

Outlook

 Washington
University in St. Louis
SCHOOL OF MEDICINE

AUTUMN 2021



From patents
to patients



During Match Day 2018, Avril Coley (right) wipes a tear after matching to a surgical residency at Massachusetts General Hospital. Future husband Max Riley raises a glass after learning he, too, would train in surgery at Massachusetts General. The couple married in October 2021. For 21 years, Kathryn M. Diemer, MD, an assistant dean for career counseling and a professor of medicine, has been helping students find their best match. See page 7.

MATT MILLER



COVER To drive clinical innovation, Washington University is helping faculty navigate the challenging world of technology transfer. It also is addressing a national disparity of female innovators. Hong Chen, PhD, associate professor of radiation oncology and of biomedical engineering, is working to become the fourth female faculty member at the School of Medicine to launch a startup, called Sonobiopsy. Her technology improves genetic diagnosis of brain cancer by targeted sound. Read more about commercializing discovery on page 20.

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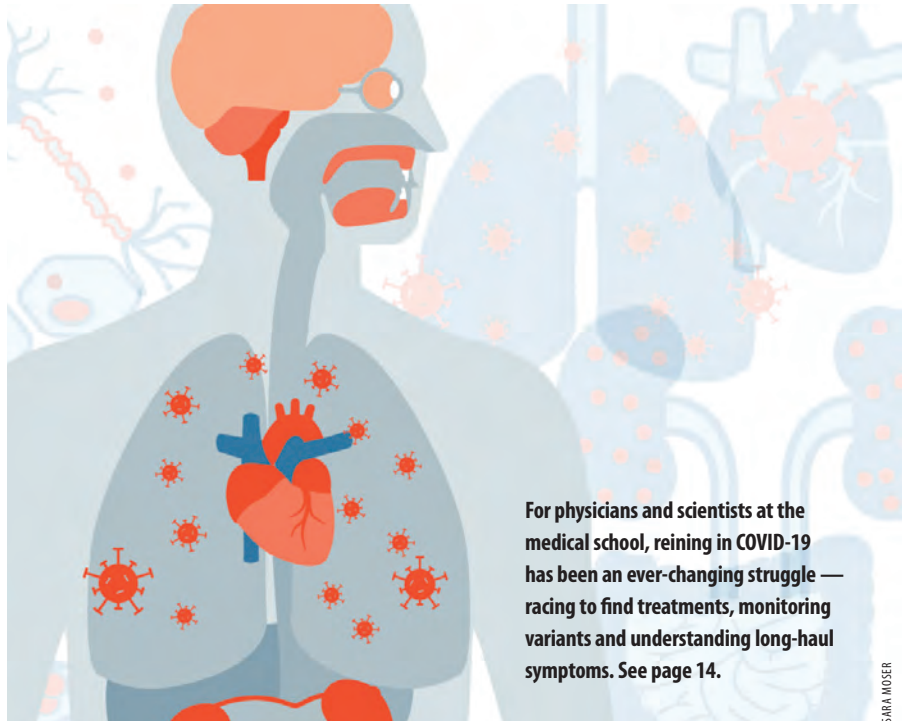


MATT MILLER

Outlook

Washington University School of Medicine

OUTLOOK.WUSTL.EDU AUTUMN 2021



SARA MOSER

For physicians and scientists at the medical school, reining in COVID-19 has been an ever-changing struggle — racing to find treatments, monitoring variants and understanding long-haul symptoms. See page 14.

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When the novel coronavirus burst onto the scene, donors came forward in a matter of weeks to support critical research, including work by virologists Michael S. Diamond, MD, PhD (left), and Sean P. J. Whelan, PhD. See page 28.



Photos of unmasked people in this magazine were taken prior to the COVID-19 pandemic or in accordance with School of Medicine masking protocols at that time.

Whole genome sequencing

in guiding blood cancer treatment

For certain blood cancers, such as acute myeloid leukemia (AML) and myelodysplastic syndrome (MDS), deciding whether patients need an aggressive treatment typically hinges on lab tests to identify genetic changes. Some of these tests rely on technology that was invented more than 60 years ago and has been used clinically for the past three decades.

Now, a study shows that whole genome sequencing is at least as accurate and often better than conventional genetic tests for determining the best treatment regimen. Genome sequencing technology continuously is decreasing in cost and recently reached a level similar to that of conventional testing. Results can be returned in just a few days.

The New England Journal of Medicine published the study March 11.

“Our study suggests whole genome sequencing is a reliable and practical approach for detecting all of the changes that are important for assessing the risk of relapse for AML and MDS patients, using a single test,” said senior author

David H. Spencer, MD, PhD, an assistant professor of medicine and medical director of the clinical sequencing facility at the Elizabeth H. and James S. McDonnell III Genome Institute.

The researchers evaluated blood samples from 263 patients by sequencing the patients’ entire genomes, and compared these results with traditional genetic tests from the same patients. Whole genome sequencing identified all of the same major genomic abnormalities as the conventional method — called karyotyping — and, importantly, it identified additional genetic abnormalities. This suggests that whole genome sequencing may be able to more effectively identify patients in the unfavorable-risk category, allowing them to receive the most appropriate therapy up front.

The Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine is offering whole genome sequencing to patients with AML and MDS. BJC HealthCare is providing funding for whole genome sequencing to those who qualify.

A bone marrow sample from a patient with myelodysplastic syndrome who participated in this study.

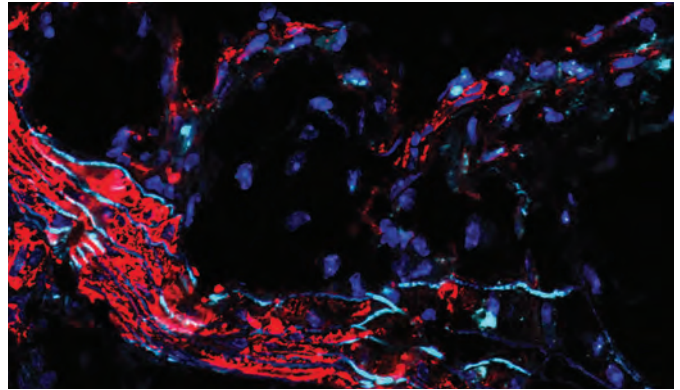
Outpatient cancer care in central facility

Siteman Cancer Center is planning a nine-story facility on the Medical Campus dedicated solely to outpatient cancer care. Although final approval is pending, plans call for a 659,000-square-foot facility on the southwest corner of Forest Park and Taylor avenues. The facility is slated to open in summer 2024.

The building will provide a central home for nearly all aspects of advanced cancer care for outpatients, meaning fewer visits to different locations on the Medical Campus. Cancer care specialists — incorporating the latest advances in the diagnosis and treatment of cancer — as well as support services from social workers, psychologists and others will come to patients in the new center. Patients also will have access to hundreds of clinical trials.

Plans call for the ambulatory care center to include 96 exam rooms, 88 infusion pods, radiology and breast imaging services, and hematology and chemistry laboratory space. An elevated pedestrian link will connect the facility to the rest of the Medical Campus.

Patients will have easy access to the parking garage within the same building and to public transportation. The new facility is conveniently located next to a hotel.



In this stained section of atherosclerotic plaque from a mouse aorta, vascular smooth muscle cells are red, proliferating cells are cyan, and nuclei of any cell are blue.

Scientists find genetic link to clogged arteries

Scientists have identified a gene that likely plays a causal role in coronary artery disease independent of cholesterol levels. The gene also likely has roles in related cardiovascular diseases, including high blood pressure and diabetes.

Science Translational Medicine published the study March 24.

Studying mice and genetic data from people, the researchers found that the gene — called SVEP1 — makes a protein that drives the development of plaque in the arteries. In mice, animals missing one copy of SVEP1 had less plaque in the arteries than mice with both copies.

Evaluating human genetic data, the researchers found that genetic variation influencing the levels of this protein in the body correlated with the risk of developing arterial plaque. Genetically determined high levels of the protein meant higher risk of plaque development and vice versa. Similarly, they found higher levels of the protein correlated with higher risk of diabetes and higher blood pressure readings.

“A major goal of treatment for cardiovascular disease has appropriately been focused on lowering cholesterol levels,” said cardiologist Nathan O. Stitzel, MD, PhD, an associate professor of medicine and of genetics. “But there must be causes of cardiovascular disease that are not related to cholesterol — or lipids — in the blood. We can decrease cholesterol to very low levels, and some people still harbor residual risk of future coronary artery disease events.”

The researchers have worked with the university’s Office of Technology Management to file a patent for therapies that target the SVEP1 protein.

To learn more about stories in Pulse, go to medicine.wustl.edu/news



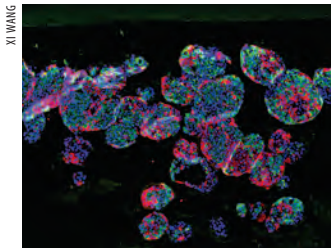
GETTY IMAGES

SUGARY DRINKS LINKED TO COLON CANCER

A study led by WUSM has found a link between consuming sugary drinks and an increased risk of colorectal cancer among women under 50. The researchers calculated a 16% increase in risk for each 8-ounce daily serving. And from ages 13 to 18, an important time for growth and development, each daily serving was linked to a 32% increased risk of developing colorectal cancer before age 50. The journal *Gut* published the study online May 6.

Tiny implant reverses diabetes in mice

A team of researchers led by diabetes specialists and biomedical engineers at the School of Medicine and Cornell University has demonstrated that, using a miniscule device, they can implant insulin-secreting cells into diabetic mice. Once implanted, the cells secrete insulin in response to blood



XI WANG

An implant contains insulin-secreting beta cells (in purple).

sugar, reversing diabetes without requiring drugs to suppress the immune system. The journal *Science Translational Medicine* published the findings June 2. “We can take a person’s skin or fat cells, make them into stem cells and then grow those stem cells into insulin-secreting cells,” said Jeffrey R. Millman, PhD, an associate professor of medicine and of biomedical engineering at Washington University and study co-senior investigator. “The problem is that in people with Type 1 diabetes, the immune system attacks those insulin-secreting cells and destroys them. To deliver those cells as a therapy, we need devices to house cells that secrete insulin in response to blood sugar, while also protecting those cells from the immune response.”

The device, about the width of a few strands of hair, is microporous — with openings too small for other cells to squeeze into — so the insulin-secreting cells consequently can’t be destroyed by immune cells. Insulin still can get out and control blood sugar, which it continued to do in the mice for up to 200 days.

sugar, reversing diabetes without requiring drugs to suppress the immune system.

The journal *Science Translational Medicine* published the findings June 2.

“We can take a person’s skin or fat cells, make them into stem cells and then grow those stem cells into insulin-secreting cells,” said Jeffrey R.

Alzheimer’s biomarkers improved by drug

An investigational Alzheimer’s drug reduced molecular markers of disease and curbed neurodegeneration in the brain, without demonstrating evidence of cognitive benefit, in a phase 2/3 clinical trial led by researchers through the Dominantly Inherited Alzheimer Network-Trials Unit (DIAN-TU).

The DIAN-TU study, published June 21 in *Nature Medicine*, evaluated the effects of two investigational drugs — gantenerumab, made by Roche and its U.S. affiliate, Genentech, and solanezumab, made

by Eli Lilly and Co. — in people with a rare, inherited, early-onset form of Alzheimer’s known as dominantly inherited Alzheimer’s disease or autosomal dominant Alzheimer’s disease. Such people are born with a mutation that causes Alzheimer’s, and experience declines in memory and thinking skills starting as early as their 30s or 40s.

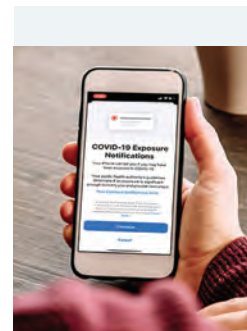
“The drug’s (gantenerumab) ability to shift multiple Alzheimer’s biomarkers toward normal indicates that it is positively affecting the disease process,” said principal investigator Randall J. Bateman, MD, director of DIAN-TU and the Charles F. and Joanne Knight Distinguished Professor of Neurology. “The effect was strong enough that we launched an open-label extension of the trial so participants have the opportunity to stay on the drug as we continue to study it.”

