Paul Sanberg to convene a Task Force composed of USF research leadership across all campuses to ascertain how to best accomplish this. This paper reflects the initial work of the Task Force over the past three days.

TASK FORCE

Given the wide-ranging research needs of multiple federal agencies as reflected in the C.A.R.E.S. Act and it supplements, the Task Force is examining which funding proposals USF should immediately pursue, given our existing unique strengths, expertise and resources, and demonstrating why agencies should select USF to receive significant funding.

Moreover, we expect to leverage this funding for longer-term institutional impact, namely, improving our infrastructure and facilities, as well as boosting and expanding programs of strategic importance to the university.

For example, there is federal funding for building renovations and new construction in response to the pandemic that we may be able to use to expand our presently limited inventory of lab and office space for faculty research and scholarship. Language in the C.A.R.E.S. Act and its supplements specifically notes allowable uses of allocated funds for construction.

This includes $156 million from the National Institute of Allergy and Infectious Diseases provided for the study of, construction of, demolition of, renovation of, and acquisition of equipment for, vaccine and infectious diseases research facilities; and funding from the Biomedical Advanced Research and Development Authority (BARDA) for necessary expenses of manufacturing, production, and purchase of vaccines, therapeutics, diagnostics, and pharmaceutical ingredients. The funds may be used for grants to construct, alter, or renovate non-federally owned facilities to improve preparedness and response capability at the state and local level.

The Task Force is composed of the following members (as of 4/1/20):

Paul Sanberg, Chair, *Senior Vice President, Research, Innovation & Knowledge Enterprise*

Michael Bloom, Vice Chair, *Assistant Vice President, Corporate Partnerships and Innovation*

Keith Anderson, *Assistant Vice President for Research, USF Research & Innovation*

Matthew L. Anderson, MD, *Director and Associate Professor, Obstetrics & Gynecology, Morsani College of Medicine*

Matthew S. Anderson, PhD, *Assistant Vice President for Research, USF Health*

Hossam M. Ashour, *Biological Sciences, St. Petersburg Campus*

Kathy Bradley-Klug, *Associate Dean of Research, Innovation and Faculty Affairs, College of Education*

Christian Brechot, *Associate Vice President, International Partnerships & Innovation, Morsani College of Medicine*

Andrew 'Drew' Bugajski, Assistant Professor, College of Nursing

Vickie Chachere, *Director, Strategic Communications, USF Research & Innovation*

David Conrad, *Director, Technology Transfer Office, USF Research & Innovation*

Ellen Daley, *Associate Dean for Research and Practice, College of Public Health*

Michael DeJonge*, Professor and Chair, Religious Studies, College of Arts and Sciences*

Robert Deschenes, *Professor and Chair, Molecular Medicine, Morsani College of Medicine*

Anne Gallacher, *Director, Research Administration, College of Public Health*

Julie Gillespie*, Associate Vice President, University Development, USF Foundation*

Howard Goldstein, *Professor and Associate Dean for Research, College of Behavioral & Community Sciences*

Yogi Goswami, *Distinguished University Professor, College of Engineering*

Rays Jiang, *Assistant Professor, College of Public Health*

Sandy Justice, *Senior Research Administrator, Sarasota-Manatee Campus*

Eric Kern, *Director, Sponsored Research, USF Research & Innovation*

Kami Kim, *Director, Division of Infectious Disease & International Medicine, Morsani College of Medicine*

Randy Larsen, *Professor and Associate Dean for Research, College of Arts and Sciences*

Stephen Liggett, Associate Vice President for Research, USF Health

Judy Lowry, Senior Director, Outreach and Engagement, USF Research & Innovation

Fred Mannering, *Professor and Associate Dean for Research, College of Engineering*

Monica McClanahan, *Director, Federal Government Relations*

Usha Menon, *Interim Dean, College of Nursing*

Shyam Mohapatra, *Associate Dean of Graduate Programs, Taneja College of Pharmacy and Distinguished Health Professor and Director, Division of Translational Medicine, Morsani College of Medicine*

Pritish Mukherjee, *Vice Provost & Associate Vice President, Strategic Talent Recruitment, University Reputation and Impact*

Matthew Mullarkey, *Director, DBA Program, Muma College of Business*

Steven Murawski, *Downtown Partnership-Peter Betzer Endowed Chair and Professor, College of Marine Science*

Arthur Santos, *Assistant Director of Development and Alumni Relations, USF Health*

Sudeep Sarkar, *Professor and Department Chair, Computer Science & Engineering*

John Sinnott, *Professor & Chair, Internal Medicine, Morsani College of Medicine*

Thomas Unnasch, *Distinguished ESF Health Professor, College of Public Health*

Mark Walsh, *Assistant Vice President, Government Relations*

PANDEMIC RESPONSE RESEARCH NETWORK™, RESEARCH & CONSTITUENT HUBS

The Task Force first convened on Monday, March 30, 2020, discussed its charge, reviewed major federal funding areas for university research on the pandemic, divided into working groups and quickly arrived at a strong strategic structure that is evolving on a continuous basis.

We propose the formation of a Pandemic Response Research Network™ structure with research hubs in key areas of USF research strength including (but not limited to):

- **Basic Research Toward Therapeutics**
- **Behavioral, Socio-emotional, and Educational Wellbeing**
- **Clinical and Translational Research**

- **Epidemiology and Surveillance**
- **Environmental Aspects of Pandemics**
- **Information and Communication Technology**

We are also in the process of creating constituent hubs for:

- **Manufacturing, Innovation and Entrepreneurship**

- **Fundraising and Partnerships**

A general description of the proposed Pandemic Response Research Network™ and a summary of initial work by several of the research hub teams follows.

Pandemic Response Research Network™ (PRRN)

Leaders: *Randy Larsen, College of Arts and Sciences; Christian Brechot, USF Health; Pritish Mukherjee, Office of the Provost; Ellen Daley, College of Public Health; Matthew Mullarkey, Muma College of Business; Thomas Unnasch, College of Public Health*

The current COVID-19 pandemic is the most recent coronavirus outbreak now infecting over 760,000 people across 177 countries with over 36,000 deaths. Current projections indicate US infections as high as 1.4 million by April 30 with deaths as high as 100,000. Coronaviruses infecting humans historically include mild common cold viruses (hCoV-OC43, HKU, 229, etc.) although more highly pathogenic human coronaviruses have emerged including SARS-CoV in 2002 and 2003 (death rates as high as 10%) and MERS-CoV in 2012 (death rate as high as 36%). Viral epidemics are not restricted to coronaviruses as recent outbreaks of *Ebola*, various strains of influenza, measles, etc., have occurred.

The preponderance of highly pathogenic virus outbreaks creates monumental challenges at all levels of human health care. As the COVID-19 pandemic has revealed, critical deficiencies exist at the national, state and local levels in areas ranging from the production of virus testing kits, local and regional outbreak modeling and tracking, and coordination and communication of critical health care information.

