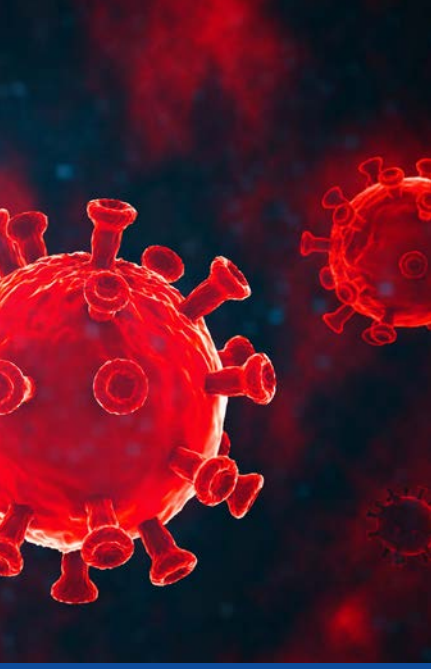


AMERICAN TECHNION SOCIETY

From **Visionary Education** to a **World** of **Impact**

COVID-19 Research at the Technion

August 2023

Produced in partnership with the Technion Division of Public Affairs and Resource Development

About ATS

The American Technion Society (ATS) supports visionary education and world-changing impact through the Technion - Israel Institute of Technology. Based in New York City, we represent thousands of U.S. donors, alumni, and stakeholders who invest in the Technion's growth and innovation to advance critical research and technologies that serve the State of Israel and the global good. For 80 years, our nationwide supporter network has funded Technion scholarships, research, labs, and facilities that have helped deliver world-changing contributions and extend Technion education to campuses in three countries.

For more than a century, the Technion - Israel Institute of Technology has pioneered in science and technology education and delivered world-changing impact. Proudly a global university, the Technion has long leveraged boundary-crossing collaborations to advance breakthrough research and technologies. Now with a presence in three countries, the Technion will prepare the next generation of global innovators. Technion people, ideas, and inventions make immeasurable contributions to the world, innovating in fields from cancer research and sustainable energy to quantum computing and computer science to do good around the world.

COVID-19 Fund Update

In 2020, as the coronavirus spread unabated worldwide, Technion researchers embarked on a comprehensive set of research programs designed to learn more about the coronavirus and potentially to alleviate its harmful effects on individuals and society as a whole. More than 50 Technion laboratories focused on COVID-19, in areas that included personal protective equipment, diagnostics, assistive technologies for healthcare providers and, most importantly, medical treatments along with vaccine research.

Three years later, the pandemic itself is significantly waning as a threat to, and factor in, daily lives across the globe. It is no longer a major health risk for the vast majority of people, with the exception of older adults and those with certain medical conditions, according to the World Health Organization (WHO). In May 2023, Dr. Tedros Adhanom Ghebreyesus, director-general of the WHO, said that while COVID-19 has ceased to be a public emergency of international concern, it is still an established and ongoing health issue. As part of the Technion Human Health Initiative, COVID-19 research continues at the Technion – as we have learned for the first time in this century how a pandemic can pose a substantial potential risk to the health of the world's population. To provide a window into continued research for the benefit of individuals worldwide, this report spotlights a sampling of work recently conducted in this area.

A 3D-printed sticker dubbed the “Maya” mask, which adds a layer of protection against COVID-19, from Prof. Eyal Zussman’s lab.

Assistant Professor

Yotam Bar-On

The Ruth and Bruce Rappaport Faculty of Medicine

Research Focus:

Identification of SARS-CoV-2 Intra-Host Variants for Uncovering Potential Vaccine-Resistant Variants

Taking a Cue from Influenza Research to Protect Against COVID-19

Most vaccines prevent infection by triggering antibodies that block the entry of pathogens – i.e., disease-causing microorganisms – into the body. But some viruses evolve relatively quickly, and this poses a great challenge for vaccine developers: is it possible to trigger antibodies that can protect against all potential variants of a virus? One strategy for accomplishing this, known as passive immunization, involves the use of so-called “broadly neutralizing antibodies,” which have the ability to protect against a large number of circulating viruses. In his research, Assistant Professor Yotam Bar-On has focused on the use of broadly neutralizing antibodies to protect against the influenza virus. He reports that the same approach is now serving as a leading therapeutic strategy in the COVID-19 pandemic.