In this study, 52 patients were randomized to gantenerumab, which led to a reduction in the amount of amyloid plaques in the brain, lowered soluble tau and phospho-tau, and slowed the rise of neurofilament light chain levels in the cerebrospinal fluid. Neurofilament light chain is a marker that reflects neurodegeneration.



MATT MILLER

Randall J. Bateman, MD, talks with research specialist Haiyan Liu, MD.



COVID EXPOSURE SYSTEM

WashU is piloting MO/Notif, a COVID-19 exposure notification system that alerts users when they have been near another user who has tested positive for the virus that causes COVID-19. On Android, find the app on Google Play. On iPhone, opt-in to Exposure Notifications in Settings > Exposure Notifications on the device.

New snack foods nurture healthy gut microbiome

School of Medicine researchers have identified ingredients for snack food prototypes that have been formulated to deliberately change the gut microbiome in ways that can be linked to health.

“Poor nutrition is a pressing and complex problem worldwide that is driven by many factors, including an overabundance of high-fat and low-fiber foods in typical Western diets,” said senior author Jeffrey I. Gordon, MD, the Dr. Robert J. Glaser Distinguished University Professor and director of the Edison Family Center for Genome Sciences & Systems Biology. “Since snacks are a popular part of Western diets, we are working to help develop a new generation of snack food formulations that people will like to eat and that will

support a healthy gut microbiome that affects many aspects of wellness.”

Gordon and his colleagues are focused on characterizing which food components interact with which components of the gut microbiome and how this interaction shapes different features of human biology.

In two pilot human studies with overweight participants, the scientists have shown that snacks containing specifically selected fiber types affect elements of the microbiome involved in metabolizing fiber components. This shift in the microbiome was linked to changes in blood proteins that are biomarkers

and regulators of many facets of physiology and metabolism. These blood proteins shifted in ways that could improve health in the long term. Nature published the study June 24.



GETTY IMAGES

Stroke-recovery device earns FDA authorization

A first-of-its kind device that helps people disabled by stroke regain significant control over their arm and hand function by using their minds has

received market authorization from the Food and Drug Administration (FDA). The IpsiHand Upper Extremity Rehabilitation System, developed by Neurolutions Inc. — a Washington University startup company — leverages brain-computer interface (BCI) technology licensed from the university.

The IpsiHand system includes a wearable robotic exoskeleton that fits over a patient’s hand and wrist and assists with opening and closing the hand based on the patient’s thoughts. By mentally controlling the IpsiHand exoskeleton with the aid of BCI technology, patients may improve their upper extremity motor function, giving them more effective movement of the affected hand, wrist and arm.

Generally, motor impairments experienced by a patient six months after a stroke have been considered permanent. In clinical trials, stroke patients who used the device

showed statistically significant improvement in motor control.

Designed for use in the home or clinic, the IpsiHand system may assist stroke patients in learning to feed themselves, grasp objects and perform other everyday tasks. It is the first stroke-rehabilitation device that relies on a brain-computer interface.

The FDA granted the IpsiHand system “Breakthrough Device” designation, which speeds access to select, novel medical devices.

The underlying BCI technology was spearheaded by Eric C. Leuthardt, MD, a professor of neurosurgery. He co-founded Neurolutions in 2007 with Daniel W. Moran, PhD, a professor of biomedical engineering at the McKelvey School of Engineering, to further develop the technology. Founding CEO Kern Bhugra was brought on board several years later. Early St. Louis-based investors BioGenerator and Ascension Ventures were critical for the company’s development and technical advancement. The company is currently led by CEO Leo Petrossian, PhD, and chairman of the board Fred Khosravi.



Eric C. Leuthardt, MD

ELIZABETH HOLLAND DURANDO

Vice chancellors appointed



Three medical school administrators have been named vice chancellors: **Eva M. Aagaard, MD**, for medical education; **Paul J. Scheel Jr., MD**, for clinical affairs; and **Richard J. Stanton**, for medical finance and administration.

Aagaard is the Carol B. and Jerome T. Loeb Professor of Medical Education and senior associate dean for education. She led the development of the school's Gateway Curriculum, and supported the creation of the Academy of Educators, which promotes and rewards teaching excellence. As interim senior administrator for occupational health, she helped the school navigate through the pandemic.



As chief executive officer of Washington University Physicians, Scheel worked with clinical department heads and BJC HealthCare to implement the EPIC medical records system. He has directed operational management of the medical school's COVID-19 response; expanded inpatient and outpatient programs at Barnes-Jewish West County Hospital; launched WUCare, a primary care practice for WashU employees; and overseen the expansion of Washington



University Physicians into south St. Louis County, north St. Louis County and Illinois.

Stanton has led the administration of the medical school since 2008. Recently, he played important roles in the school's response to the pandemic and in the implementation of MyDay, and he has been a key figure in the neuroscience research building under construction and other Medical Campus building projects.

Neurology head named



Jin-Moo Lee, MD, PhD, recognized internationally for his research on the cellular and molecular pathophysiology of brain injury, was named head of the Department of Neurology and the Andrew B. and Gretchen P. Jones Professor of Neurology, effective Sept. 1.

Lee also is the Norman J. Stupp Professor of Neurology, chief of the cerebrovascular disease section in the Department of Neurology, a professor of radiology and of biomedical engineering, co-director of the Washington University and Barnes-Jewish Hospital Stroke & Cerebrovascular Center, and co-chair of BJC HealthCare's stroke care clinical program.

Lee succeeds David M. Holtzman, MD, director of the Hope Center for Neurological Diseases and associate director of the Knight Alzheimer's Disease Research Center, who is focusing more intensely on new strategies to prevent neurodegeneration.

Immunologist becomes BJC investigator



Kodi S. Ravichandran, PhD, a world leader in understanding innate immunity, has been named a BJC Investigator as well as director of the Division of Immunobiology in the Department of Pathology & Immunology, effective Jan. 1. He also will hold the Robert L. Kroc Professorship.

His studies of how dead cells are cleared from the body have shed light on innate immunity — the body's first line of immune defense — and the understanding of inflammation and tumor-causing conditions.

Ravichandran is the Harrison Distinguished Professor of Microbiology and chair of the Department of Microbiology, Immunology and Cancer Biology at the University of Virginia.

Ravichandran is the sixth BJC Investigator named.

Couple honored by alma maters



Two separate alma maters recognized married professors — **Elizabeth Matthews Brunt, MD**, and **L. Michael Brunt, MD** — with alumni awards this past year.

Elizabeth Matthews Brunt, emeritus professor of pathology & immunology, received the 2021 Ashbel Smith Distinguished Alumna Award from her medical school, the University of Texas Medical Branch in Galveston.



She formerly served as a Washington University section chief and fellowship director of liver and GI pathology. Her research on nonalcoholic fatty liver disease led to a microscopic scoring system, "the Brunt criteria," to assess the severity of nonalcoholic steatohepatitis (NASH). She co-led a National Institutes of Health (NIH) effort to develop pathology scoring used worldwide in clinical trials for NASH.

She was president of the Hans Popper Hepatopathology Society and received its Lifetime Achievement Award, as well as the American Association for the Study of Liver Disease Distinguished Service Award.

L. Michael Brunt, the Pruett Family Professor of Surgery and section chief of minimally invasive surgery, received a Distinguished Alumni Award from Johns Hopkins University School of Medicine.

Brunt, a leader in laparoscopic, endocrine and hernia surgery, was one of the first Washington University physicians to fully adopt laparoscopic surgery and directs a safe cholecystectomy initiative to reduce bile duct injuries. He is team surgeon for the St. Louis Blues, and has a nationwide referral practice for collegiate/professional athletes with sports hernias.

Brunt is past president of the Society of American Gastrointestinal and Endoscopic Surgeons and of the Central Surgical Association.

The Brunts have been married 38 years.

A perfect match

Kathryn M. Diemer, MD (right), assistant dean for career counseling, congratulates a student at Match Day.

Diemer devotes her career to helping students find their best fit

BY KRISTINA SAUERWEIN



MATT MILLER

Graduating students open envelopes that reveal their Match Day results every March in the Eric P. Newman Education Center. Leading up to the big day, Diemer (left) and Angela MacBryde, program coordinator in career counseling, spend many hours consulting with students. Here, Diemer and MacBryde enjoy some of the fruits of their labor.

For medical students, the third Friday in March marks the beginning of their careers as physicians, a milestone in which they learn where they will train as residents after graduation. For many, the occasion, known as Match Day, is as momentous as a wedding. For better or for worse, it's a life event forever etched in memory.

Twenty-one years ago, when Kathryn M. Diemer, MD, began overseeing Match Day at the School of Medicine, her skills as an academic physician and scientist sufficed. But soon, her role became more complicated and demanding, a mirrored response to the increasing competitiveness of the match process itself.

Today, Diemer's roles include counselor, strategist, cheerleader, data analyst, mother figure and, to survive it all, dedicated Diet Coke drinker. To facilitate the best Match Day results, Diemer gets to know the 100-plus students in every

medical class. She's often on-call during evenings and weekends, calmly problem-solving with current or past medical students experiencing a professional — or personal — crisis.

"Match Day was a lot easier 20 years ago," said Diemer, an assistant dean for career counseling and a professor of medicine. "Today, it's significantly more competitive."

The higher expectations correlate with a steady rise in the number of graduating medical students competing for a limited number of residency spots. In 2021, the National Resident Match Program recorded the largest match ever, with 48,700 applicants registered and 38,106 positions offered.

In 2021, the national match rate for U.S. doctor of medicine applicants seeking first-year positions hovered at 92.8%. That same year, the School of Medicine boasted a match rate of 96%. Two years earlier, in 2019, all 125 students matched.

"The success of our Match Day program is rooted in Dean Diemer's dedication as an adviser, advocate and mentor," said Eva Aagaard, MD, vice chancellor and senior associate dean for education and the Carol B. and Jerome T. Loeb Professor of Medical Education. "She goes above and beyond to ensure that our students are engaged, prepared and supported throughout the match process."

Since 1952, the National Resident Matching Program has acted as a clearinghouse to fill positions at U.S. teaching hospitals, pairing the preferences of graduating medical students with those of residency program directors. Based on rank lists provided by both groups, a match is

"The success of our Match Day program is rooted in Dean Diemer's dedication as an adviser, advocate and mentor."

— Eva Aagaard, MD

generated by a computerized mathematical algorithm that served as the foundation for the 2012 Nobel Prize in Economic Sciences.

“The algorithm is accurate,” Diemer said. “Match disappointments stem from everything beforehand.”

Students will match if they submit realistic rank lists and favorably impress residency directors. “Which is where we come in,” Diemer said, referring to herself and Angela MacBryde, program coordinator in career counseling. “I tell students, ‘If you stick with Angie and me, you’ll be fine.’”

Match Day preparation begins in students’ first two years of medical school. “Our office has evolved over time,” MacBryde said. “Initially, we mainly advised fourth-year students about residency programs and the application process. Now, we meet students earlier to help them explore and select their best-fit medical specialty.”

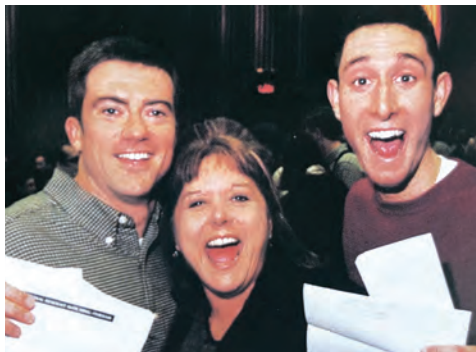
“This is an involved process that requires guiding students toward necessary clinical, service and research experiences, as well as making sure they network sufficiently to understand what life would look like in a certain specialty. The better we are, the better our match results and, importantly, the happier our students.”

Tapping into resources

Diemer’s office has enlisted the university’s writing and career centers, both on the Danforth Campus, to help students craft personal statements and refine job-interviewing skills.

Additionally, Diemer compiles and analyzes annual match data. “We have information on average board scores for particular residency programs and on the number of places in which students should interview, based on a specialty’s competitiveness or student academic records,” she said. “We also gather feedback about students who didn’t match. None of these tools were available before.”

Over the years, Diemer has developed trusted relationships with the nation’s residency directors. “I’ve been doing this long enough that I have cellphone numbers and can pick up the phone and call any time. They know me, and they know our program,” she said.



Diemer even has contacted residency programs on behalf of a student’s spouse or partner attending another medical school. “We support our students and, sometimes, that means helping their significant others,” Diemer said. “Couples matching adds layers of complexity to the process.”