USF is ideally positioned to address these deficiencies with extensive capabilities in surveillance, epidemiology, information systems, basic and translational research, clinical research and laboratory testing, biomedical engineering, immunology and therapeutic design.

Moreover, USF can provide the state of Florida with a unique and essential resource that is well-positioned to meet immediate and future pandemics. In addition, USF's relationship with US Central Command and US Special Operations Command as well as strong connection with the Global Viral Network (GVN) provide additional resources that can be leveraged to meet current and future pandemics.

PRRN Concept

The proposed USF Pandemic Response Research Network™ will be a transdisciplinary effort to coordinate existing assets and to expand critical infrastructure in order to respond not only to the existing COVID-19 outbreak, but future natural or bio-terrorism pandemics.

Through leveraging USF existing assets, the PRRN aims to coordinate research and scholarship efforts in key hubs of pandemic response including but not limited to the research hubs described earlier.

Laboratories and faculty researchers across USF with expertise in the designated research hubs can be quickly coordinated through the PRRN in response to critical global health threats. Moreover, these hubs will be directly connected through the Global Virus Network with the top experts in the USA and worldwide, directly integrating the PRRN in a truly international context.

The research hubs within the PRRN will also provide critical training for the next generation of researchers and health specialists in areas related to viral outbreaks. Additionally, the development of the PRRN will also involve the enhancement of existing research facilities as well as the build-out of new facilities that will allow USF to better address the current COVID-19 pandemic as well future pandemic threats.

For example, as part of the Information and Communication Technologies arm of the USF-PRN, we envision three areas of work. (1) *Data infrastructure to support the network*, which will involve creating data lakes on the cloud in partnership with USF IT that are secure and store all the relevant clinical, public health, mobility, and any other relevant datasets that are necessary to model present and future pandemic outbreaks. (2) *Cloud-based analysis infrastructure*, which will involve developing models and methods to generate insights, early warning signals, identifying hotspots, and visualizations using big data technologies. (3) *Communications and Policy infrastructure*, which will involve creating forward-looking simulations and analytical modeling tools with a goal of informing various stakeholders, including policymakers.

These three areas together will likely involve researchers from multiple units within USF, including the School of Information Systems and Management at the Muma College of Business, Computer Science and Industrial Engineering departments at USF College of Engineering and other units as well on the campuses that can contribute to one or more of the three areas.

USF Pandemic Response Research Network™ Proposal

The PRRN can be developed through three tiers of activities. The Tier 1 activities are required for an immediate response to the COVID-19 pandemic (including research projects and infrastructure), Tier-2 activities are those required to continue to address the COVID-19 pandemic in the intermediate term and Tier 3 activities are required to position USF to address future pandemics, either natural or bio-weapons related.

Tier 1 Activities

- *Basic R&D funding related to viral biology, genomics, and mechanism of pathogenesis directed to the development of therapeutics*
- *Research related to viral spread including modeling, surveillance, epidemiology, etc.*
- *Infrastructure required for laboratories to immediately house virus testing including BSL3 facilities, etc.*
- *Establish research hub leadership teams*
- *Identify key researchers associated with research hubs*

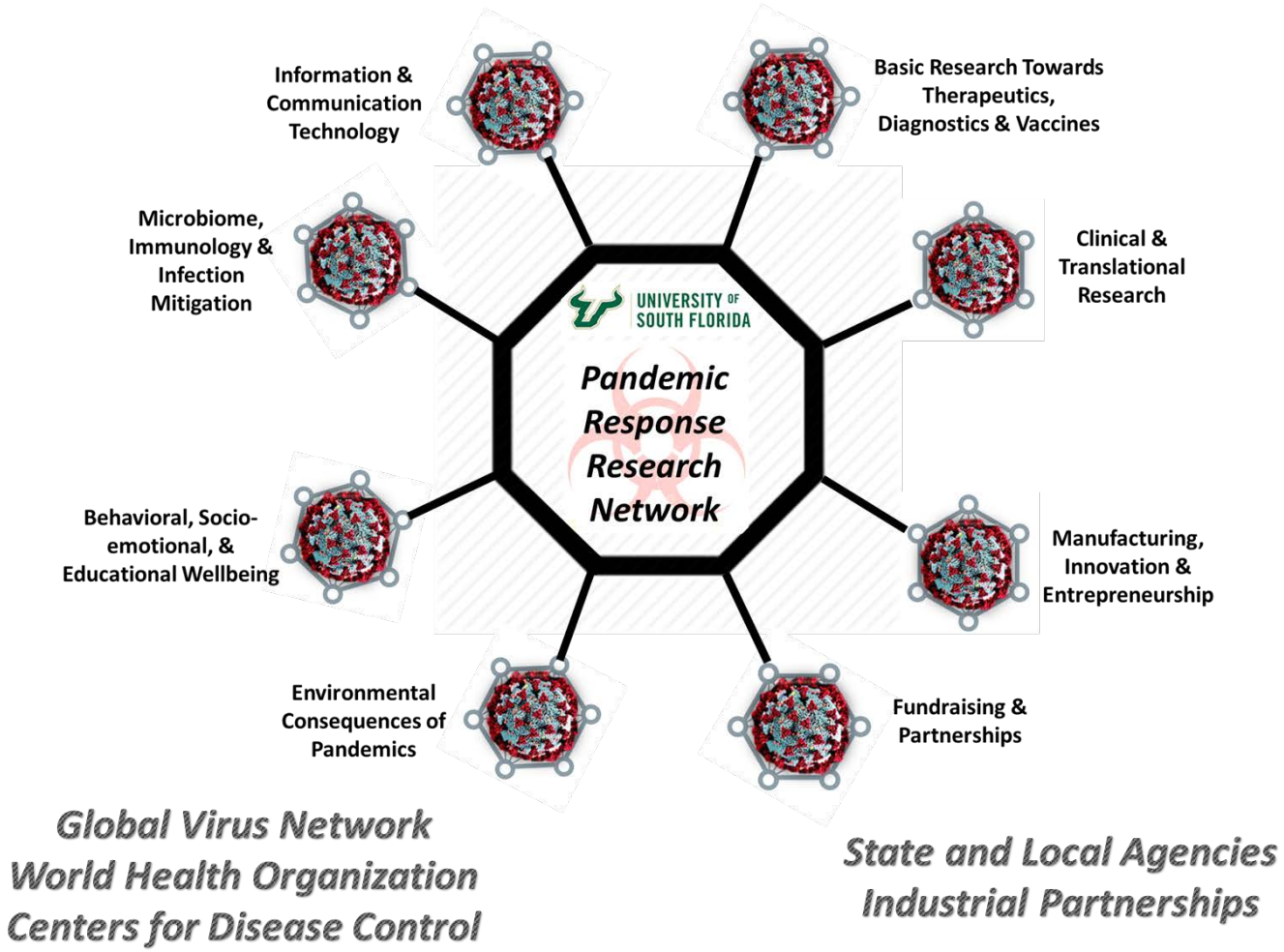
Tier 2 Activities

- Longer term funding for projects related to viral biology, genomics, and mechanism of pathogenesis directed to the development of therapeutics
- Longer term funding related to viral spread including modeling, surveillance, epidemiology, etc.
- Infrastructure required for laboratories to enhance the research hub basic infrastructure (laboratory renovations, space re-tasking, etc.)