Assistant Professor

Joachim Behar

The Faculty of
Biomedical Engineering

Research Focus:

Digital Biomarkers for the Monitoring of Cardiac and Pulmonary Function in COVID-19 Patients

Elucidating the Physical Symptoms of Severe COVID-19 Cases

In one recent study, Assistant Professor Joachim Behar examined medical records from patients with respiratory illnesses admitted to Rambam Health Care Campus between October 2014 and October 2020. He defined four groups of patients: COVID-19, influenza, severe acute respiratory infection, and others. Among his findings were that severely and moderately ill COVID-19 patients older than 65 suffered a higher rate of in-hospital mortality compared to hospitalized influenza patients, and that several critical body functions – including immune response, heart and respiratory function, and metabolism – were uniquely affected by COVID-19. In a separate study, Asst. Prof. Behar studied Rambam patients' oxygen saturation levels, a central vital sign in the management of COVID-19. He concluded that an oxygen saturation level of 93% was the dividing line between critical and noncritical cases. This finding could potentially help healthcare professionals identify patients at severe risk of COVID-related complications in a more timely manner.

Associate Professor

Eran Friedler

The Faculty of Civil and
Environmental Engineering

Research Focus:

Smart Monitoring in Municipal Sewer Networks for Fast Spatially-Based Tracking of COVID-19 Morbidity Hotspots; Smart Wastewater-Based Monitoring for Fast Detection and Early Warning of COVID-19 Morbidity Hotspots in the Technion Campus

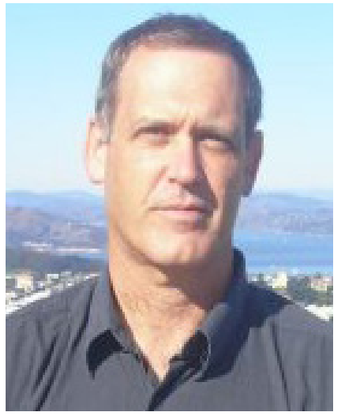
Monitoring the Presence of COVID-19 in Wastewater

Can the spread of COVID-19 be traced through municipal sewage systems? Associate Professor Eran Friedler devoted a recent study to developing a strategy for detecting SARS-CoV-2 in urban sewer networks, with the goal of providing warnings for COVID-19 outbreaks and helping to detect hotspots of the disease. To demonstrate the feasibility of this approach, he set up sewage-sampling units in nine sewer manholes and a wastewater treatment plant in the city of Ashkelon, Israel. Analysis of samples collected at each site showed sewage surveillance could be an effective tool to monitor the virus's spread. In a companion study, Assoc. Prof. Friedler conducted a similar exercise utilizing 11 sewer manholes at the Technion's Haifa campus, as part of a wastewater surveillance program developed and implemented to protect students' health. Once again, the evidence showed that wastewater monitoring can serve as an effective virus warning system.

Professor

Avigdor Gal

Faculty of Decision and Data Sciences



Professor

Danny Raz

Faculty of Computer Science

Research Focus: Avidan: Campus Management with COVID-19

Taking Steps to Keep the Technion Open During the Pandemic

Professors Avigdor Gal and Danny Raz have collaborated on the Technion's "Open and Safe Campus" project, which was initiated with the goal of keeping the campus open for researchers and students during the height of the pandemic. In a recent report, they provided highlights of the efforts involved in the project. Four different measures were implemented: strict adherence to the Technion's "purple badge" rules (wearing a mask, hygiene, and social distancing); aggregated COVID-19 tests using sewage analysis; regular individual, rapid, and noninvasive saliva tests; and PCR tests for those who had relevant symptoms or who tested positive on the saliva tests. The main aim was to assign each person on campus – including researchers, students, employees, and visitors – a color indicating the probability that the person was healthy. Profs. Gal and Raz concluded that the project worked well and can serve as a prototype for any similar health crises (including potential future events as deadly as the COVID-19 pandemic) that might arise in the future.

