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Penn Dental Medicine
PATIENT ENTRANCE
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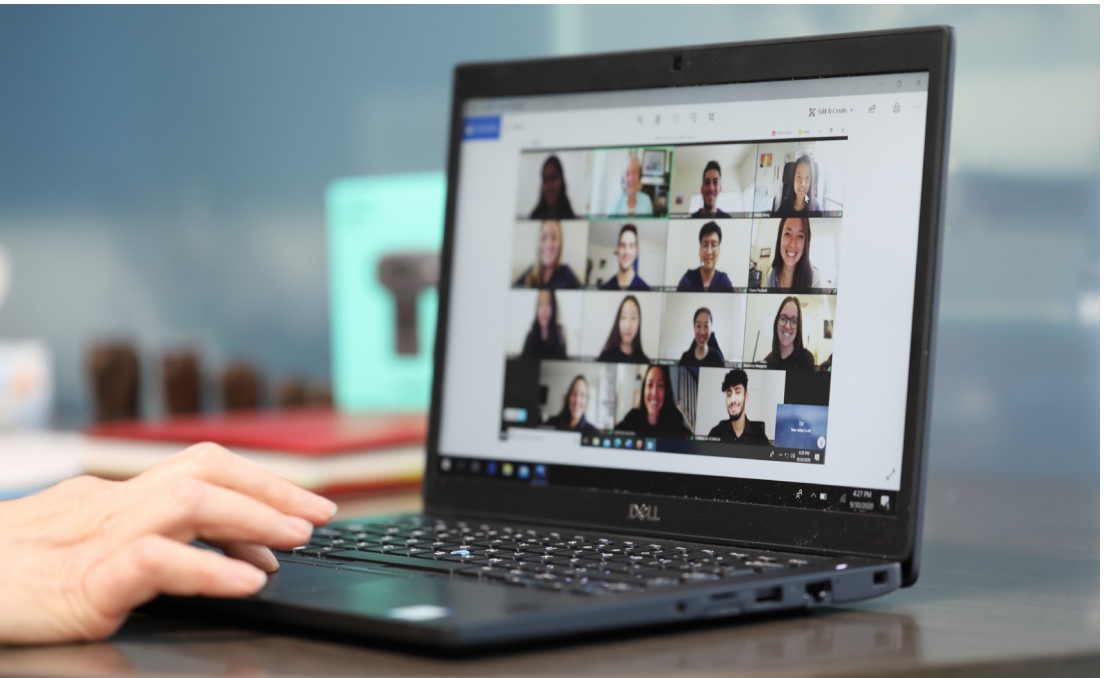

DELL

NAVIGATING A NEW NORMAL

MEETING ACADEMIC GOALS AND PATIENT CARE NEEDS DURING COVID-19

ON FRIDAY, MARCH 13, the University of Pennsylvania halted on-campus operations for all students, faculty, and staff due to the rapidly emerging threat of the novel coronavirus, SARS-CoV-2, and the resulting COVID-19 disease. That day in March began the start of a new normal that has permeated every aspect of University life.

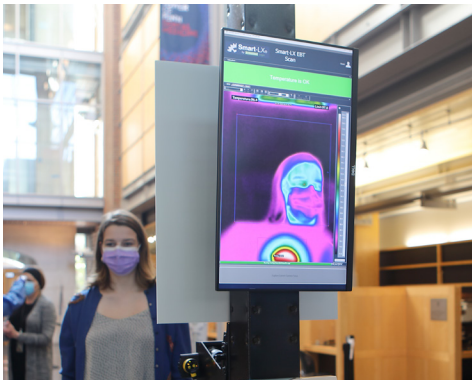
Over the next few months, with a nimble response to virtual instruction and new policies and procedures in place to protect the health and safety of students, faculty, staff, and patients, Penn Dental Medicine worked to ensure that students, particularly those graduating, were able to complete all necessary experiences and competencies and return to campus, and that clinical care was able to resume for a full range of patients.

OPPOSITE: Among the safety protocols put in place is PennOpen Pass, an online daily symptom tracker required for students, faculty, and staff; temperature checks and hand sanitizer by the entrance; extensive signage on social distancing; and comprehensive PPE for clinical care. Dr. Najeed Saleh (center), has managed clinical protocols, while courses have moved to virtual instruction.