Tier 3 Activities

- Strategic planning towards critical infrastructure required to meet future pandemics
- Strategic planning for a new campus facility that will serve as an interdisciplinary center for PRN activities including additional laboratory space for future pandemic response

Pandemic Response Research Network™ Concept Map (as of 4/6/20)



Research Hub on Clinical, Translational and Therapeutic Discovery

Leaders: *Stephen Liggett, USF Health; Robert Deschenes, Morsani College of Medicine; Matthew L. Anderson, Morsani College of Medicine; Matthew S. Anderson, USF Health; Shyam Mohapatra, Morsani College of Medicine and Taneja College of Pharmacy*

A key element in constructively leveraging the impact of a USF-led Pandemic Response Network will be its ability to connect state of the art science to real world implementation that improves the health and safety of both the Tampa Bay community and the nation. We believe that the university's recognized strengths in medicine, pharmacy, nursing, engineering, public health and social sciences can be successfully leveraged to achieve these goals on multiple levels.

Notable strengths include a well-developed platform for the design and operationalization of clinical trials, emerging resources for biorepository activities and newly streamlined regulatory and bioinformatic pathways for managing and mining clinical demographics with an eye towards population science and disease surveillance.

Specific strategies for potential research appropriate for each of the three planned tiers of activity include data-centric strategies to enhance our community's response to emerging pandemics, develop novel diagnostic, prophylactic and therapeutic strategies; improve the engineering and manufacturing responses to these crises; and execute long reaching models of dissemination and implementation of advances.

Potential concepts for research and infrastructure development include:

- **Developing data centric approaches to a) identify regional hotspots for emerging pandemics and b) develop novel diagnostic and therapeutic strategies needed for infection control and/or treatment**. These approaches would leverage USF's expertise in therapeutic discovery, virology, nanomedicine, computer sciences, artificial intelligence, public health and engineering. Examples could include USF's recent success with the use of 3-D printing to develop a nasal swab for COVID-19 testing that has received national attention; Dr. Goswami's rapid development of an electrostatic facemask to minimize exposure of health care workers to infectious aerosols; and rapid initialization of at least two investigator-initiated clinical trials relevant to COVID-19.

- **Leveraging USF's close relationship with Tampa General Hospital to develop a regional pandemic response team.** Of note, Tampa General Hospital serves as the region's primary safety net health facility and the region's only quaternary hospital. This team would support regional and state authorities such as the Mayor or County Commissioners as they seek to disseminate up to date information to the community, develop and implement effective regional infection control measures and/or bring care to impacted individuals and/or infection hotspots within the Tampa Bay region and/or the West Coast of Florida. Specific research opportunities could include opportunities to develop IT platforms for communication and management of disease outbreaks, community surveillance and coordination of care. In part, these efforts could build on Tampa General Hospital's recent success with the realization of its "CareComm" command center to enhance hospital operations.

- **Utilizing USF's experience with educational and social science research to determine the best ways to communicate with diverse individuals within communities across the region in times of crises with attention to culture and literacy.** The end goal of these projects would be to develop durable platforms that could be rapidly adapted and utilized to keep communities informed. The expertise and experience of USF researchers in medicine, pharmacy, public health, nursing, education and social sciences could be

used to examine and better understand responses of individuals in our community to the COVID-19 pandemic, understand self-management needs of those with co-morbid conditions, identify the most effective route to disseminate communications from public health and medical officials in times of crises, connect public officials with the community, understand individuals' risk perceptions and behaviors in times of crises, and develop models of longer term implementation. Multiple short- and long-term research opportunities exist that relate to the implementation of telehealth, understanding individual, legal and other barriers to its effective implementation and impact on safety and efficacy of diverse medical issues.

- **Building partnerships with local manufacturing and biotechnology companies capable of developing effective strategies to address current and future pandemics**. The goal of these projects would be to develop effective engineering and manufacturing solutions for previously unrecognized clinical needs. Notable examples of strengths include the ability of USF initiatives to access and coordinate with international viral research consortia (Brechot), partner with local biopharma to craft microbiome and nutritional strategies to mitigate infection rates and the clinical course of disease. Another key aspect could be leveraging local manufacturing expertise in electronics (e.g., Jabil) to assist with the manufacture of the electrostatic masks being developed by Dr. Goswami. The emerging relationship between USF and TGH for clinical research could be leveraged to support these clinical evaluations of agents and/or devices developed by these collaborations.

Funding:

There are multiple funding opportunities for COVID-19 clinical, translational and therapeutic research. Shortly after the outbreak, various NIH Centers & Institutes released funding announcements and the NIH received over $1B from the stimulus package. In addition to NIH funding, other federal agencies such as CDC, DoD and NSF have relevant funding opportunities. Non-federal opportunities include funding from private foundations and associations, along with partnering with pharma and biotech companies. Specifically, capitalizing on our long-term working relationships with pharma companies to establish clinical research sites in Tampa Bay.

Research Hub on Behavioral, Socio-emotional, and Educational Wellbeing

Leaders: *Howard Goldstein, College of Behavioral & Community Sciences; Kathy Bradley-Klug, College of Education; Ellen Daley, College of Public Health; Sandy Justice, USF Sarasota-Manatee; Sudeep Sarkar, College of Engineering; Randy Larsen, College of Arts and Sciences; Michael DeJonge, College of Arts and Sciences*

The COVID-19 virus is creating an epidemic of illness, but also a wave of psychological and social stress. Researchers have used incidents of unexpected stress in the past (such as hurricanes and 9-11) to examine the impact of stress on health and well-being. COVID-19 is quite different from these previous incidents. The effects are not only nationwide, but global. The time course is undetermined, as the globe faces months of uncertainty, isolation, fear, job loss, loss of income, illness, and death.

There will be great variability in the timing of such effects, and how populations will vary in their physical and psychological resilience and vulnerability to these unprecedented, co-occurring conditions. Moreover, people are interacting with community-based systems largely ill-prepared and struggling to meet these challenges, including education, criminal justice, media and communication outlets, markets and supply chains, transportation, as well as health care systems (to mention a few).

Investigators at USF are poised to generate new knowledge that will inform preparedness and responsiveness to the current and future global crises. More than 50 scientists from across the university with expertise in behavioral, socio-emotional, and education wellbeing in diverse individuals, communities, and populations have submitted research ideas that seek to generate such knowledge. We recognize that these complex approaches to addressing these issues have a time element component (i.e., immediate, near-term and long term) that may influence when these projects should be submitted for funding. We have sorted those research ideas into four overall themes that represent areas of strength and expertise among our faculty.