In 2020, Kate and Will Gerull — high school sweethearts who recently celebrated their sixth wedding anniversary — successfully couples-matched from Washington University to Barnes-Jewish Hospital, their first choice in the highly competitive specialties of orthopedic surgery and general surgery, respectively.

Surprisingly, they weren’t too nervous. “We’re used to it,” Kate Gerull said. “We applied to the University of Washington for undergraduate and here for medical school. Honestly, those times felt more stressful.”

Will Gerull nodded in agreement: “That’s because this time we had an incredible, fierce ally in Dr. Diemer.”

The Association of American Medical Colleges recognized Diemer’s dedication and talent with the 2018 Excellence in Medical Student Career Advising Award.

“Kathy Diemer is the reason why Washington University’s Match Day program is highly regarded nationwide,” said S. Andrew Josephson, MD, a professor and chair of the Department

2001: S. Andrew Josephson, MD (right), now a professor and chair of the Department of Neurology at UCSF School of Medicine, celebrates Match Day with Robert H. Brophy, MD (left), now a professor of orthopedic surgery at WashU, and then-student program coordinator Diane Smith.

2018: Classmates jump for joy as Victor Kovac hugs fiancée Madison Mack, immunology PhD student at Washington University. Kovac matched in internal medicine at Brigham & Women’s Hospital.



MATT MILLER

of Neurology at the University of California-San Francisco School of Medicine, who also has served as a UCSF assistant residency program director. “Residency programs know that students recommended by Kathy will be outstanding. The neurology residents she’s referred to our program have been nothing less than spectacular.”

Josephson brings a unique perspective, having worked with Diemer on both sides of the match process. In 2001, Diemer helped Josephson match from Washington University to neurology at UCSF. “She was — she is — incredibly friendly, thoughtful, smart, kind and funny,” he recalled. “These qualities go a long way in easing Match Day stress. Still today, you’ll not find a stronger advocate for Washington University and its medical students than Kathy Diemer.”

Asking the tough questions

However, properly advocating often requires bluntness. “I will caution students applying for competitive residencies to have a parallel plan,” Diemer said. “I’m very realistic and honest, but I will also support students applying to a competitive residency because you never want regret.”

Diemer also asks tough questions. “You want to be a surgeon because grandma had cancer and a surgeon saved her life, or because your parents

were surgeons, but do you have the personality of a surgeon? Do you love the high-stakes drama of an operating room? Because if you don’t, then you may not enjoy surgery. Do you want to form one-on-one relationships with your patients? Because if you do, then you may want to consider internal medicine instead.”

She imparts perspective. She humbles. “To be a medical student at Washington University, you have to be a superstar,” Diemer said. “But not everyone can be top in the class. Not everyone can match at the top-ranked residencies. And that’s OK. There are many paths to success.”

And she critiques. To the student mumbling “ums” during a practice interview, or to the student who overshares personal information, or to the student who changes the subject from his love of neurology to his love of magic tricks, Diemer interrupts: “No, no and nope, you will not talk about that during your residency interviews.”

Because honesty can hurt, Diemer stocks her office with Kleenex. She and MacBryde also installed a door between their adjoining offices. “That way we can comfort a crying student in privacy,” MacBryde said.

Diemer’s office is also a place where students go when they need reassurance or a confidence boost from someone who believes in them. She’s offered relationship advice, encouraged students after a setback and hugged them through the pains of illnesses and the deaths of their loved ones.

With Diemer’s encouragement, Vikram Shankar, MD, MPH, withdrew from the match in 2017 amid doubts about pursuing plastic surgery. “I wasn’t excited,” he recalled. “It felt more like an obligation.”

Shankar called Diemer. Calmly, sympathetically, she recounted students who felt happier after switching specialties. Diemer shared how she had matched in obstetrics-gynecology, but three months into her residency, she felt unsatisfied and changed to internal medicine. Today, Diemer is a nationally recognized expert in osteoporosis and metabolic bone disease.

“It was valuable to have her reaffirm the importance of being passionate about your specialty,” Shankar said. “With her support, I took a gap year to explore other specialties. I did a

Mementos and messages of gratitude line Diemer’s office.



MATT MILLER

rotation in ophthalmology, and I fell in love with the mix of medicine and surgery.”

However, Shankar feared disapproval during residency interviews.

“No problem,” Diemer coached. “Say, ‘I was going for plastic surgery, but then I did ophthalmology, and I loved it.’ Ophthalmology directors will react, ‘Of course, you love ophthalmology. Of course, you changed your mind.’”

In 2018, Shankar matched in ophthalmology at the prestigious Wills Eye Hospital in Philadelphia.

An emotional journey

Every student’s match story differs. And every student causes Diemer’s stomach to flutter on Match Day. Most get their top match choices. A few don’t. “I find out the day before,” Diemer said. “I go through a range of emotions. Happiness. Excitement. Pride. For students disappointed in their matches, I feel sick to my stomach. I care for my students deeply.”

Even so, the day before Match Day, she avoids students like a celebrity dodging paparazzi. “On that day, we get an unusually high number of students dropping by the office to say hi,” Diemer said, chuckling. “You can feel their excited, nervous energy. I have to lock my office door and hide.”

On that day, MacBryde’s role as assistant is more Hollywood awards show than top-tier medical school. “Once we saw a student while getting coffee, and, abruptly, I had to guide us in another direction,” she said. “Sometimes, I wish I had a wig and sunglasses for Dr. Diemer.”

Match Day morning brims with jitters. Medical schools celebrate in different ways. Some have students simultaneously open envelopes that divulge the names of the institutions where they matched. Others host formal brunches or informal gatherings at restaurants.

At Washington University, a big screen behind the stage at the Eric P. Newman Education Center recalls each student’s ambitions as first-year students and juxtaposes that past with the future. Students individually walk, strut or dance across the stage to theme songs each chooses. Some invite friends and families — including babies, toddlers and teens — to accompany them on stage. Each then reads out loud his or her match.

“I’m excited, nervous and in awe during the ceremony,” Diemer said. “Every Match Day is as thrilling as my first one 21 years ago.” □



HUY MACH

In 2020, MD graduates Kate and Will Gerull successfully couples-matched to Barnes-Jewish Hospital. They hosted a video chat with their West Coast families as they sat side by side at their Central West End dining room table, laptops open, waiting for the news via email.

Matching in a pandemic

Months before the pandemic arrived in the U.S., School of Medicine faculty, staff and students started imagining ways to honor Kathryn Diemer, MD, who would oversee her 20th Match Day, on March 20, 2020.

Flower bouquets. Chocolate cake. Handwritten letters of appreciation.

But like most events in 2020, nothing worked according to plan.

“To say my 20th Match Day was unforgettable is an understatement,” said Diemer, assistant dean for career counseling and a professor of medicine.

When Match Day arrived, the Class of 2020’s 118 physicians-to-be ended up celebrating virtually. Instead of faculty, family and friends clapping and cheering in the Eric P. Newman Education Center (EPNEC), their congratulations were offered through FaceTime, Zoom and various social media platforms.

“Resilience is key to being a successful doctor, and the resiliency these students showed was nothing less than inspirational,” Diemer said.

For Match Day 2021, a hybrid celebration was offered to the 105 graduating students.

Some students unveiled their matches at home or in small meeting places with a handful of loved ones. But many attended the traditional celebration at EPNEC — albeit masked and socially distanced. Each student took center stage, opened an envelope revealing the match and announced it to the class.

Match Day 2021 was open only to students, who were each allowed one guest. Groups of students and their guests rotated in and out of the auditorium from nearby rooms to minimize capacity.

“The Class of 2021 has shown remarkable resilience since the beginning of the pandemic,” Diemer said, “from adjusting to abrupt changes in classes and clinicals, to spearheading student volunteer efforts against COVID-19, to mobilizing to fight health inequalities and racial injustices. The pandemic spotlighted the school’s exceptional students.”



Match Day 2021

On Friday, March 19, the medical school's 105 physicians-to-be participated in Match Day, the momentous milestone when U.S. medical students learn where they will train as residents. Because of COVID-19, the celebration was limited to students and one guest per student. All participants were masked and in compliance with the school's COVID-19 safety precautions. Thirty-two graduates are staying in St. Louis for residencies at Barnes-Jewish and St. Louis Children's hospitals. Others matched at hospitals throughout the U.S.

26
Internal
Medicine

24
Surgery

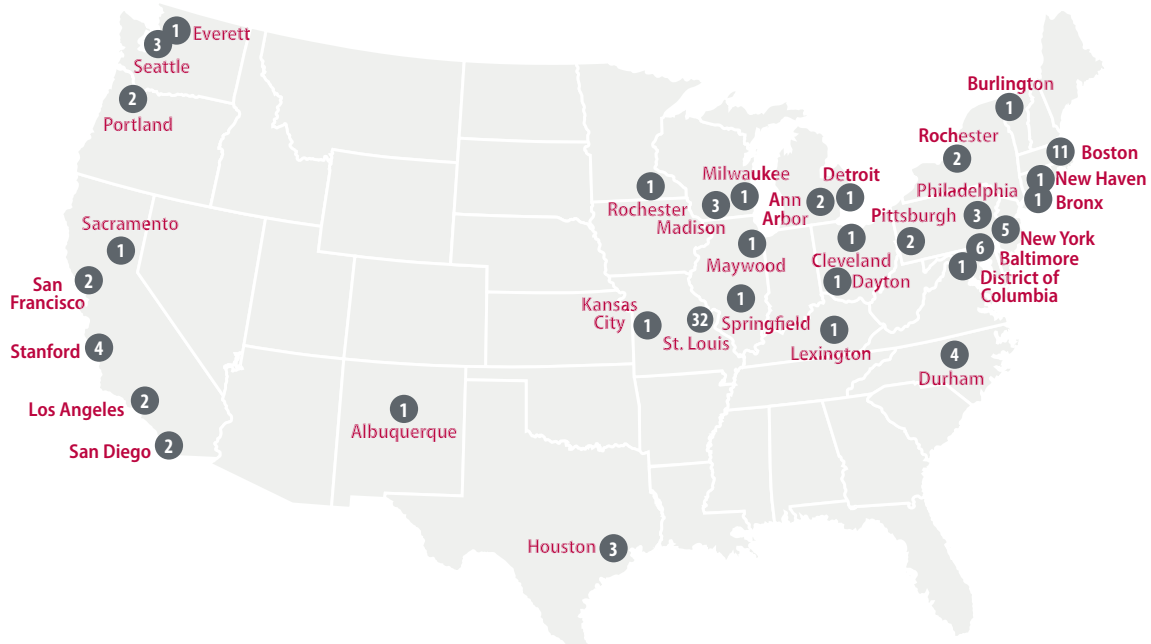
9
Pediatrics

7
Radiology-
Diagnostic

6
OB/GYN

6
Psychiatry

5
Anesthesiology



CALIFORNIA**Cedars-Sinai Medical Center**

GENERAL SURGERY
Adam Surti

Stanford University Programs

ANESTHESIOLOGY
Moises Arriaga
GENERAL SURGERY
Chuner Guo
INTERNAL MEDICINE
Ashima Chadha
John LeClair

University of California-Davis Medical Center

PLASTIC SURGERY
(INTEGRATED)
Ella Gibson

University of California-San Diego Medical Center

ANESTHESIOLOGY
Corey Vural
DERMATOLOGY
Umber Dube

University of California-San Francisco

INTERNAL MEDICINE
Julia Wagner
MEDICINE-PRIMARY
Sharon Abada

University of Southern California

ANESTHESIOLOGY
David Kneiber

CONNECTICUT**Yale New Haven Hospital**

PSYCHIATRY
Yang (Jae) Lee

DISTRICT OF COLUMBIA**Children's National Medical Center**

PEDIATRICS/COMMUNITY HEALTH
Leah Newcomer

ILLINOIS**Loyola University Medical Center**

ORTHOPAEDIC SURGERY
Nithya Lingampalli

Southern Illinois University School of Medicine & Affiliated Hospitals

PLASTIC SURGERY
(INTEGRATED)
Samantha Lund

KENTUCKY**University of Kentucky Medical Center**

NEUROLOGICAL SURGERY
Alexander Skidmore

MARYLAND**Johns Hopkins Hospital**

INTERNAL MEDICINE
Hannah Miller
NEUROLOGICAL SURGERY
Connor Liu
ORTHOPAEDIC SURGERY
Niyathi Prasad
PLASTIC SURGERY
(INTEGRATED)
Ashwathi Mohan
RADIOLOGY-DIAGNOSTIC
Norman Atagu