Associate Professor

Josué Sznitman

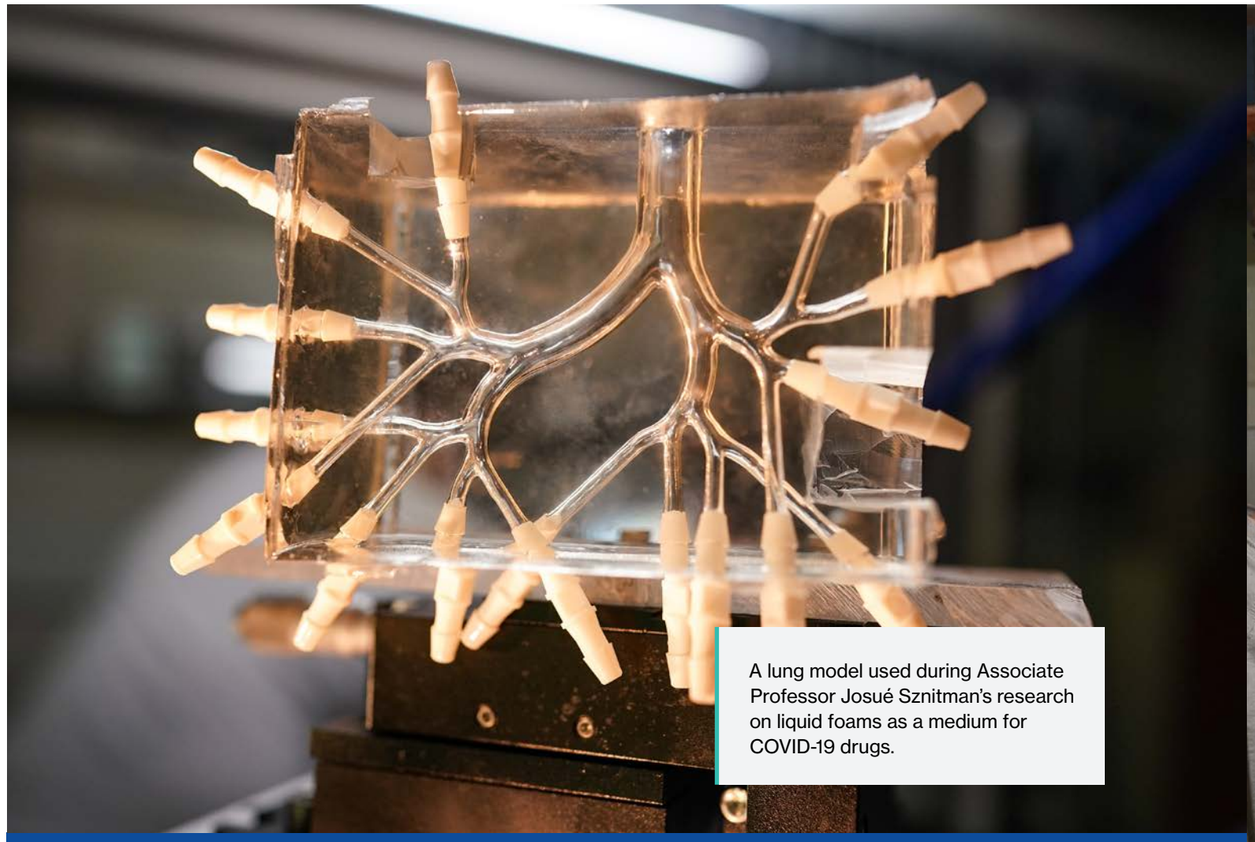
The Faculty of Biomedical Engineering

Research Focus:

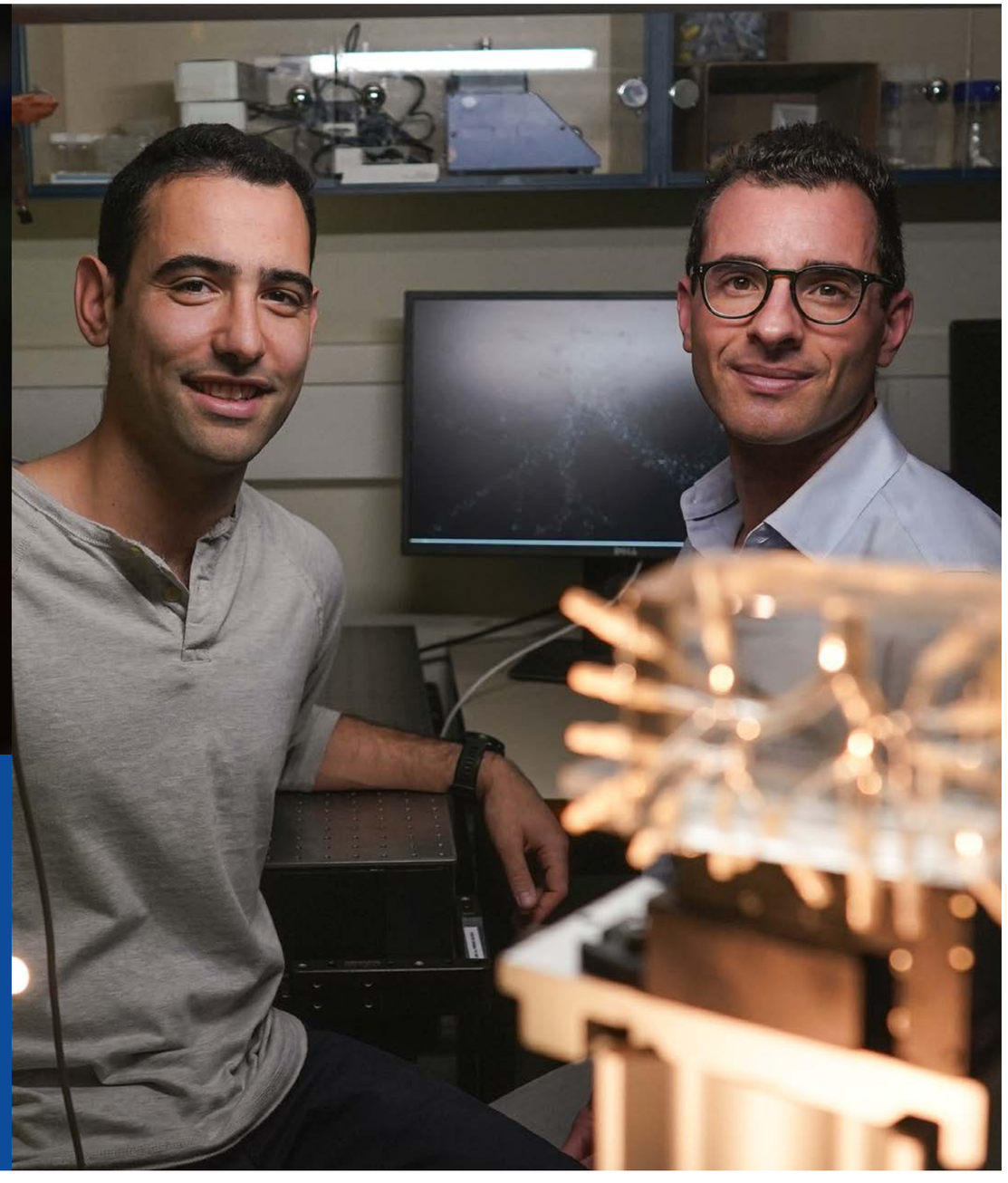
Liquid Foam Therapy for Acute COVID-19 Patients; Experimental Development of Advanced In Vitro Lung Models for Preclinical Research

Exploring Liquid Foams as a Medium for COVID-19 Drugs

As a potential therapy for COVID-19 patients, Associate Professor Josué Sznitman has studied foams capable of carrying drugs like Tyloxapol – which can be inhaled to remove bronchopulmonary secretions of mucus and pus. In various research studies, Assoc. Prof. Sznitman analyzed the structure and stability of the carrier foam at different foam-to-drug ratios. These measurements could serve as a way to finetune the characteristics of foams for specific therapeutic applications, and for estimating the maximum drug dose that the foams could reliably carry. In separate research, he tested the hypothesis that foam has an advantage over liquid treatments in clearing mucus, through *in vitro* experiments involving laboratory tubes of various widths, as well as by conducting *ex vivo* experiments on pigs' lungs. This is a continuation of Assoc. Prof. Sznitman's research on liquid foam therapy that was described in April 2021's "Report on the Use of COVID Funds at the Technion."



A lung model used during Associate Professor Josué Sznitman's research on liquid foams as a medium for COVID-19 drugs.



The COVID-19-related research outlined in this report reflects the ongoing spirit of scientific discovery focused on this area at the Technion – an initiative that was born during the earliest stages of the pandemic and one that has continued to the present day. These and other studies, which are conducted within the Technion Human Health Initiative, aim to ensure that people around the world are able to remain as safe and healthy as possible in the face of pandemics and other extraordinary health crises that may arise in years to come.

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National Office
55 East 59th Street
New York, NY 10022

212.407.6300
info@ats.org | ats.org