1) <u>Impact of COVID-19 on Psychosocial & Physical Wellbeing</u>

- Potential negative effects of COVID-19 on parental stress, child abuse, alcohol and substance abuse, suicide, family violence, gun violence, crime, smoking, over-eating, sexually transmitted infections, physical activity
- Mental health challenges and responses to personal loss and grieving (among spouses, family members, seniors, students, and others)
- Health literacy among diverse stakeholders (e.g., women, children, families, individuals with chronic physical and mental health conditions, workplaces, community members) and how people access, understand, appraise, and use information in communication, health behavior, and healthcare decision-making
- The role of media and communication and its accuracy on health literacy
- Role of risk and resilience on the wellbeing of children, youth, and young adults and the role of child welfare, foster care, education, and other agencies
- Potential COVID-19 effects on perinatal health (e.g., pregnancy, labor/delivery, infant health, follow up services)

- Effects of the pandemic on housing, food insecurity, and social isolation among multiple populations (e.g., children, college students, seniors)
- Development of a model of prevention, education, and self-management of chronic diseases involving multiple disciplines (e.g., health promotion, behavior change, and message delivery and dissemination)

2) Impact of Online Education & Telehealth

- Quick transition to remote instruction and its impact on student outcomes and other stakeholder effects (including potential effects of online pedagogy, teacher training, family caregivers)
- Impact on vulnerable student populations (low income, migrant, developmental disabilities, homeless)
- Telehealth and its role in evaluating individuals with implications for court proceedings, child welfare, crisis care (e.g., mental health services, psychiatric evaluations, involuntary commitments)
- Outcomes for children and families that use telehealth to manage emotional and mental health challenges within the family
- Augmented instruction as an alternative instructional or therapeutic tool when one cannot rely on hands-on and face-to-face interactions

3) **Dissemination of Information/Communication**

- Social media and communication dissemination and strategies for mitigating misinformation/disinformation campaigns (e.g., artificial intelligence as a tool to prevent the spread of misinformation)
- Automated ways to provide individuals with referrals to link needs to community resources
- Generic ways of reaching and monitoring elderly (or sick) people who are in isolation through the use of mobile devices

4) **Community Services and Public Policy**

- Artificial Intelligence-based tracking of human activity and movement to predict spread of disease via satellite imagery
- Effects of release of seniors and low-risk inmates and the role of follow-up services
- Preparedness of law enforcement in a growing range of tasks dealing with new policies related to mitigating spread of the virus
- Personal responses to public policies and recommendations and their relation to perceptions of governmental responses to the pandemic

Federal Funding Sources

The following funding sources are available through the C.A.R.E.S. Act and its supplements:

1. $103.4 million is included the National Heart, Lung, and Blood Institute.

2. $425 million is included for SAMHSA's Health Surveillance and Program Support.

3. $706 million is included for the National Institute of Allergy and Infectious Diseases.

4. $75 million is included for NSF to fund research grants and other necessary expenses.

5. $275 million is included for the Health Resources and Services Administration

Research Hub on Environmental Consequences of the COVID-19 Viral Epidemic

Leaders: *Steven Murawski, College of Marine Science; Matthew Mullarkey, Muma College of Business; Rays Jiang, College of Public Health; Robert Bertini, College of Engineering, CUTR; Sandy Justice, USF Sarasota-Manatee; Pritish Mukherjee, Office of the Provost and College of Arts and Sciences*

Human health is intimately linked to environmental health and sustainability of critical resources. Apart from the direct human health consequences of the COVID-19 epidemic, the significant slowdown in global economic activity is having global secondary impacts on a variety of factors related to environmental health and safety, wildlife populations, urban traffic and related pollution and other consequential factors. Many environmental parameters, including physical and biological factors that change seasonally or abruptly, may have interactions with COVID-19 and either improve or degrade human health exposure to COVID-19 or other stressors. These factors may include temperature, or biological factors such as pollen, flu, red tide, and others. Some interactions may have long-term consequences on ocean chemistry and production that again have direct and indirect impacts on humanity.

The Anthropocene, a proposed geologic era, is defined by extensive human influences on planet earth, has been halted for a brief moment because of the COVID-19 pandemic. The COVID-19 outbreak presents a rare opportunity to observe effects on the planet of such a consequential event in terms of the human footprint, and the interactions and feedbacks that affect human well-being. Gathering baseline information, a unique global minimum of human activity, has important environmental policy consequences. This allows for a natural experiment that may help set goals for environmental pollution reduction and their feasibility as they are being considered. For example, satellite monitoring of nitrogen oxide (NO_2) shows a very substantial reduction within one month (Figure 1).

At a global scale, there is considerable pollutant information that can be derived from remote sensing from satellites and from ground station monitoring programs. Both the USA-NASA and the European Space Agency (ESA) and others fly such sensors that detect pollutants in the troposphere. At a local scale, there are ground station observations of atmospheric and ocean concentrations of important chemicals in the environment including CO_2. There is also substantial information about human density, activities, socio-economic status and population parameters that could be combined more effectively to better understand the short-term and long-term impacts and feedbacks between the decrease in human activity, environmental factors and pollution, and human well-being.