Wilmer Eye Institute-Johns Hopkins

OPHTHALMOLOGY
Shahriyar Majidi

MASSACHUSETTS**Beth Israel Deaconess Medical Center**

INTERNAL MEDICINE
Meg Landon
Sirui Ma
OBSTETRICS-GYNECOLOGY
Cory French

Boston Children's Hospital

CHILD NEUROLOGY
Kayla Berry

Brigham & Women's Hospital

INTERNAL MEDICINE
Andrew Qi
NEUROLOGY
Sarah Smith
PSYCHIATRY-CHILD
Margaret Duncan

Massachusetts General Hospital

EMERGENCY MEDICINE
Jason Morris
INTERNAL MEDICINE
Akua Nuako
Aaron Silverstein
RADIOLOGY-DIAGNOSTIC
Gautam Adusumilli

MICHIGAN**Henry Ford Hospital**

OPHTHALMOLOGY
Benjamin Katz

University of Michigan Hospitals-Ann Arbor

INTERNAL MEDICINE
Katherine Goodenberger
RADIOLOGY-DIAGNOSTIC
Preethi Kesavan

MINNESOTA**Mayo Clinic School of Graduate Medical Education**

INTERNAL MEDICINE
Eliza Thompson

MISSOURI**Barnes-Jewish Hospital**

ANESTHESIOLOGY
Rebecca Chen
Mitsukuni Yoshida
DERMATOLOGY
Damien Abreu
Trisha Bhat
Jolee Potts
EMERGENCY MEDICINE
Matthew Matlock
INTERNAL MEDICINE
Nathan Adams
Elisa De Togni
Jerry Fong
Samantha Hsieh
Francis Loh
Lekha Pandya
Avira Som

NEUROLOGICAL SURGERY

Alexander Yahanda
NEUROLOGY
Jared Goodman
OBSTETRICS-GYNECOLOGY
Christina Herbosa
ORTHOPAEDIC SURGERY
Jesse Hu

OTOLARYNGOLOGY

Joseph Roh
PATHOLOGY/ANATOMIC AND NEUROPATHOLOGY
Emilie Russler-Germain
PHYSICAL MEDICINE & REHAB
Brian Brady
Shariq Khan
PLASTIC SURGERY
(INTEGRATED)
Grace Keane
PSYCHIATRY
Reeti Pal

RADIOLOGY-DIAGNOSTIC

Derek Miller
Anna Schroeder
SURGERY (PRELIMINARY)
Ioana Florea
Omolade Sogade
VASCULAR SURGERY
Shirli Tay

Saint Louis University**School of Medicine**

PEDIATRICS
Ethan Pfeifer

St. Louis Children's Hospital

PEDIATRICS
Devon Camp
Na Le Dang
Madeline Spencer

University of Missouri-Kansas City

RADIOLOGY-DIAGNOSTIC
Mitchell Lynn

Washington University**School of Medicine**

UROLOGY
James Gross

NEW MEXICO**University of New Mexico**

School of Medicine
FAMILY MEDICINE
Owen Hamilton

NEW YORK**Icahn School of Medicine/Mount Sinai Morningside West**

EMERGENCY MEDICINE
Nicholas Becker

Montefiore Medical Center-Einstein Campus

FAMILY MEDICINE
Gabriel Tissian

New York Presbyterian**Hospital-Columbia University Medical Center**

INTERNAL MEDICINE
Mark Terng
PEDIATRICS
Faith Williams

New York Presbyterian**Hospital-Cornell Medical Center**

UROLOGY
Malik Wahba

New York University Grossman School of Medicine

INTERNAL MEDICINE
Shahroz Fatima

University of Rochester/Strong

Memorial Hospital
ORTHOPAEDIC SURGERY
Lucas Fowler
PEDIATRICS
Eric Balta

NORTH CAROLINA**Duke University Medical Center**

INTERNAL MEDICINE
Katherine Jordan
Nishkala Shivakumar
NEUROLOGICAL SURGERY
Mounica Paturu
OBSTETRICS-GYNECOLOGY
Dayana Hernandez Calderon

OHIO**Cleveland Clinic Foundation**

RADIOLOGY-DIAGNOSTIC
Alexander Scott

Wright-Patterson Air Force Base

GENERAL SURGERY
Matt Miller

OREGON**Oregon Health & Science University**

GENERAL SURGERY
Connie Gan
ORTHOPAEDIC SURGERY
Katherine Velicki

PENNSYLVANIA**Hospital of the University of Pennsylvania**

PSYCHIATRY
Helen Liljenwall

Mainline Health/Bryn**Mawr Hospital**

UROLOGY
Anthony Brooks

Pennsylvania Hospital

OBSTETRICS-GYNECOLOGY
Kaitlin McCallum

University of Pittsburgh Medical Center

INTERNAL MEDICINE
Farid Farkouh
PSYCHIATRY-GENERAL
Chad Donahue

TEXAS**Baylor College of Medicine-Houston**

OBSTETRICS-GYNECOLOGY
Carly O'Donnell
ORTHOPAEDIC SURGERY
Timothy Rooney

University of Texas MD**Anderson Cancer Center**

RADIATION ONCOLOGY
Kamaria Lee

VERMONT**University of Vermont**

Medical Center
PEDIATRICS
Benjamin Kim

WASHINGTON**Elson S. Floyd College of Medicine-****Washington State University**

INTERNAL MEDICINE
Sean Terada

University of Washington**Affiliated Hospitals**

NEUROLOGICAL SURGERY
Julian Clarke
PHYSICAL MEDICINE & REHAB
Garrett Wahl
PSYCHIATRY
Nisha Bhat

WISCONSIN**Medical College of Wisconsin****Affiliated Hospitals**

INTERNAL MEDICINE
Chanelle Chua

University of Wisconsin**Hospital & Clinics**

OBSTETRICS-GYNECOLOGY
Carrie Sibbald
OPHTHALMOLOGY
Georges Guillaume
PEDIATRICS
Matthew Lammers

Living with COVID-19

**Science, medicine and health care adapt
to a pandemic world**

BY TAMARA BHANDARI

A year and a half after the first COVID-19 shutdowns in the U.S. transformed life as we know it, the end to the pandemic is nowhere in sight. Masking and distancing can bring case numbers down, but at an economic and social cost many find intolerably high. Scientists developed fantastically effective vaccines in record time, but officials failed to get shots into arms fast enough to prevent a devastating fourth wave in the U.S.

For the physicians and scientists at the School of Medicine, reining in COVID-19 has been an ever-changing struggle. In the first, desperate months, they dove into the global race to find treatments, diagnostics and vaccines. Later, attention shifted toward understanding the long tail of COVID-19 symptoms, monitoring the threat of new virus variants, studying racial inequities and optimizing vaccination strategies.

Experts predict that mass vaccination eventually will end the pandemic but won't eradicate the virus. We will just have to learn to live with it, they say. But the insights into human biology and behavior gleaned from this extraordinary time also will stay with us, informing medical care as we all adapt to the new normal.



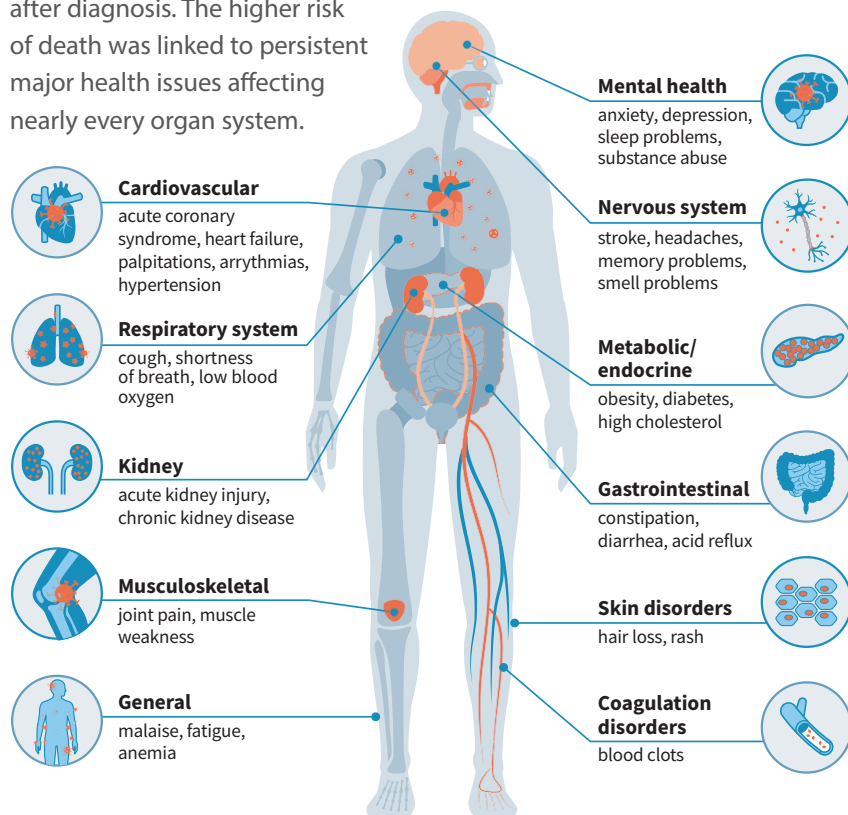
The long tail of COVID-19



Some people survive COVID-19 but don't fully recover for months, if at all. School of Medicine researchers are investigating why the effects of COVID-19 can linger long after the virus is gone.

Still at risk

Even people with mild cases of COVID-19 are at increased risk of death for months after the acute illness has passed, according to a study by Ziyad Al-Aly, MD, a kidney doctor who specializes in big data. By analyzing thousands of veterans' health records, Al-Aly found that COVID-19 survivors face nearly a 60% higher chance of death from all causes in the six months after diagnosis. The higher risk of death was linked to persistent major health issues affecting nearly every organ system.



SURVIVING BUT NOT THRIVING

A third of COVID-19 survivors seek care for a new medical condition in the aftermath of the disease, estimates data scientist Philip R.O. Payne, PhD, based on an ongoing analysis of new patient visits. Heart trouble is among the most common problems. A study by cardiologist Kory J. Lavine, MD, PhD, found that the virus that causes COVID-19 can infect heart muscle and destroy the muscle fibers responsible for contractions, possibly resulting in lasting damage.



GETTY IMAGES

The nose knows

A curious symptom of COVID-19 is loss of the sense of smell. Otolaryngologist Jay F. Piccirillo, MD, aims to restore people's sense of smell by retraining their brains via daily exposure to essential oils. "When we think about loss of smell, we probably think about the inability to appreciate cheese or coffee or wine," Piccirillo said. "But our patients' main concern is smelling smoke and natural gas. Their first concern is safety."



The vaccine race

With multiple COVID-19 vaccines available and the global vaccination effort underway, focus has shifted to understanding how well such vaccines work for special populations and creating better vaccines for current and future pandemics.

A needle-free vaccine

Cancer biologist David T. Curiel, MD, PhD, and Michael Diamond, MD, PhD, a virologist and immunologist, have created an inhaled COVID-19

vaccine that may reduce infection and transmission in addition to preventing severe illness and death. The vaccine is designed to fortify immune defenses in the nose, right where the virus is most likely to land. The vaccine sailed through animal testing and is now in clinical trials in people.



GETTY IMAGES

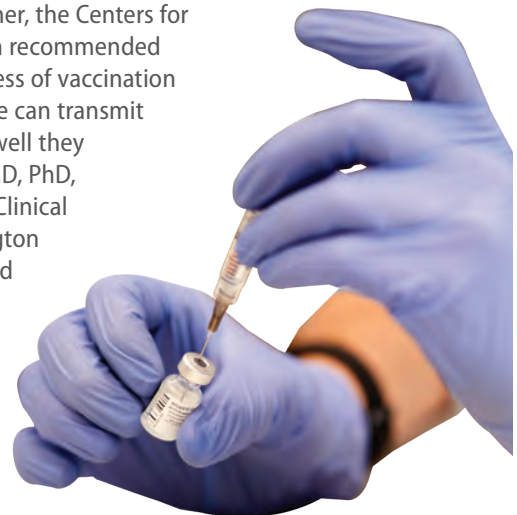
No one left behind

Pregnant women, breastfeeding mothers, and people with certain medical conditions were excluded from COVID-19 vaccine trials, so School of Medicine researchers are stepping up. Ob-gyn Jeannie C. Kelly, MD, found that vaccinated nursing mothers may pass

protective antibodies to their babies through breast milk. Rheumatologist Alfred Kim, MD, is evaluating COVID-19 vaccines in people taking immunosuppressive drugs such as the ones for arthritis and lupus.