RIGHT: A thermal screening unit is located within the School's atrium to screen patients and visitors as they enter the building. A similar unit is used at the entrance designated for students at the rear of the Evans Building.

While uncertainty about the trajectory of the pandemic is perhaps the one certainty in these unprecedented times, the School continues to fulfill its academic, clinical, and research missions, while utilizing best practices to ensure the safety of the entire Penn Dental Medicine community and the patients served.

"Indeed, the impact of COVID-19 on our students, faculty, staff, and patients cannot be overstated. Over the past eight months, we have all had to venture into unknown territory, but everyone at Penn Dental continues to respond to the challenges with great care and commitment to the School, our patients and each other," says Penn Dental Medicine's Morton Amsterdam Dean, Dr. Mark S. Wolff. "I am so proud of the adaptability and resilience of the entire Penn Dental Medicine community in their great work to maintain academic and research progress as well as safely provide patient care."



PROVIDING PATIENT CARE DURING COVID-19

As in much of the country, and the world, the weeks around mid-March were a rollercoaster for Penn Dental Medicine's clinical care. As the University announced a shift to online instruction, the dental clinics halted normal operations on March 13, and reopened the following Monday solely for urgent care, treating cases that didn't require aerosol-producing procedures, such as drilling. Less than a week later, Pennsylvania Governor Tom Wolf issued guidelines that shut down emergency operations at the School and nearly every dental practice in the state. With lobbying by Dean Wolff and the Deans of the state's other dental schools as well as organized dentistry in Pennsylvania, those guidelines were revised and emergency care resumed on March 30.

"It was quite difficult for us as providers; you feel powerless when patients can't be helped," says Dr. Najeed Saleh, Associate Dean of Clinical Affairs and Professor of Clinical Restorative Dentistry. Even with the limitations, the School was able to treat many patients during this time for such emergencies as tooth extractions, infections, denture adjustments, and crown cementations. "There were certain cases where we resolved the problem for the patient completely, and they were very appreciative," says Dr. Saleh. (Read Dr. Saleh's perspective on responding to the pandemic on p. 17).

In the early days of the pandemic, Dr. Saleh managed the recruitment of faculty to care for patients with emergency needs while following new safety protocols. Patient care also went remote through teledentistry with faculty conducting about 40 teledentistry "visits" daily at that time, prescribing medications and answering questions. Dean Wolff points to the success of teledentistry as a significant takeaway of the pandemic response.

"With the leadership of Dean Wolff, we were able to not only prepare for the current situation, but to continuously have a futuristic look to prepare for additional changes and keep everyone safe."

– DR. NAJEED SALEH

"I think we will find new ways of doing this and interacting with patients going forward," he says. He's especially hopeful that the current relaxing of HIPAA restrictions will be re-examined once the pandemic ends, which would allow expanded access to dental services remotely.

Meanwhile, a three-stage plan was developed to fully reopen for patient care. The first phase, starting June 3, enabled a small cohort of fourth-year (Class of 2020) students who needed to complete some hands-on clinical requirements to graduate to do so. Students and faculty had to be fitted for N95 masks, and clinical care (still limited to urgent cases) was operating at reduced capacity to facilitate distancing.

In the second phase, starting July 6, rising third- and fourth-year students returned to the clinics to treat patients with specific needs that would satisfy the students' clinical requirements. At the same time, faculty clinicians continued to provide urgent and emergency care for patients across a full range of procedures, including those requiring aerosol, with new safety precautions in place. The third phase, starting August 17, welcomed first- and second-year students to the campus to start their educational program.

In each phase, COVID-19 testing was required for all students, and Dr. Saleh notes that some students had to quarantine for 14 days depending on which states they were returning from. By mid-August, Penn Dental Medicine was providing a full range of patient care, and presently, clinical care is operating close to full capacity.

It is not, however, business as usual. Aerosol procedures are now being done with multiple mitigations, including frequent air exchange, use of rubber dams when possible, increased strength of high volume evacuation, and the use of electric hand pieces at reduced speeds with water stream only — no spray.