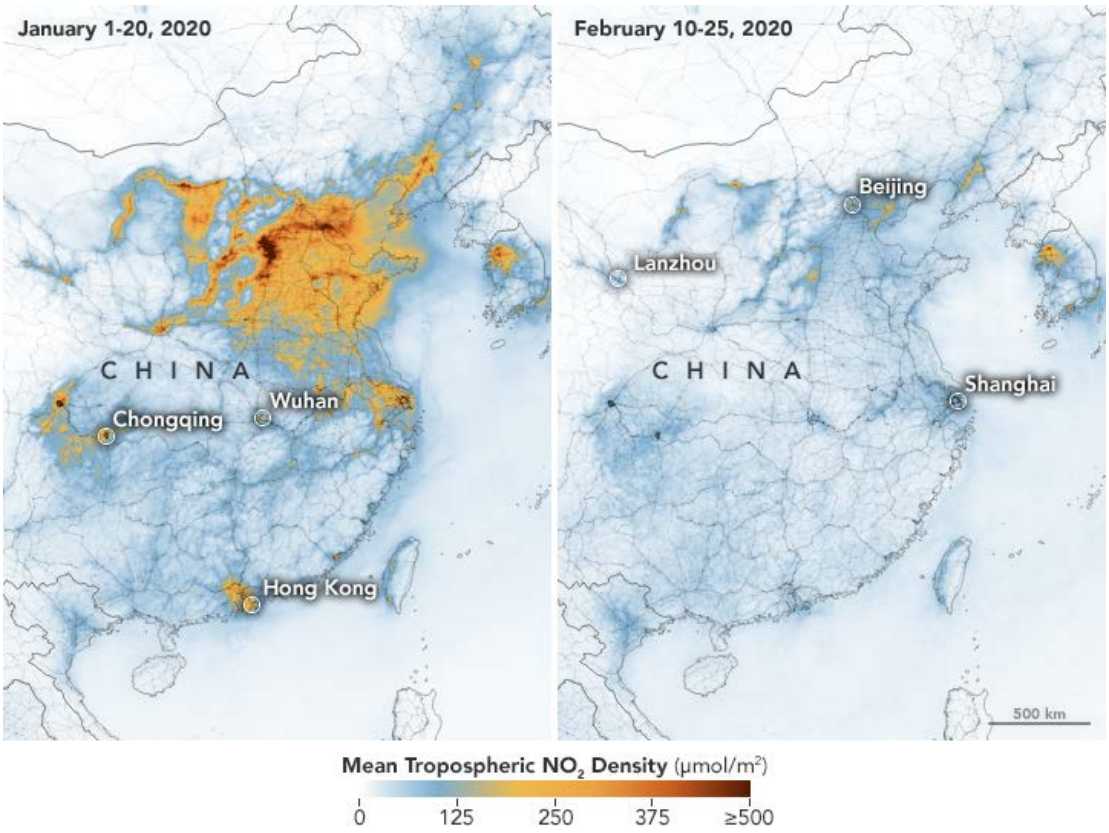


Figure 1. Source NASA: https://earthobservatory.nasa.gov/images/146362/airborne-nitrogen-dioxide-plummets-over-china

The scale of short-term reductions in these pollutants in relation to the COVID-19-related economic slowdown is a unique opportunity to understand how successful policies such as reductions in greenhouse gases (NOx, CO_2, methane, etc.) and other pollution could be under different reduction scenarios. For example, is the reduction to a specific level for any of these

chemicals feasible without the draconian measures that had to be implemented globally given COVID-19?

One Health is a CDC defined concept that focuses on the interconnection between people, animals, plants, and their shared environment (https://www.cdc.gov/onehealth/index.html). *One Health*, by definition, is a collaborative and transdisciplinary approach aimed at achieving optimal health outcomes with a systematic understanding of the health systems.

An estimated three-fourths of all human infectious diseases originated from animals, i.e., zoonosis. COVID-19 is one example that animal coronavirus adapted to efficient human-to-human transmission globally. The significance of *One Health* is twofold: firstly, the movement of people, animals, and animal products has increased from international travel and trade. As a result, diseases can spread quickly across borders and around the globe. Secondly, the animal reservoir and their migratory patterns are linked to the disease emergence pattern.

These issues play out with respect to a variety of terrestrial and aquatic pollutant scenarios. USF has considerable satellite and environmental monitoring expertise to draw upon for such a set of analyses. These are, of course, scalable to understand impacts at the state (Florida) and local levels (e.g., the Tampa Bay region), and the lessons learned are applicable to other communities around the nation and the world.

One of the most dramatic environmental effects of the slowdown has been the reductions in surface transport demand across the country. This progression is observed nation-wide and in specific urban regions, including Tampa Bay (Figures 2 and 3):

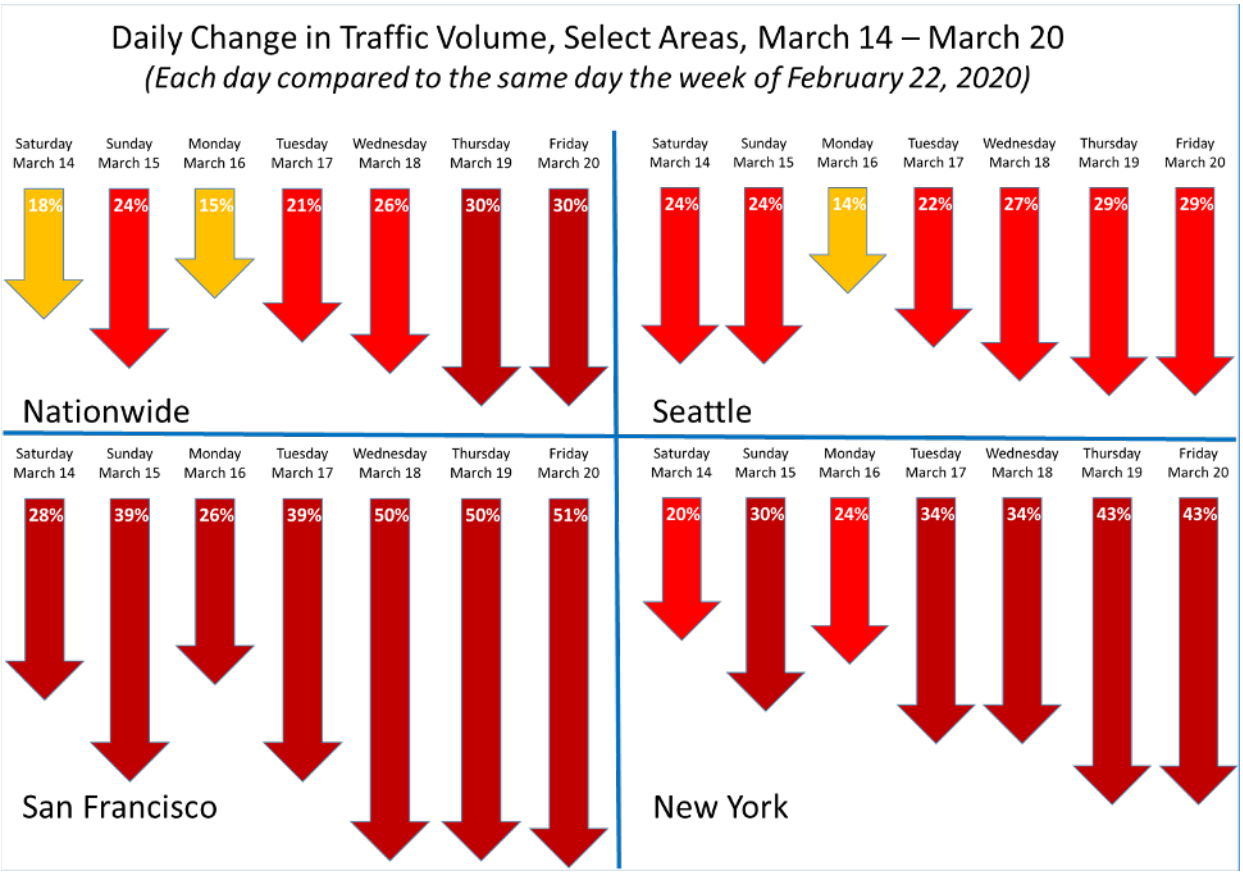


Figure 2. From:
https://inrix.com/blog/2020/03/covid19https://inrix.com/blog/2020/03/covid19-us-traffic-volume-synopsis/-us-traffic-volume-synopsis/