DOES VACCINATION REDUCE TRANSMISSION?

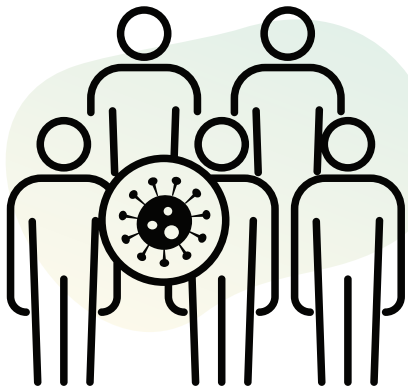
As COVID-19 resurged last summer, the Centers for Disease Control and Prevention recommended that everyone wear masks, regardless of vaccination status. "We know vaccinated people can transmit the virus, but we don't know how well they transmit it," said Rachel M. Presti, MD, PhD, director of the Infectious Diseases Clinical Research Unit. Presti is the Washington University site leader for the NIH-led PreventCOVIDU trial. The trial aims to measure transmission by vaccinated and unvaccinated people. Participants will fill out daily questionnaires, take daily nasal swabs over a four-month period, provide blood samples and undergo contact tracing.



MATT MILLER

Closing *the deal*

Bringing this virus to heel requires not just having effective vaccines but getting those vaccines into the people who still need them, monitoring how long immunity lasts, and tracking the spread of new virus variants.



Aiming for herd immunity

The St. Louis region is still far from herd immunity, and reaching the remaining unvaccinated people is challenging. Data scientist

Philip R.O. Payne, PhD, spent much of 2020 finding local hot spots of disease to track its spread. Now, he has turned his attention to finding cold spots of low vaccine uptake so distribution can be targeted to the communities most at need.

HOW LONG DOES IMMUNITY LAST?

The pandemic nightmare scenario was that COVID-19 immunity induced by disease or vaccination would fade quickly, making herd immunity impossible. Immunologist Ali H. Ellebedy, PhD, helped put those fears to rest. In a pair of papers, he showed that survivors of mild COVID-19 harbored antibody-producing cells nearly a year after infection. Most Pfizer vaccine recipients had laid the foundations for strong, lasting immune responses, even though certain high-risk populations may benefit from a booster after eight months.



Tracking a changeable foe

Virus variants are constantly emerging, and some may be resistant to COVID-19 drugs and vaccines. In a pair of papers, Michael S. Diamond, MD, PhD, showed that while antibodies that work against the original form of the virus tend to be less effective against variants, COVID-19 drugs made from combinations of two antibodies mostly retained effectiveness. "We will have to continue monitoring and be prepared to adjust our vaccines and antibody-based therapeutics if necessary," Diamond said.



The new normal

When the pandemic recedes, the world will be different. Telemedicine may be here to stay, and possibly masking in winter, too. And the racial inequities laid bare by the pandemic may spur a reassessment of biases in medicine and a move toward better health for all.

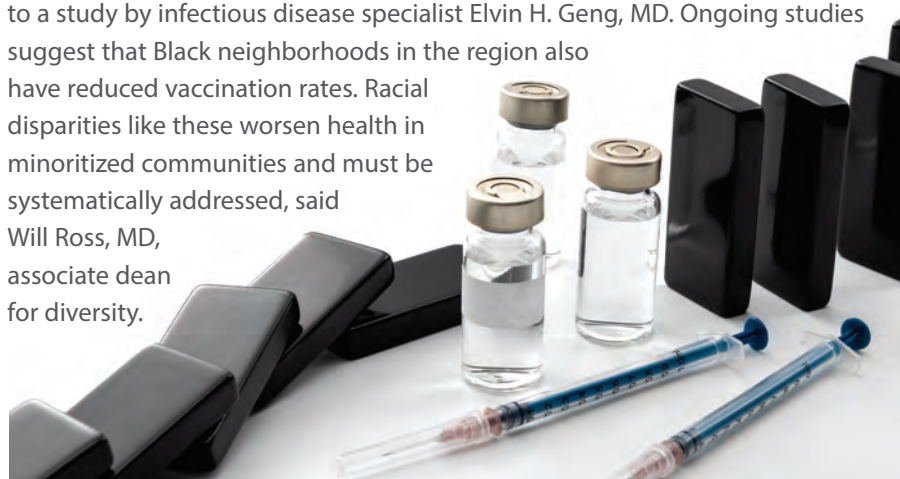


The doctor is home

The infrastructure for telepsychiatry was underutilized until the pandemic forced a rethinking of traditional practices. "One of the silver linings of the pandemic has been a wholesale conversion of outpatient mental health practice to telehealth," said child psychiatrist John N. Constantino, MD. "Most patients are very happy with telehealth, especially when necessary for safety or transportation barriers, and with increased efficiency we're actually delivering more mental health care than before."

Rooting out bias

Black neighborhoods in St. Louis received less COVID-19 testing in the spring and summer of 2020 despite higher hospitalization rates, according to a study by infectious disease specialist Elvin H. Geng, MD. Ongoing studies suggest that Black neighborhoods in the region also have reduced vaccination rates. Racial disparities like these worsen health in minoritized communities and must be systematically addressed, said Will Ross, MD, associate dean for diversity.



THE MASK STAYS ON

In-school COVID-19 transmission is rare as long as schools heed public health precautions such as mandatory masking, distancing and frequent hand-washing, according to a CDC study in Missouri and elsewhere.

"The study was done before vaccines were available, so it tells you that prevention strategies work," said pediatric infectious disease specialist Jason G. Newland, MD, who helped lead the Missouri arm. "Until we have universal vaccination, we can't stop masking. We need to continue doing what we did last year to protect children and adults in schools."





Inventive pathways

A research powerhouse becomes an innovation incubator

BY DEB PARKER

Moving innovations out of the so-called ivory tower and into the public domain holds enormous power to treat disease and improve quality of life.

But while academic researchers and physicians may imagine promising clinical solutions, some are unprepared to navigate commercialization: pitching themselves, attracting investors, wrangling with intellectual property law, designing rigorous proof-of-concept studies, locating a commercial space and hiring talent.

Taking an idea from the lab bench to market typically spans a decade.

Washington University is working to empower faculty inventors — paving pathways, clearing obstacles and dedicating significant resources to technology transfer.

At the School of Medicine, entrepreneurial momentum is surging. Leaders say the institution has only begun to realize its potential.

Star Steam
Generation

BioSTL in the Cortex Innovation District is a launch zone for WashU startups. Young businesses often start at a single lab bench in the innovation hub. As they grow, startups such as Arch Oncology (viewed on the second floor), move to larger spaces in the building.





The Office of Technology Management (OTM) entryway showcases WashU startups. In 2018, OTM began yearly events honoring patent awardees, startup founders and National Academy of Inventors inductees, including the “Celebration of Inventors” and “Welcome to the Wall.”

MATT MILLER



JENNIFER KORMAN PHOTOGRAPHY

(Left to right) Biomedical engineers Daniel W. Moran, PhD, and Matthew R. MacEwan, MD, PhD, and neurosurgeon Eric C. Leuthardt, MD, founded the startup OsteoVantage. Notably, Leuthardt is the most prolific WashU faculty inventor.

Undeniable impact

In hospitals worldwide, people depend on WashU technology to determine whether a loved one has experienced a heart attack. The gold standard test for heart attack detection originated nearly 35 years ago, when clinical chemist Jack H. Ladenson, PhD, and collaborators invented the first monoclonal antibodies to enable rapid, accurate diagnosis from a blood sample.

Ladenson’s work still forms the basis of such diagnostic tests, affecting many millions of people. It remains the No. 1 commercialization piece to emerge out of the university.

Today, other products developed at the medical school are revolutionizing health care. PrecivityAD, the first blood test for Alzheimer’s

disease, received FDA breakthrough device designation this year. Until now, clinical trial participation for many Alzheimer’s studies hinged on time-consuming, expensive brain scans. With the blood test, researchers could screen thousands of potential clinical trial participants per month. “This will help us find treatments faster, and could have an enormous impact on the cost of the disease as well as the human suffering that goes with it,” said product co-developer Randall J. Bateman, MD, the Charles F. and Joanne Knight Distinguished Professor of Neurology.

In the aftermath of stroke, many patients experience hand or arm paralysis. It’s long been assumed motor impairments are permanent at the six-month mark. Eric C. Leuthardt, MD, professor of neurosurgery and chief scientific officer at Neuroolutions Inc., is shattering those assumptions. The FDA granted market authorization for Neuroolutions’ IpsiHand Upper Extremity Rehabilitation System, a first-of-its-kind brain-computer interface technology licensed from the university. Stroke patients wear a robotic exoskeleton on their hand and wrist, allowing them to regain significant arm and hand function by using their minds. As new neural connections form, the device is no longer needed.

A university imperative

The medical school, a top-five National Institutes of Health (NIH)-funded powerhouse, spends nearly \$1 billion annually on research.

“Taking our research and getting it into the clinic is critical,” said David H. Perlmutter, MD, executive vice chancellor for medical affairs and the George and Carol Bauer Dean of the School of Medicine. “We believe in the idea that research can improve health outcomes, decrease health-care costs and improve the regional economy. Here, we’re talking about licensing technology, starting and attracting companies and employing people.

“We’ve had incredible success in understanding disease and advancing knowledge. Now we want to lead in commercializing our research.”

Chancellor Andrew D. Martin, PhD, tasked Perlmutter to expand tech transfer initiatives universitywide, as part of his executive vice chancellor role. In August, the university appointed Dedric Carter, PhD, as its first vice chancellor for innovation and chief commercialization officer. “Dedric will have a singular focus of leading our effort to create greater impact through commercialization,” Perlmutter said.

Carter, who joined WashU in 2014, has overseen several operational areas, including food service, parking, summer programs and environmental safety, along with the Office of Technology Management (OTM) and technology transfer functions. Carter’s national reputation in translating research to new ventures extends from his time at MIT and launching the National Science Foundation I-Corps. He also is a key university liaison to the Cortex Innovation Community, a 200-acre business and technology hub that sits along the medical school’s eastern border. WashU and BJC HealthCare have taken leading roles in developing this formerly blighted area into a nationally known innovation district. OTM sits prominently in the district’s @4240 Building.

Carter said he was hired seven years ago with the understanding that WashU was seeking to dramatically grow its commercialization activity. “Seven years ago, we were launching three or four startup companies a year. We have reached a high point of seven, and there’s more room to grow, given the substantial research base that we have at WashU,” Carter said. “We realized we’ve come a long way, but future opportunities are significant.

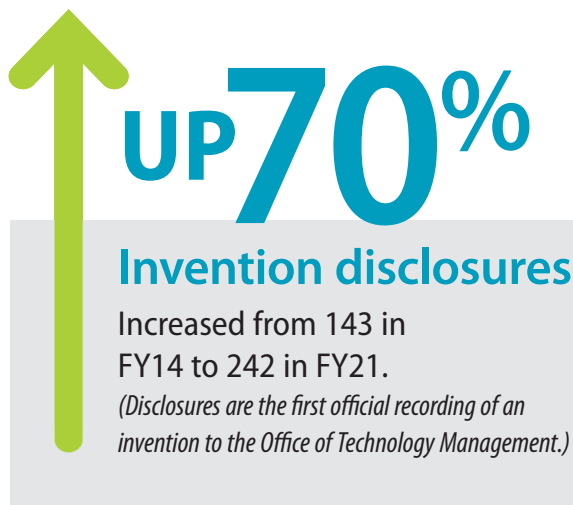
“Our goal is to help people understand that both knowledge for knowledge’s sake and knowledge that moves to a deeper impact on the human condition are both really important in an academic environment,” he added. “We can do a lot of good by thinking about how to commercialize, protect and move some of these research outcomes from the laboratory to life.”