In addition, new safety protocols throughout the School include HVAC system modifications, sanitizer stations, traffic controls to ensure social distancing, plexiglass screens, and signs throughout Penn Dental Medicine to help ensure the health and safety of patients, faculty, students, and staff. Full personal protective equipment (PPE) for faculty and students and masks for patients

are required. Temperature-taking and thermal screening stations greet visitors, staff, students, and faculty just inside the building and masks are required to enter the School.

In addition, the new PennOpen Pass, used throughout the University, is an online daily symptom tracker that requires faculty, students, and staff to answer questions regarding their health and social contacts to enable them to get the "green light" to enter Penn Dental Medicine and all Penn facilities. If they answer "yes" to any questions, they are not permitted to enter any Penn buildings and are provided with information on testing and other assistance.

Patients are similarly questioned both prior to dental appointments and the day of, as well as two days after, to confirm they were healthy and didn't potentially spread the virus. Dr. Saleh points out that many of these protocols can be used in private practice, but Penn Dental Medicine alumni also need to follow their own state health department guidelines.

"We are strictly enforcing all of this — compliance is a must," says Dr. Saleh, noting the challenge now is to review and adjust safety protocols as needed to ensure they continue to be based on the best evidence at that time.

"With the leadership of Dean Wolff," Dr. Saleh says, "we were able to not only prepare for the current situation, but to continuously have a futuristic look to prepare for additional changes and keep everyone safe."

KEEPING ACADEMICS ON TRACK

Academically, the Class of 2020 was finishing up the last few months as Penn Dental Medicine students when the world seemingly came to a halt in mid-March due to COVID-19. With the clinical settings closed for all but urgent care, they still had to complete clinical competency exams to graduate in May.

"A real pressing concern was ensuring that students fulfilled both our programmatic and national requirements for graduation," says Dr. Faizan Alawi, Associate Dean for Academic Affairs and Professor of Pathology.

In a typical year, dental students prove their clinical competencies by treating real patients. But spring 2020 was anything but normal, and the School had to come up with another way, just as exacting, for fourth-year students to demonstrate their expertise.

To accomplish this, Dr. Alawi says department chairs and faculty were asked to create case-based, virtual assessments that covered all parameters previously included in patient-based assessments — except for the actual work on patients.

The one-on-one video examinations had to meet Commission on Dental Accreditation standards, and some students had multiple assessments. In all, several hundred online assessments were completed within about one month — in time for the May 18 virtual commencement ceremony.

"In some ways, it was more challenging than patient-based assessments," Dr. Alawi says. "Students were asked to describe a

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>
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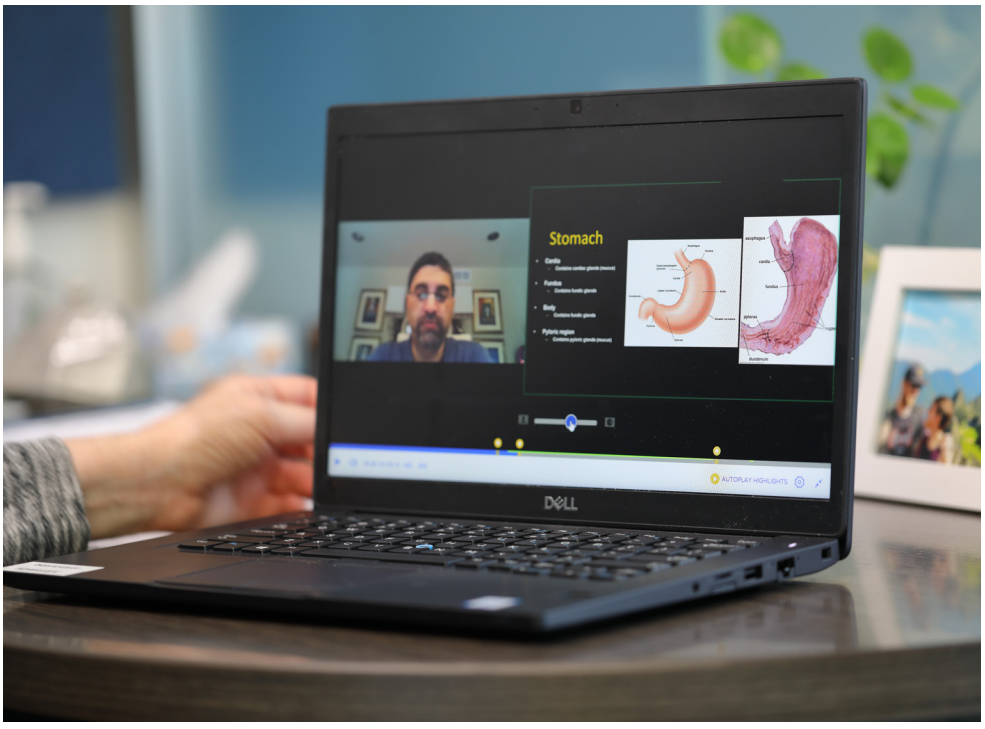