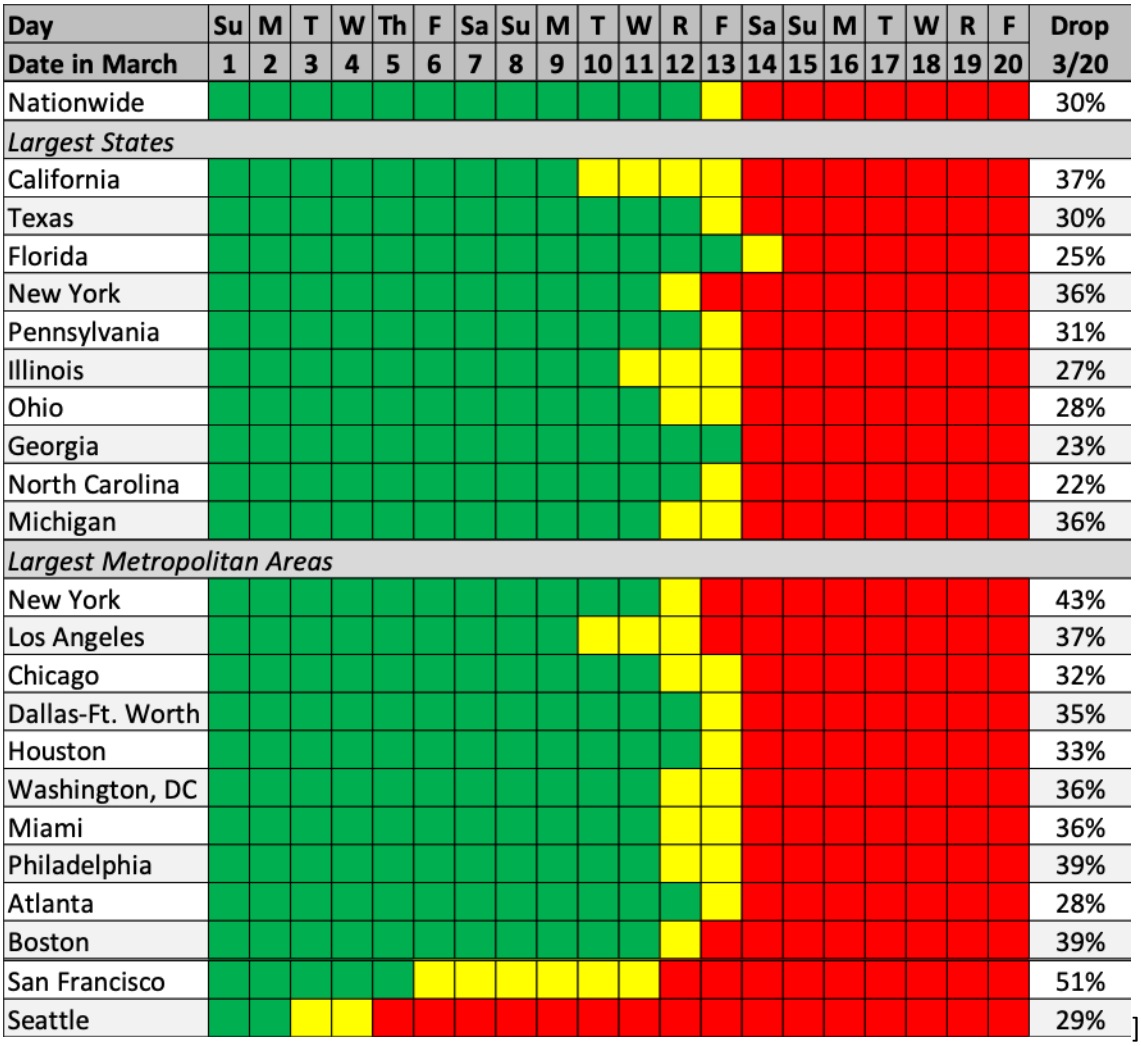


Figure 3. Relative traffic volumes (same=green, yellow is slightly declining, red=major declines) for a number of ISA states and cities (same source as Fig. 2).

A key question relative to COVID-19 is what has been the impact on transportation-related emissions and energy use in metropolitan areas as millions of Americans are asked to shelter at home? Such emissions range from greenhouse gas emissions, such as ozone and CO_2, to particulate matter and carbon monoxide. To what extent might some aspects of this change be permanent? For example, will there be a greater propensity for teleworking in the future and a corresponding reduction in emissions and energy use? And how might COVID-19 impact ridesharing programs aimed at reducing travel demand?

The INRIX data that shows the change in daily traffic volumes for several major cities and nationwide, as compared to one month ago, captures those that have been furloughed from their jobs, school closings, and reduction of shopping and other trip purposes due to the closing of what have been considered nonessential businesses. However, some portion of decreased

trip making has been replaced with teleworking and online instruction by colleges, universities, and K-12. Decreased trip making also represents some replacement of trips for other purposes, such as telemedicine, certain government functions, and other business that can be conducted remotely.

Prior to COVID-19, ongoing rapid advances in communications and information technologies of the last 40 years have laid the groundwork for a steady increase in the replacement of some work trips to telework, especially in certain employment sectors, such as finance, insurance, real estate, government, and technology. This tells us that during the COVID-19 crisis, the economy has not ground to a halt. Those activities that now demonstrate success in moving business, education and commerce to remote locations represent untapped potential to reorganize commerce in such a way as to preserve the discovered benefits to individuals, organizations, and society, with corresponding benefits to the environment.

The USF telework listservs maintained by the Center for Urban Transportation Research (CUTR) connects with more than 2400 telework or transportation demand management professionals that have extensive linkages with employers. These individuals could offer data that can be evaluated using forecasting and other methods to answer these questions. In addition, Dr. Amy Stuart of the Colleges of Public Health and Engineering, offers expertise in air quality modelling that could be leveraged to identify the air quality impacts of traffic changes.

Public transportation is viewed as a more environmentally sensitive alternative to single occupant vehicle travel. How are social distancing rules and fear of exposure reducing transit ridership? How might this impact the viability of this mode in the future? To what extent are public transportation systems able to weather the changes financially or will they need additional subsidies? Vehicle cleaning protocols and technologies are another topic of great interest to the transit and air travel industries, as well as mobility as a service (MaAS) systems. An analysis of these impacts could be readily conducted using the vast network of contacts and expertise that CUTR has developed as the nation's premier transit research center.

As the science community mobilizes to respond to the near-term challenges of the COVID-19 epidemic, preparing for the likelihood of other natural disasters acting in synergy is a critical consideration. For example, as the COVID-19 epidemic eases during the summer and potentially increases again in the autumn, this would be at the heart of the hurricane season in Florida. How would governments and emergency planners balance the needs for social (physical) distancing while at the same time managing evacuations from threatened areas? There is a role for geospatial tools and natural hazards planning that could perhaps be a topic for planning research by the USF Natural Hazards Network (http://www.cas.usf.edu/hazards/). This activity may be an opportunity for funding received by NOAA. Along these lines, if there is a red tide outbreak this summer/autumn, does this represent a toxic synergy of diseases affecting, in particular, coastal communities?

Who at USF?