WashU is making substantial investments around technology transfer, with more to come. In addition to its Cortex development efforts, WashU has expanded the budget, staffing level and expertise of OTM, which ushers innovators through the tech transfer process, and increased gap funding dollars for faculty. While government funding or foundation grants cover early-stage science research, university gap funding often covers the rigorous proof-of-concept experiments or feasibility studies needed to attract financial partners and move to subsequent stages.

In his first 90 days, Carter plans to listen closely as he meets with faculty, staff, students and others involved in commercialization. He’s exploring what the university has done historically in tech transfer, evaluating resources available to innovators and determining what additional support is needed.

WashU is using new methods to move potential assets, especially drug candidates, Perlmutter said. These include forming a board of U.S. pharmaceutical leaders, venture capitalists and entrepreneurs to advise the university on tech transfer strategies and investing significantly in the Center for Drug Discovery, which will expand its role and enter labs to help identify early drug targets.

Additionally, some aspects of commercialization are being outsourced to contract research organizations (CROs), which provide expert guidance in biopharmaceutical and assay development, preclinical and clinical research and clinical trials management. This may be a new arrangement for faculty members, Perlmutter said, but it allows the university to focus on finding therapeutics and moving assets forward without needing to hire specialized labor. CROs, for example, are set up to perform experiments over



and over, with exact operating procedures to ensure results can be replicated.

The many efforts are paying off. Fiscal year 2020-21 was a record-breaker for WashU tech transfer, marking the seventh year of continuous growth.

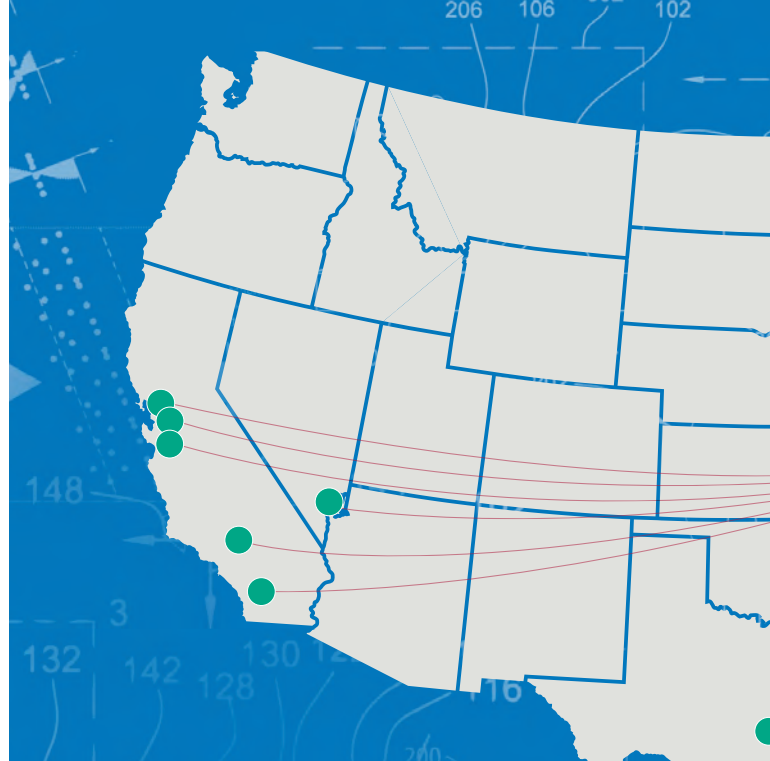
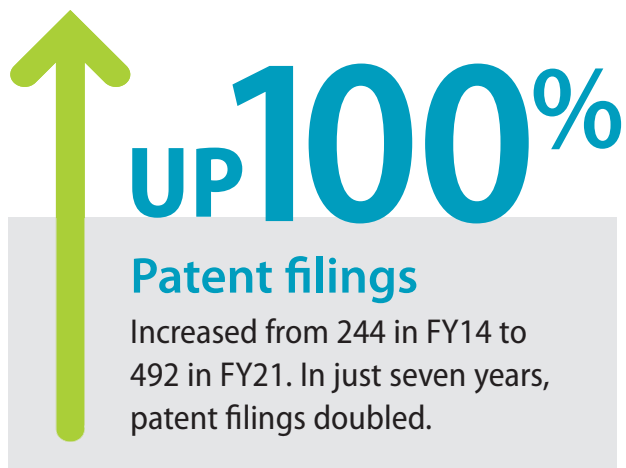
In the midst of the pandemic, faculty researchers rapidly devised tools to address the virus. Among other breakthroughs, Michael Diamond, MD, PhD, the Herbert S. Gasser Professor of Medicine, and David T. Curiel, MD, PhD, professor of radiation oncology, worked to develop a COVID-19 nasal vaccine. India-based Bharat Biotech licensed the technology from the university for further development and, now, the vaccine is in phase 2 trials.

Also, a research team at the Elizabeth H. and James S. McDonnell III Genome Institute and the Department of Genetics developed a saliva test for COVID-19 in collaboration with South San Francisco-based life sciences company Fluidigm. This effort expanded and simplified testing capacity. Richard D. Head, director of the Genome Technology Access Center, and Jeffrey D. Milbrandt, MD, PhD, executive director of the McDonnell Genome Institute, led the team.

WashU innovators this past year submitted 242 invention disclosures (first official recording of an invention to OTM), filed 492 patents and signed 149 revenue-generating license agreements. In these agreements, WashU grants intellectual property rights to a third party, either an established company or startup, for development, and the licensee makes financial payments to WashU. The university in FY20-21 earned \$60 million in royalties and licensing agreements.

Revenue is shared with inventors and distributed to schools, departments and central administration to support research, education and tech transfer initiatives. With licensing fees from the heart attack test, Ladenson helped establish two undergraduate scholarships and three endowed professorships at the medical school.

In the last five years, 81% of WashU inventions involved medical school participation; 71% came exclusively from the medical school.



A track record of success

WashU innovators have commercialized **35 products** and launched **76 startups** across the U.S. in recent years. Here are some examples.



ACERA SURGICAL

Bioscience company with three FDA-cleared products utilizing resorbable synthetic hybrid-scale fiber matrices to improve wound healing and soft-tissue repair.



ARCH ONCOLOGY

Developing biologic therapeutics to treat patients living with cancer.



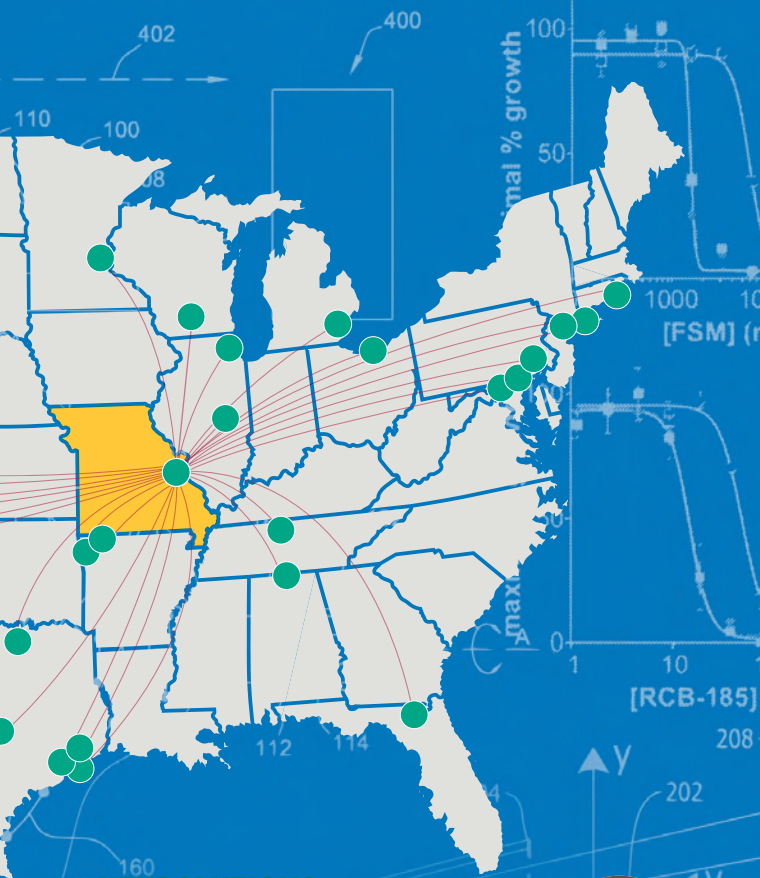
C2N DIAGNOSTICS

Launched PrecivityAD, the first blood-based Alzheimer's disease diagnostic. In clinical trials.



DISARM THERAPEUTICS

Creating a new class of disease-modifying therapeutics for patients with axonal degeneration; acquired by Eli Lilly.



NEUROLUTIONS

Invented a brain-computer interface to enable stroke patients to move their hands. FDA has granted de novo market authorization.



NOUS IMAGING

Software solution provides real-time monitoring and biofeedback technology addressing the significant problem of patient motion during brain magnetic resonance imaging. In clinical trials and has achieved FDA 510K approval.



PRECISION VIROLOGICS

This St. Louis biotech startup develops adenovirus-based vaccines. The company has worked to develop vaccines against Zika and other viruses.



SENTIAR

Created a 3D augmented-reality platform with holographic visualization of patient anatomy. In clinical trials and has achieved FDA 510K approval.



WUGEN

Deploying memory natural killer cells and CAR-T cells against cancer. In clinical trials.



To a certain extent, Perlmutter said, this uptick is a maturing realization of the bipartisan 1980 Bayh-Dole Act, which helped launch academic tech transfer offices. The act gave universities ownership rights to federally funded discoveries, but obligated them to protect and commercialize the discoveries and report progress. A 2018 Return on Investment Initiative deemed the legislation successful in driving academic innovation.

“Science is being questioned right now, and universities have a story to tell about how research impacts everyday life through tangible products,” said Nichole R. Mercier, PhD, assistant vice chancellor and managing director of OTM. “Faculty members also are understanding that the funding landscape outside the university is changing, with government funding agencies’ expectations that research be commercialized.”

Mercier often fields tech-transfer questions from prospective faculty hires. “People want to know they can commercialize their work at WashU. Innovation at WashU is a selling point,” she said.

Carter agreed: “We see more and more junior faculty come in who are very engaged on commercialization topics. Questions about licensing and royalty streams are common comparison points with other institutions as they are perhaps thinking about taking a position.”

Breaking down barriers

While some faculty members are enthusiastic about commercialization, others may have no idea where to begin. OTM has refined its operation to make tech transfer accessible to faculty who are balancing multiple time pressures. “The process can be daunting, and we tell people that it doesn’t have to be — and that we’re willing to spend as much time with you as needed to lower the barriers,” Mercier said.

Nearly 30 OTM staff members work to evaluate promising technologies and guide innovators in licensing intellectual property, filing patents, finding funding and launching startups.

A global network of experts recruited by OTM is available to provide direct feedback on ideas. These are potential investors, serial entrepreneurs, people with deep industry expertise — some are alumni — who understand how to get products on the market, and who have agreed to sit down with innovators and answer questions in real time.

Faculty hear firsthand the rationale behind the decision. “We’re educating in the process,” Mercier said. “I understand you think this idea can do x, y and z. But here are the limitations on x and y, so if you focus on z, I think we have something. Can you get more data on z? And that’s a decision point for a faculty member. It’s about creating this as a partnership.”



Pediatric electrophysiologist Jennifer N. Silva, MD (above), and her husband, biomedical engineer Jonathan R. Silva, PhD, developed technology that helps doctors see real-time 3D holograms of the heart during procedures to fix erratic heart rhythms.

Engaging female entrepreneurs

WashU OTM has been recognized for innovative programs addressing the national disparity of female inventors. The office hosts Equalize, a first-in-class pitch competition for academic women entrepreneurs in the U.S., and sponsors Women in Innovation in Technology, an internal program that teaches how to move from basic research to product commercialization.

In 2013, when the office began developing programs geared toward women, WashU had launched 55 startups — all led by men. Now, females have founded three WashU startups and are equally represented on invention disclosures.

Hong Chen, PhD, associate professor of radiation oncology and of biomedical engineering, is working to launch a startup, called Sonobiopsy, which she pitched at Equalize 2021. Chen's technology allows genetic diagnosis of brain tumors through a simple blood draw following focused ultrasound sonification. Sonification enhances release of brain tumor biomarkers into the bloodstream. Existing surgical biopsy procedures carry risks and aren't always possible, depending on location. The promising technology may improve survival outcomes.