OPPOSITE: Presently, clinical care is operating close to full capacity. Students and faculty providing care use full PPE, part of which includes a face shield over two masks and loupes.

RIGHT: Dr. Faizan Alawi, lecturing in the Biological Systems course. Currently, all dental lectures are being delivered online with the exception of first-year students, with a quarter of the class at a time coming to campus for in-person lectures.

technique in detail without actually doing it and were graded on a strict criteria-based rubric."

At the same time, a number of fourth-year and postgraduate students still needed to fulfill clinical experiences for certain patient procedures to assure the completeness of their education, and were the first students to return when the phased reopening of the teaching clinics began on June 3.

Meanwhile, as the pandemic continued, plans were developed for this fall semester to ensure that the pedagogical and clinical needs of all undergraduate and postgraduate specialty students would continue to be met, while safeguarding the health of students, faculty, and patients. This includes following all new safety policies and protocols for entering Penn Dental Medicine facilities and working in the clinical settings, which now also includes second-year students per recent clinical curriculum revisions (see related story, p. 24).

"We're moving forward; we're seeing all patients," says Dr. Alawi, who in May gave a presentation to the American Dental Education Association on Penn Dental Medicine's COVID-19 experience, highlighting both early steps to keep the academic program advancing and later plans to bring students back to campus for instruction and clinical work.

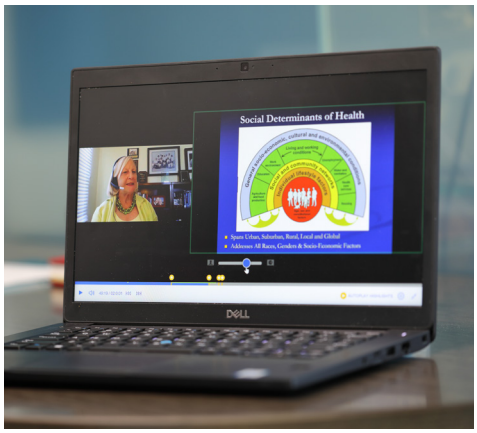
Currently, all dental lectures are being delivered online; attendance is mandatory and students must watch them in real time. The only exception is for first-year students, with one-quarter of the class at a time coming to campus to attend the lectures in person.

Another change is that preclinical simulation laboratory days are now longer and run from 8 a.m. to 8 p.m., with staggered hours that allow small groups of students to rotate in for about three hours each.

Considering the disruption to didactic and clinical instruction since last spring, Dr. Alawi is pleased that Penn Dental Medicine has been able to promptly make appropriate adjustments and ensure the academic needs of undergraduate and postgraduate students continue to be met. At the same time, continuing education needs for practicing clinicians have also continued to be met, with the School launching a robust schedule of virtual courses last spring that is ongoing (see story, p. 3).

"We've never had to shift the academic program to this extent; it was a real undertaking that required the efforts and cooperation of the entire faculty and student body," says Dr. Alawi of the impact of COVID-19. "We worked together to pull this off and, in the end, we did it really well."

— By Debbie Goldberg



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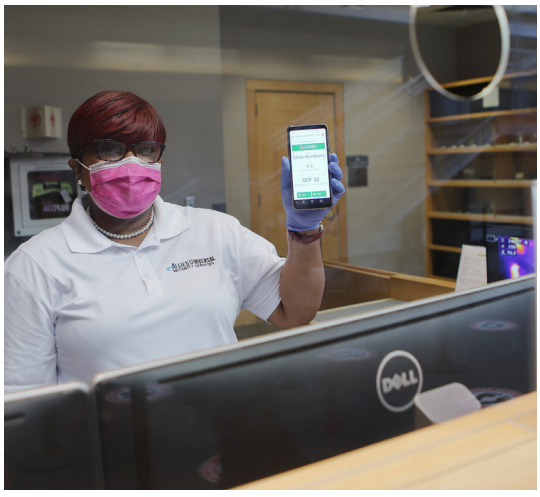
TOP: Traffic controls and floor decals are used at the entrance and throughout the school to ensure social distancing.