There are a wide variety of environmental impacts that are within the skill sets of USF entities such as, in Engineering, the Center for Urban Transportation Research: https://www.cutr.usf.edu/ (Robert Bertini, Director; Kristine Williams, Program Director, Planning & Corridor Management; Phil Winters, Program Director Transportation Demand Management), College of Marine Science, Institute for Remote Sensing: http://imars.usf.edu/; and Optical Oceanography Laboratory: https://optics.marine.usf.edu/ , Patel College of Global Sustainability (George Philippidis, Director of Sustainable Energy), College of Public Health, Department of Geosciences (Mark Rains, Chair), Integrative Biology (Valerie Harwood, Chair), Environmental Science and Policy at USFSP, Muma College of Business, Anthropology, Sociology, Hospitality (e.g., decline in hospitality-related economy) and the USF Natural Hazards Network (Tim Dixon, Director).

Next Steps?

(1) Near term goals for this research enterprise can include the following: (a) develop a list of PIs and their research titles being proposed to NSF RAPID and other near-term funding opportunities; (b) convene a series of online (e.g., TEAMS) discussions concerning specific topics such as those identified below; (c) organize contacts with relevant program managers at federal agencies to ascertain the areas of interest, timing and interest in considering thematic proposals; and (d) develop a SIP award competition to develop research ideas (especially emphasizing cross-university collaborations).

(2) Long-term goals for research under this theme can include: Identifying larger-scope research collaborations and the funding vehicles to which they can be submitted.

Collaborative Research questions may include (i.e.):

- What is the impact of reduced air traffic and other changed land/sea travel patterns (CO_2 emissions, healthy oceans)?
- Integrating machine learning with genomics, what can we learn about the public health factors of the zoonotic global animal response?
- What useful information can be gained through a crowd-sourced approach to health and well-being that can be useful to service agencies including local governments?
- What is the global environmental impact(s) of decreasing pollution globally (financial, public health, attitudinal, policy)?
- What do we need to do in advance of an active hurricane season (crisis on top of crisis)?

Some Potential Funding Opportunities

A number of relevant federal agencies (DOT, NASA, NOAA, EPA, etc.) are funded under the most recent federal COVID-19 authorization to implement research that would be relevant to these and other environmental consequence research. The NSF RAPID grants wording includes environmental projects such as those outlined above.

Additionally, there are a number of active solicitations among the various agencies of the federal government that seem relevant, including:

1. NSF Environmental Convergence Opportunities in Chemical, Bioengineering, Environmental, and Transport Systems (ECO-CBET) due May 14, 2020 (request waiver of pre-proposal) https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505748

2. NSF Humans, Disasters, and the Built Environment (no deadline, proposals accepted anytime) https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13353

3. NASA Topics in Human Factors and Behavioral Performance 80JSC019N0001-HFBP (Due April 30, 2020)

4. NASA HERO Human Research Program Omnibus Opportunity 80JSC019N0001-OMNIBUS3 (Due April 30, 2020)

5. NASA Infrared Telescope Facility Observing Proposals (deadline extended to 09 April 2020) http://irtfweb.ifa.hawaii.edu/observing/callForProposals.php

6. NIST Measurement Science and Engineering (MSE) Research Grant Programs (due May 31, 2020) https://www.grants.gov/web/grants/view-opportunity.html?oppId=324363

Research Hub on Microbiome, Immunology and Infection Mitigation

Members: *Christian Brechot, USF Health; and Shyam Mohapatra, Morsani College of Medicine and Taneja College of Pharmacy*

Compelling evidence indicates that a dysbiotic gut microbiota seems to partner with the SARS-CoV2 virus in aggravating COVID-19 as well as with the Human Respiratory Syncytial Virus (RSV), a major respiratory pathogen and the main causative agent of pediatric bronchiolitis and of pneumonia of the elderly and immunocompromised worldwide. Gut cells show a high expression of the receptor ACE2 for SARS-CoV-2 infection. SARS-CoV-2 was detected in fecal samples from 29% of COVID-19 patients. Live virus particles were also isolated and cultured from their fecal samples, indicating possible early infection in the gut. More importantly, 48.5% of COVID-19 patients admitted to the hospital had digestive symptoms including anorexia, diarrhea, vomiting and abdominal pain, with a much lower rate for being cured and discharged (34.3% vs. 60%). Gut viral infection can lead to overgrowth of opportunistic pathogens such as

endotoxin producers, which may contribute to cytokine storm and induce sepsis, two main causes of mortality in hospitalized COVID-19 patients.

Toward developing COVID-19 probiotics targeting gut microbiota, Drs. Brechot and Mohapatra (USF) are collaborating with Dr. Liping Zhao (Rutgers University), who is also a founder of Notitia Biotechnologies. The USF Health is collaborating with Notitia Biotechnologies in clinical trials to mitigate respiratory viruses, including COVID-19 and RSV.

In this context the project will be focused on the design of two novel strategies for mitigating COVID-19 and RSV infections through intervention on the gut microbiota**:** 1) A nutrient-based approach of gut microbiota for mitigating COVID-19; and 2) a nanoparticle system to modulate gut microbiota and mitigate RSV infection.

Nutrient-based approach

Currently, there are no effective mitigation strategies for COVID-19. Treatment-focused mitigation strategies are needed to minimize hospitalization and reduce mortality and morbidity, especially among those with pre-existing chronic conditions, such as obesity and Type 2 Diabetes. A gut microbiome targeted treatment has the potential to alleviate symptoms for both early and late-stage COVID-19 patients, since the beneficial effects of short-chain fatty acids (SCFAs) produced by gut bacteria on antiviral immunity are documented. Notitia Biotechnologies has developed an innovative therapy that specifically promotes a special group of SCFA producers called the “Foundation Guild”. This therapy can potentially increase SCFA production, alleviate pre-existing chronic conditions, strengthen antiviral immunity, and suppress pneumonia-causing pathogens in COVID-19 patients.

Our clinical trials in obese and diabetic patients show that healthy gut microbiota has an essential group of gut bacteria that works as Foundation Guild to stabilize the healthy gut microbiota. Foundation Guild bacteria competitively thrive on a specific combination of dietary fibers as an energy source and then produce beneficial SCFAs, such as acetate and butyrate. Clinical data show that the promotion of Foundation Guild can alleviate obesity and type 2 diabetes, as well as suppress opportunistic pathogens that may induce sepsis**. This approach can reduce mortality and speed up recovery in hospitalized COVID-19 patients.**

To this end, a Foundation Guild with a special combination of fermentable dietary fibers to increase SCFA production may significantly alleviate COVID-19 symptoms, particularly in patients with pre-existing chronic conditions. A Foundation Guild Restoration Therapy (FGRT) was developed with three components: 1) a non-invasive testing platform that can identify Foundation Guild bacteria for each individual; 2) a method to enrich and culture Foundation Guild bacteria and formulate them into an LBP (live bio-therapeutics) capsule as a new generation of probiotics; 3) an optimized nutrient mix formula that can sustain the Foundation Guild bacteria at a high population level. Thus, for early-stage COVID-19 patients and their close contacts in quarantine, we propose to use the nutrient mix to promote their Foundation Guild bacteria to boost antiviral immunity and reduce the need for hospitalization. For hospitalized

patients, we plan to restore their Foundation Guild with LBP and the nutrient mix to alleviate secondary complications. This treatment-focused mitigation strategy is non-invasive and evidence-based; and has the potential to reduce mortality and shorten hospital stay for COVID-19 patients.