"Perhaps the most important thing OTM has done is to include us in the process and teach us," said pediatric electrophysiologist Jennifer N. Silva, MD, who invented a 3D augmented-reality platform. "I can touch a million patients this way."

Biomedical engineer Matthew R. MacEwan, MD, PhD, has started multiple companies based on his prior work in biomedical engineering. While a graduate student at the medical school, he founded Acera Surgical and developed, in conjunction with WashU neurosurgeons, the first FDA-approved nanofabricated surgical material, Cerafix Dura Substitute. The engineered synthetic material is used to seal and heal defects in the membrane around the brain and spinal cord incurred during routine neurosurgical procedures.

OTM introduced MacEwan to investors and mentors who assisted in crafting the vision for the company and the technology. Through these interactions, MacEwan developed other products, including Restrata Wound Matrix. The regenerative material has helped patients recover from chronic wounds and injuries, including one man who had endured an open leg wound for more than a year following reconstructive surgery for head and neck cancer.

The St. Louis ecosystem

It takes a village to recognize nascent science and get it out into the world. One of the university's largest Cortex collaborators is BioSTL, a nonprofit organization whose mission is to cultivate bioscience companies. WashU purchased and renovated the former St. Louis Post-Dispatch printing plant at 4340 Duncan Ave. that now houses BioSTL and its office and lab space called BioGenerator Labs. The medical school also provides \$1.5 million yearly to support the organization.

This 80,000-square-foot incubator provides affordable space and shared specialty equipment, allowing startups to thrive. "Prior to this, St. Louis had very little in place to help products emerging from research institutions," said BioGenerator President Eric Gulve. "If you're thinking about a drug to treat disease, you need access to labs and to people who know how to run a company. The average university professor doesn't have that skill set."

BioSTL and BioGenerator Ventures, its investment arm, often provide the crucial first money into a potential startup.

At BioSTL, entrepreneurs also can find mentors, grant-writing support and hiring assistance. "We take PhDs and MDs from WashU and give them a crash course in MBA," said Maggie Crane, BioSTL communications director.

As research advances, the startup can expand from a single employee to hundreds. WashU startups, such as Arch Oncology and WUGEN, have relocated to larger spaces within the building — keeping their tech and jobs in St. Louis.

The university is particularly interested in attracting businesses to St. Louis. “Our home runs are things like we’ve done with Vir Biotechnology,” Perlmutter said. Longtime medical school faculty member Herbert “Skip” Virgin, MD, PhD, was recruited in 2018 as executive vice president, research and science officer at Vir in San Francisco. Now, the company is basing part of its operation in Cortex. “It is a win for Vir because they have a great pool of talent in the region to draw from and it connects them to WashU,” said J. Gregory Barrett, associate vice chancellor of strategic external projects and outreach on the Medical Campus. “For us, it’s great because it brings a major biotech company to St. Louis and is an example for others who might want to make similar moves.”

WashU is continuing to broaden its net, cultivating national and international industry partners. The goal for most startups is to get bought or, in limited cases, to acquire other companies. This way, faculty can stay involved, turn the business operation over to experts, get discoveries out into the world and pursue other initiatives.

Last year, pharmaceutical giant Eli Lilly and Co. purchased Disarm Therapeutics, a biotechnology startup founded by WashU researchers Jeffrey Milbrandt and Aaron DiAntonio, MD, PhD, to speed the development of treatments for neurodegenerative conditions. Lilly paid \$135 million upfront.

“Disarm Therapeutics had reached the point in the drug development process where we either needed to raise much more funding ourselves or work with a pharmaceutical company with the infrastructure in place to take this technology to the next level,” said Milbrandt, the James S. McDonnell Professor and head of the Department of Genetics.

Up until 20 years ago, large pharma companies led U.S. drug research and development. But pharma companies merged, the industry contracted, and universities took over most early-stage drug discovery.

“Sometimes we have preliminary validation of a lead molecule, but it can be too early for a pharma company to come in because there is still too much uncertainty,” Mercier said. “Startups are a very important piece of a university’s ability to



UP 100%

Revenue-generating agreements

Increased from 48 agreements in FY14 to 149 in FY21.

(WashU grants intellectual property rights to a third party for development, and the licensee makes financial payments to WashU.)

get ‘shots on goal,’ to get partnerships that lead to bigger partnerships.”

In another ongoing collaboration, Sun Pharma Advanced Research Company (SPARC), based in Mumbai, India, secures licensing for WashU-identified small-molecule drug candidates and biologics. It funds preclinical research at WashU and validates the work at its facilities, in compliance with regulatory guidelines, and shares intellectual property with the university. This arrangement gives partners a peek at promising assets and, ultimately, moves the research from lab to clinic.

A cultural shift

Perlmutter is encouraging department and division leaders to watch for commercial potential. “One of the problems we have is how do we find out what’s going on in our 700 laboratories? And how do we get to it early and accelerate it?” he said.

To nurture a culture of entrepreneurship, tech transfer activity should be woven into the promotion and tenure process, Perlmutter said. Faculty typically are awarded tenure and promotion based on research grants and publications, not patents, startups or licensing revenue. Commercialization efforts should be appropriately honored, he noted.

Many faculty already are embracing the shift. “Great faculty have been driving success,” he said.

Mercier agreed. “Our metrics aren’t slowing down. They didn’t slow down in COVID-19. And now with labs reopening, they are just going gangbusters.

“The fire is burning here at WashU.” □



Bridging the COVID-19 funding gap

Donors and faculty members
come together to advance
critical research

BY MARY LEE

In ordinary times, scientists and physicians spend months, or even years, working to secure funding for their research. When the novel coronavirus burst into world consciousness in early 2020 and rapidly became a global health concern, that timetable became untenable. By spring, School of Medicine investigators had quickly shifted gears to mount a coordinated response to the crisis. They needed an immediate infusion of capital to advance efforts that could save hundreds of thousands of lives.



Sean P. J. Whelan, PhD (right), and postdoctoral fellow Zhuoming Liu, PhD.

MATT MILLER

To secure this capital, Chancellor Andrew D. Martin and Executive Vice Chancellor for Medical Affairs David H. Perlmutter, MD, formulated a bold plan: They would convene a group of dedicated supporters and community leaders, bring them together with experts leading the medical school’s pandemic response and invite them to invest in the work.

The group, dubbed the Coronavirus Research Task Force, had its first meeting April 16. Within days, members committed \$2.5 million in seed funding. After additional meetings were held throughout the summer, the total climbed to \$4 million.

“These leaders’ generosity and confidence in our capacity to advance countermeasures against a serious infectious disease gave us a critical boost,” said Perlmutter, the George and Carol Bauer Dean of the School of Medicine. “Few academic medical centers in the country can count on such enthusiastic support.”

Here, Andrew M. Bursky, a university trustee who made two gifts to support COVID-19 research, and virologist Sean P. J. Whelan, PhD, the Marvin A. Brennecke Distinguished Professor of Microbiology, discuss their involvement with this unique funding mechanism — and its impact in the pandemic fight.

Can you describe your thoughts and experiences in the early days of the pandemic?

Whelan: When I arrived in St. Louis on Jan. 4, 2020, to begin my tenure as head of the Department of Molecular Microbiology, I planned to focus on recruiting new faculty members. I’d heard a little bit about SARS-CoV-2 in the news, and I thought it had real potential to be something concerning. Very early on, I met with Mike Diamond (WashU virologist and the Herbert S. Gasser Professor of Medicine), and we discussed our interest in investigating the virus. We started having weekly meetings with faculty members who were working with COVID — people from all over the university. It was a way for information to be rapidly exchanged among different groups. At the time, my lab was in the process of moving here. It finally arrived during the first week of March, and by then, we knew the virus was widespread and could not be contained through public health measures alone.

Bursky: When the country started shutting down in March 2020, it was an instantaneous shock. Suddenly, the world changed almost beyond recognition. It was destabilizing. My work as chairman of an equity investment firm involves identifying and fixing businesses that have lost their way. So in a weird way, I was accustomed to being in destabilized environments. That said, the pandemic affected all of us personally. We shared the real human fear that something terrible could happen to people we cared about.

What obstacles did WashU researchers face in securing funding to conduct COVID-19 research?

Whelan: In the beginning, most of us were working without financial support. Fortunately, WashU had given me some funds for my lab as part of my recruitment package. I used that and some departmental resources to outfit a Biosafety Level-3 containment laboratory by the end of January. And that was the only place anyone was working with the virus for a while. We were trying to get federal grants to support COVID-19 research at the medical school. But obtaining funding from



Andrew M. and Jane M. Bursky



MATT MILLER

A research team examines cellular assays as part of COVID-19 vaccine efforts. (Left to right) visiting researcher Michael A. Tartell, instructor Louis-Marie Bloyet, PhD, visiting researcher Paul W. Rothlauf and Sean P. J. Whelan, PhD.

the National Institutes of Health (NIH) is a slow process. It takes months. In fact, I was notified that I received my first COVID-19 grant more than a year into the pandemic.

What did you think about the idea of convening a task force to solicit funding from donors?

Bursky: When I heard about the plan from Chancellor Martin and Dean Perlmutter, I was excited to participate. And I thought there were many others like me who would be eager to join. When you fund medical research, as my wife, Jane, and I have done for many years at Washington University and elsewhere, you resign yourself to the fact that it may take a decade to see results. With this COVID-19 research, it was exhilarating and encouraging to think it could have an immediate impact.

Whelan: It was exhilarating and encouraging for me as a scientist, too. In the task force meetings, my colleagues and I were able to interact directly with people who'd been successful in the business world, and they didn't want to deal with the level of bureaucracy that is associated with the grant-funding process. They wanted to know, "How do we get something done now?" It was impressive to see these business leaders and donors come together so quickly and recognize the importance of our research.

How did the seed funding from donors change the way researchers approached their work?

Whelan: It allowed us to focus on science instead of applying for grants. Their support was incredibly valuable to my lab and to many other labs in the WUSM community, such as those led by Mike Diamond, Daved Fremont, Ali Ellebedy, Rachel Presti, Jeff Milbrandt (McDonnell Genome Institute) and Debbie Lenschow. It helped us advance two vaccine candidates, one of which is now in clinical trials, an early mouse model to study infection, and a Biosafety Level-2 high-throughput assay to investigate neutralizing antibodies against SARS-CoV-2. Funds also were allocated to support the development of therapeutic monoclonal antibodies and a rapid COVID-19 saliva test that played an important role in combating the pandemic at the university and in our community. All of this work and more was happening simultaneously last summer.

Were you surprised that task force members provided a significant amount of funding so quickly?

Whelan: I was at the time. But looking back, I'm less surprised. It was clear the potential impact of the pandemic was huge. During one of the group's meetings, we discussed the financial costs, how much money was being lost every day because of the effects on the economy. I remember one task force member said that if we didn't have immediate action, there wouldn't be an economy.

Bursky: It wasn't surprising to me. All the task force members are familiar with the intellectual horsepower of our medical school faculty. And we were excited to hear what they were focusing on. The breadth of it, from testing to therapeutics to vaccines, was very encouraging. It was a privilege to be able to participate in something like this. And I don't think our contributions are unique. We represent a small subset of a very large group of folks who for many years have given to this institution. I suspect I speak for all task force members when I say it was rewarding for us to have had an impact, in some small way, through the talent and genius of these researchers.

How unusual is it for an academic medical school to ask investors to fund research this way?

Whelan: To have people committed and engaged and willing to fund the science you are doing in real time — that's never happened to me before in my career.

Bursky: I think it was the only way to approach it. And I give David Perlmutter and Andrew Martin credit for having that insight. It was an act of courage for them to step out and ask for multiple millions of dollars with nothing more than some good ideas and preliminary data. But the truth is, it wasn't that difficult to get to yes. My peers and

I are accustomed to investing in the person, the entrepreneur, as much as the idea. And that's exactly what happened here, at least for me. I have such a high regard for these researchers, just as I have for the people I invest in on the commercial side. You bet on proven talent that has historically delivered the goods. And in this case, I don't think anyone was disappointed with the outcome.

What is it about Washington University that makes it possible for people to come together to address our world's greatest challenges?

Bursky: A key WashU characteristic, which I think had an impact on the success of these COVID efforts, is the ingrained, almost genetically programmed, collaborative nature of the institution. People here are wired to collaborate.