ABOVE, LEFT: Dr. Todd Singer, conducting a teledentistry appointment. In the early stages of the pandemic, faculty conducted about 40 "visits" per day, prescribing medications and answering questions.

ABOVE, RIGHT: Faculty and student PPE protocols include a surgical mask over an N95 mask.

RIGHT: Masking is required for all staff and visitors entering the building and plexiglass barriers were added both at the security desk by the entrance and at the check-in desks within the clinics.



Tackling COVID-related Studies as Research Resumes

THE UNIVERSITY OF PENNSYLVANIA SUDDENLY SHIFTED to remote operations on March 13 and research across the Penn campus essentially ceased. Except for two COVID-19 projects, research at Penn Dental Medicine stopped and quickly went to a maintenance phase that involved securing equipment and reducing the size of the animal colonies.

Since then, research went through two ramp-up phases. In early June, Phase 1 resumption of research was initiated following University guidelines, which allowed research to proceed, but on a limited basis; each lab was required to develop an individual research plan with a limited number of people allowed in a lab at one time. Research activities moved to Phase II on July 13, allowing additional population density in the labs, including participation by students in the School's MSOB and DScD programs. In September, an update was made to Phase II that has allowed for limited pairs of researchers to work cooperatively provided there was written permission and additional precautions were taken, including extra personal protective equipment (PPE). In this new phase, DMD students are now also allowed to participate in research projects.

"The current Phase II plan has enabled research to ramp up to a good level with most labs active," says Dr. Dana Graves, Vice Dean for Research & Scholarship. "Yet the number of individuals able to work at any one time or work in teams continues to restrict research progress depending on the nature of the studies." He notes that rigorous training in the use of PPE and other safety procedures is required for all who start or resume laboratory work. And protocols are in place to support social distancing, including a new one-way walking plan in the Levy Center for Oral Health Research.

"I think Penn has handled this well for the circumstances," adds Dr. Graves. "There has been clarity across the campus on how to resume research activities with careful regulations and controls for the safety of all researchers. Compliance has generally been good."

There is no time frame yet for a return to full research operations given the continued prevalence of COVID-19. "The extra precautions, PPE, and utilization of remote work whenever possible has made the laboratories a safe place to work," notes Dr. Graves. Meanwhile, as Penn Dental Medicine's research enterprise continues to move forward, a number of Penn Dental Medicine researchers are working on studies to potentially help in the understanding, treatment, and prevention of COVID-19 (see p. 16).

> "There has been clarity across the campus on how to resume research activities with careful regulations and controls for the safety of all researchers."
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> – DR. DANA GRAVES

COVID-Related Research Ongoing

Penn Dental Medicine researchers are working on studies to potentially help in the understanding, treatment, and prevention of COVID-19.

USING PLANT-BASED PROTEINS FOR THERAPY, VACCINE

Dr. Henry Daniell, W.D. Miller Professor in the Department of Basic & Translational Sciences, is working on two novel strategies for combating COVID-19, both of which leverage decades of experience with the successful development of plant-based protein therapies to develop targeted oral therapeutics and vaccination strategies.

In the therapeutic realm, Dr. Daniell, in collaboration with Dr. Kenneth Margulies of Penn's Perelman School of Medicine, is pursuing first-in-human studies of an oral preparation that supplements two beneficial proteins — ACE2 and its protein product, angiotensin (1-7) — that are severely depleted in COVID-19 patients. It will assess whether a drug developed to treat pulmonary arterial hypertension could reduce lung and heart injuries in coronavirus patients.

The second project is focused on developing a plant-based oral vaccination to induce durable mucosal immunity that would boost waning immunity following an injected vaccine. Virtually all COVID-19 vaccination strategies are employing injectables that will produce systemic immunity, Dr. Daniell says, but not mucosal immunity. Mucosal immunity, however, is required to protect at viral entry ports and to be more durable and effective in patients with compromised immune systems.