A nanoparticle system to modulate gut microbiota and mitigate RSV infection

At USF, Dr. Mohapatra's group has developed a microbiome-metabolome-based nanosystem, to mitigate RSV infection; which causes acute respiratory distress syndrome similar to COVID-19 in the lower lung with pediatric hospitalization with an average of 2.1 million outpatient visits among children younger than five years old in the USA annually. Furthermore, there are ~60,000 hospitalizations for severe pediatric complications and ~177,000 hospitalizations among adults older than 65 annually. Globally, RSV causes ~64 million infections and ~166,000 deaths annually. The only approved therapies for RSV disease are aerosolized Ribavirin and palivizumab, an anti-F monoclonal antibody therapy used as prophylactic for high-risk groups, such as premature infants. However, these treatments have moderate efficacy and come at a very high financial cost. This illustrates the need for the development of safe and effective therapy against RSV. A broad range of anti-RSV efforts using either vaccines or passive prophylaxis with fusion and/or replication inhibitors are being developed but have yet to show any proven therapeutic results. Despite progress made in the biological roles of these RSV proteins, developing effective prophylaxis or therapy has been difficult.

Thus far, a novel multifunctional nanoparticle system comprising microbiota metaboloms was shown to inhibit RSV replication in in vitro human cell cultures and in vivo mouse model, thus providing proof of concept against viral respiratory infection, caused by RSV which can be applicable to COVID-19.

Constituent Hub on Manufacturing, Innovation and Entrepreneurship

Leaders: *Yogi Goswami, College of Engineering; David Conrad, Technology Transfer Office; Michael Bloom, Corporate Partnerships and Innovation*

The present COVID-19 pandemic has become much worse due to shortages of personal protective equipment (PPE), and mobile and rapid testing instrumentation. Technological and manufacturing innovations can overcome such shortcomings for this, as well as future extreme events.

USF has become a national leader in advancing a culture of innovation and entrepreneurship with evidence of technological and manufacturing innovations in the College of Engineering. Development, rapid prototyping and manufacturing of COVID-19 testing swabs and development of Plasmonic PECO integrated respirator/mask prototypes are just two of many examples.

A Manufacturing Innovation and Entrepreneurship Hub will leverage the ongoing work at centers such as the Institute for Applied Engineering funded by SOCOM and the USF Jabil Innovation Institute, funded by Jabil, Inc., and the Entrepreneurship centers at various USF campuses.

Federal Funding Sources

Funding sources may include Economic Development Administration; Office of Biomedical Advanced Research and Development Authority (BARDA) Division of Research, Innovation & Ventures (DRIVe); Advanced Manufacturing and DoD SBIR programs.

Additionally, $36M is included in the C.A.R.E.S. Act and its supplements for the National Center for Advancing Translational Science; and $10M for the National Network for Manufacturing Innovation (collaboration through relevant Manufacturing USA Institutes).

Constituent Hub on Fundraising and Partnerships

Leaders: *Julie Gillespie, USF Foundation; Michael Bloom, Corporate Partnerships and Innovation; Arthur Santos, USF Health; Carissa Davis, Corporate Partnerships*

We are identifying and inventorying a wide range of potential funding partners, including companies, foundations, organizations and individual donors that can support USF's Pandemic Response Network and research hubs.

And while federal funding does not seem to apply specifically to support this constituent hub, here, the availability of matching dollars does make applications for federal funding more competitive.

CONCLUSION: IMMEDIATE STEPS

In addition to refining and developing the work of each hub, the Task Force is also continuing to generate ideas on how to respond even more quickly to immediate COVID-19 funding opportunities with short deadlines. Novel approaches currently in discussion include creating a **USF COVID-19 Research Response Research Grant Fund** to encourage faculty to rapidly develop and submit funding proposals, and a virtual researcher "speed dating" program to match faculty for NSF Rapid projects and NIH requests.

In order to best coordinate our efforts in this regard, the Task Force will continue to:

- Refine, detail and fully develop our proposed Pandemic Response Research Network™, research and constituent hubs

- Collect and share information on coronavirus projects currently underway across USF colleges and campuses

- Match researchers/projects for interdisciplinary collaborations

- Align these projects to funding opportunities with best chance for quick wins and impacts

- Facilitate these funding submissions, removing potential administrative and other obstacles that can slow down the process

- Promote invention disclosures, licensing and startup opportunities for USF technologies and intellectual property related to coronavirus

- Examine how to best work with companies (including small businesses and manufacturers), government agencies (local, state and federal), foundations, and global partners

- Update university leadership on our progress regularly

APPENDIX

A. COVID-19 RESEARCH FUNDING OPPORTUNITIES ON USFRI WEBSITE

(as of 4/1/2020 and constantly updated)

https://www.usf.edu/research-innovation/sr/covid-19-funding/

Funding agencies across the country and abroad have begun making funding available to conduct both medical and non-medical research that can be used to explore ways to model and understand the spread of COVID-19, to inform and educate about the science of virus transmission and prevention, and to encourage the development of processes and actions to address this global challenge. Many of these agencies are already accepting proposals, and many more will begin to do so in the days and weeks ahead.

USF Research & Innovation encourages USF researchers to pursue these funding opportunities and stands ready to assist with the development and submission of funding proposals for this important research.

In an effort to collect, organize, and disseminate information about these opportunities as they become available, USF Research & Innovation has developed this webpage with information about COVID-19 related research funding opportunities that is now available online. We will continue to update this webpage as new funding opportunities become available.

Federally Funded Opportunities

State of Florida Funded Opportunities

Locally Funded Opportunities

Internationally Funded Opportunities

Other Funding Opportunities and Corporate Partnerships

B. SELECT FEDERAL FUNDING ALIGNED WITH OVERVIEW

Compiled by Monica McClanahan, Director, USF Federal Government Relations – Research funding opportunities related to the C.A.R.E.S. Act and its supplements

National Institutes of Health	**$103.4M** – National Heart, Lung and Blood Institute
National Institutes of Health	**$706M** – National Institute of Allergy and Infectious Diseases
National Institutes of Health	**$36M** – National Center for Advancing Translational Services
National Institutes of Health	**$425M** – SAMHSA's Health Surveillance and Program Support
Department of Health and Human Services	**$27B** – Public Health and Social Services Emergency Fund
Department of Health and Human Services	**$12.5M** – Toxic Substances and Environmental Public Health
Department of Defense	**$3.805B** – Defense Health Program
National Science Foundation	**$75M** – To fund research grants and other necessary expenses