Both projects were awarded funding through Pennsylvania's COVID-19 Vaccines, Treatments and Therapies program to support the rapid advancement of vaccines, treatments, and therapies.

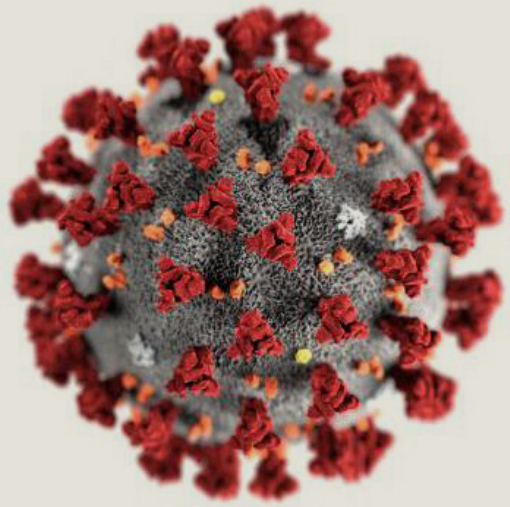
AN ANTIVIRAL DRUG TO PREVENT ACUTE RESPIRATORY DISTRESS

The laboratory of Dr. Robert Ricciardi, Acting Chair and Professor of Basic & Translational Research, is working on research to develop an antiviral drug that would prevent extreme respiratory distress following infection with the COVID-19 virus. When the virus enters the nasal and oral cavities via air droplets, it may progress to the lungs and infect the air sacs that exchange carbon dioxide for oxygen. For this study, researchers are constructing special molecules to coat and mask the COVID-19 virus spike protein, which allows it to bind to the lungs' epithelial cells, and could thus prevent the virus from infecting lung cells. Such an antiviral drug is intended to be inhaled to prevent lung destruction and provide sufficient time for patients to develop immunity.

ASSESSING TRANSMISSION IN AEROSOL-PRODUCING ENVIRONMENTS

Dental practice includes the generation of aerosols, which are thought to increase the risk of SARS-CoV-2 infection. This study, launched earlier this fall in partnership with the Perelman School of Medicine, will determine whether the resumption of clinical dental practice increases the risk of SARS-CoV-2 infection after baseline testing for the virus and compared to a large cohort of medical healthcare workers. Dr. Dana Graves, Professor of Periodontics and Vice Dean for Research & Scholarship, and Dr. David Hershkowitz, Division Chief of Restorative Dentistry, are the principal investigators.

The information from this study may help determine whether the protocols for PPE and infection control are effective against SARS-CoV-2 transmission in an aerosol-generating environment. It is enrolling 300 Penn Dental Medicine practitioners who will have antibody testing performed at baseline and every two months for six months afterwards.



NOVEL THERAPEUTIC PATHWAYS TO PREVENT INFECTION

Dr. Bruce Shenker, Professor of Pathology in the Department of Basic & Translational Science, is principal investigator for a study recently awarded by the National Institute of Dental and Craniofacial Research in response to its Notice of Special Interest Program for Urgent Competitive Revisions and Administrative Supplements for Coronavirus Disease 2019 (COVID-19). This funding supports groundwork for developing a novel, alternative, and potentially transformative therapeutic approach to mitigate SARS-CoV-2, or COVID-19, infection.

The multidisciplinary team on the grant includes Dr. Gary Cohen, Professor of Microbiology, Department of Basic & Translational Science, and Dr. Kathleen Boesze-Battaglia, Professor of Biochemistry, Department of Basic & Translational Sciences.

The scope of the original study, which focused on bacteria and lymphocyte suppression in periodontitis, has been expanded to build on the researchers' recent observations from their current study on the cytolethal distending toxin, which may help identify novel therapeutic pathways for preventing SARS-CoV-2 infection.

According to the grant proposal, to contain the SARS-CoV-2 infection, it is important to identify early molecular mechanisms that contribute to its high infectivity, as these likely also represent attractive targets for therapeutic intervention. As part of the study, researchers will investigate human oral and pulmonary epithelial cells, including those in the tongue, gingiva, and floor of the mouth.