Whelan: The very first paper that came out of my lab after I moved to WashU, which describes a virus we generated and our Biosafety Level-2 assay that mimicked the neutralization of COVID, involved seven principal investigators here. And it was published in June 2020. The speed with which it came together reflects a tremendous amount of cooperative effort. The collaboration really is unparalleled. And I think it's a testament to this community.

Coronavirus Research Task Force members

Andrew M. Bursky*
Alumnus, trustee

Sam Fox*
Alumnus, emeritus trustee

David W. Kemper*
Distinguished trustee

James S. McDonnell III*
School of Medicine
National Council member

John F. McDonnell*
Alumnus, emeritus trustee

Jim McKelvey*
Alumnus, trustee

Philip Needleman, PhD*
Former faculty member,
emeritus trustee,
School of Medicine
National Council member

Michael Neidorff*

Andrew E. Newman*
Distinguished trustee,
School of Medicine
National Council member

Mike Powell
Trustee

Rodger O. Riney
School of Medicine
National Council member

Jim Weddle
Alumnus

Jess Yawitz, PhD*
Alumnus, former
faculty member

*Donors

Faculty presenters

Michael S. Diamond, MD, PhD
Herbert S. Gasser Professor

Ali Ellebedy, PhD
Associate professor of
pathology & immunology,
of medicine and of molecular
microbiology

Jeffrey D. Milbrandt, MD, PhD
James S. McDonnell Professor
of Genetics, head of genetics

William G. Powderly, MD
Dr. J. William Campbell
Professor of Medicine,
Larry J. Shapiro Director of
the Institute for Public Health

Rachel M. Presti, MD, PhD
Associate professor of medicine

Sean P. J. Whelan, PhD
Marvin A. Brennecke
Distinguished Professor of
Microbiology, head of
molecular microbiology

Achieving remarkable results

Task force donations supporting faculty research yield important COVID-19 breakthroughs.



MOUSE MODEL

Replicates human illness, accelerates testing of treatments and preventives



NASAL VACCINE

Produces a more widespread immune response than intramuscular injection



LAB-MADE VIRUS

Mimics COVID-19 virus; safer to handle; critical in search for drugs and vaccines



VACCINE TRIALS

Evaluates effectiveness by enrolling thousands of St. Louis participants



SALIVA TEST

Enables testing on a massive scale; faster and simpler than a nasal swab

1960s



Michael Pacin, LA '65, MD '69, has completely retired from the practice of allergy and immunology. He sold the practice he founded, which became the largest allergy

practice in Florida. His wife, Amy Ronner, is a law professor emeritus who recently published her sixth book, "Dostoevsky as Suicidologist: Self-Destruction and the Creative Process," available on Amazon.



Alan Peterson, DE '84, captain in the U.S. Public Health Service, is the chief dental officer for the Department of Justice, Federal Bureau of Prisons, at the Atlanta Federal Penitentiary in Georgia. Peterson provides oversight and treatment for the dental health of more than 2,300 resident inmates and more than 100,000 transient inmates. Peterson also was a member of the Dental Identification Unit that identified the casualties of the 9/11 terrorist attack in New York. For the past 20 years, he has served as a volunteer dentist for Zoo Atlanta, where he provides dental services to the animals. Peterson and his wife, Marshalita Sims Peterson, PhD, are firm supporters of global humanitarian aid. Through international initiatives, Peterson operates a Dental Clinic in Salala, Liberia (West Africa). He has provided this dental service to residents of Liberia (Lower Bong County) for the past 11 years.

1970s

Ruth Rose-Jacobs, PT '73, recently was promoted to clinical professor of pediatrics at Boston University School of Medicine and Boston Medical Center. Her research, teaching and clinical practice has centered on families with young children, their development, and factors associated with material hardships, maternal substance use and exposure to violence. Rose-Jacobs has been married to Jerry Jacobs for 47 years. They live in Boston and have three adult children. She would love to hear from classmates!

Paul Golden, MD '74, HS '74, retired in 2013 after 35 years of nephrology practice in Modesto, Calif. Since retirement, he has written books on bipolar and major depressive disorders and has been active in mental illness advocacy. He and his wife, Sue, enjoy spending time with their toy poodles. He encourages everyone to stay safe and get vaccinated.

Tom Harbin, MD, HS '75, MBA, recently published a book, titled "Practical Ethics in Ophthalmology." He retired from Eye Consultants of Atlanta and is vice chair of the Georgia Composite Medical Board.

H. Brent Clark, MD '78, PhD '78, recently became professor emeritus of laboratory medicine and pathology after 30 years of directing the Neuropathology Laboratory at the University of Minnesota Medical

School, Twin Cities. He continues to teach, collaborate on research and perform service work.

1980s

Ethan Cruvant, MD '84, has remained voluntarily out of work (some might call it retirement) for two years. He celebrated receiving his COVID-19 vaccination by hobnobbing in Chicago with MD '84 classmates **Joe Kent, George Hvostik, Howard Rowley** and **Eric Suba**.

Michael Kolodziej, LA '80, MD '84, HS '85, joined the Board of Directors of the LUNGevity Foundation, the nation's premier lung cancer-focused nonprofit organization. In his role at ADVI Health, Kolodziej provides support for innovative alternative payment programs, including the Oncology Care Model and private-payer initiatives, on behalf of life science, payer and provider organizations worldwide.

Heather Gantzer, MD '85, completed a term as chair of the Board of Regents of the American College of Physicians in May 2021. "It was a privilege to serve my fellow internists in their work in this past year of the pandemic," she said.

Sherrie Perkins, MD '85, HS '87, retired in April 2021 as CEO of ARUP Laboratories in Salt Lake City. Perkins, a hematopathologist and an internationally known expert in pediatric lymphoma, joined ARUP in 1990



The American Academy of Dermatology honored Massachusetts dermatologist **Louis Kuchnir, MD '97, PhD**, as a Patient Care Hero for establishing a COVID-19 vaccination site in Marlborough, Mass., for school nurses early in the vaccine rollout when vaccines were in short supply.

After receiving more COVID-19 vaccinations than his dermatology staff needed, Kuchnir acted quickly to ensure the vaccines were used by public health professionals, which was a state mandate at

that time. Coordinating with local superintendents, Kuchnir organized a vaccination site at his dermatology office to make the vaccine available for school nurses from eight districts who were eligible in Phase 1A of the state's distribution plan.

"School nurses found it difficult to receive the COVID-19 vaccines needed to do our critical work safely," said Julia McCoskery, a nurse for Westborough Public Schools who received her vaccination at Kuchnir's vaccination site. "I am grateful to Dr. Kuchnir for donating his time, clinic and extra vaccines to ensure school nurses can continue keeping our communities healthy."

as a fellow and became CEO in 2017. She has held numerous leadership roles at ARUP and at the University of Utah Department of Pathology. In addition, she has a record of countless other accomplishments as a clinician, researcher and educator.

John Blaich, DE '86, recently was featured in the Biolase Advancing Dentistry newsletter for his work on laser infant frenuloplasty for latch enhancement. Through development of this simple laser procedure, mother and infant nursing is improved. This procedure allows patients to visit their local family dentist, saving many, particularly those in rural areas, a trip to the hospital in a major city, medical expenses, time off and stress. Blaich practices at Dental Arts Group in Poplar Bluff, Mo.

Jeff Bennie, MD '87, HS '91, is medical director of Chikondi Health in Malawi. Chikondi is a rural health system based at Blessings Hospital, which sees about 60,000 patient visits per year.



Regina Nouhan, MD '87, HS '91, has started an educational podcast, after retiring from plastic surgery practice in 2020. "Plastic Surgery Decoded" uses clear and relatable explanations to inform the public about this wonderful field. It is available on most podcast platforms, or through PlasticSurgeryDecoded.com.

1990s



Sara Grethlein, EN '84, MD, HS '94, MBA, FACP, earned a master's degree in business administration in 2020 from the Kelley School of Business at Indiana University. She

recently became executive medical director of the Swedish Cancer Institute in Seattle.



School of Medicine 2019 graduates Michael Senter-Zapata MD, and Anastasia (Tasha) Evanoff, MD, said "I do" during a socially distant April 18, 2020, wedding. The three-person wedding, including officiant Hari Raman, MD, also a School of Medicine graduate, took place on the steps of Harvard University's Memorial Church and was followed by a Zoom wedding reception.

The bride, Evanoff, is a psychiatry resident at Massachusetts General Hospital. She is the daughter of Bradley A. Evanoff, MD '86, MPH, and Laura J. Bierut, MD '87, both faculty members at the School of Medicine. The groom, Senter-Zapata, and the officiant, Raman, are internal medicine residents at Brigham & Women's Hospital in Boston.

During the virtual wedding reception, the couple's parents and members of the bridal party delivered their toasts over Zoom. Following a short "staycation" at home in Boston, the couple returned to the hospital wards, both to inpatient COVID-19 units.

Michael Raney, MD '94, was elected president of the Missouri Radiological Society for 2021.

Michael Finley, PhD '98, was promoted in March 2021 to scientific director, lead evaluation and cellular pharmacology at Janssen Research and Development, where he has worked in small-molecule drug discovery since October 2016. Along with colleagues, he received the Hofmann Award in May 2020 for the identification of novel inflammasome inhibitors. It is the second-highest award within Janssen R&D.

Amanda Heidemann, MD '99, recently was named chief medical informatics officer for QliqSOFT, which provides patient engagement solutions to hospitals and health systems. Specializing in clinical workflow automation, she enjoys trying to make things easier for physicians and patients alike, while checking all the regulatory boxes. She lives in St. Louis and is active in scouting with her two Eagle Scouts.

2000s



Stephanie Baker, LA '00, MSPT '02, PhD, recently was promoted to associate professor of public health studies with tenure at Elon University. She and a colleague also launched

the Health Equity & Racism (H.E.R.) Lab. Website: herlab.org.

Adam Wende, PhD '06, is excited to announce the publication of a new study from his laboratory that has identified an association between race, socioeconomic status, epigenetics (i.e. DNA methylation) and heart failure outcomes. This study was published in *AJP-Heart and Circulatory Physiology* (doi.org/10.1152/ajpheart.00036.2021) with an accompanying editorial from another group (doi.org/10.1152/ajpheart.00186.2021). Wende hopes that this is just the first study of many in this exciting new area of research for the lab.

2010s

Kelly Chaplin, LA '08, DPT '11, started a full-time women's health position at Northwestern Memorial Hospital. She also specializes in oncology and lymphedema. Chaplin and her husband, Matt Chaplin, EN '09, MBA '09, welcomed their third daughter in January 2020.



Keith Jacobs, PhD '15, and **Gina Castelvechi, PhD '20**, both graduates of the Division of Biology & Biomedical Sciences, are happy to announce they became engaged March 7, 2021.

They reside in Washington, D.C., and are planning to get married in October 2022.



Heather (Annis) Linkugel, OT '15, and **Andrew, MD '17, Linkugel** welcomed their first child, Haley Anne Linkugel, in July 2021.



Laura Bliss, MD '17, and **Chetan Vakkalagadda, LA '13, MD '17**, were married April 24, 2021. The couple had a traditional Hindu ceremony followed by a civil ceremony, both at

Vakkalagadda's family's home in San Jose, Calif., with only immediate families in attendance.



Nicholas Jarjour, PhD '19, has been named a Damon Runyon Cancer Research Foundation Fellow. This award will support his work with sponsor

Stephen Jameson, PhD, at the University of Minnesota, Minneapolis, on memory CD8+ T cell proliferation and therapeutic manipulation of this process in vaccination and immunotherapy.



Regina Abel, PhD, instructor in occupational therapy and in medicine at the School of Medicine, died Tuesday, June 15, 2021, in St. Louis, following a heart attack. She was 70.

Abel was fascinated by the interaction between animals and humans and how this facilitated rehabilitation and education. She often was seen with Dolly and Wally, therapy dogs she trained, on her way to teaching students how to help pediatric patients maximize their recovery.

Her research focused on the benefits of therapy dogs in pediatric patient recovery and the impact of dog training programs in prisons. She also was interested in how animal-human interaction could help children with chronic conditions.

"Regina was the kindest soul around and had a love of animals, especially dogs," said Lisa Tabor Connor, PhD, associate dean and director of the Program in Occupational Therapy. "She was instrumental in developing a program of animal-assisted therapy and mentored many of our students in projects on this topic. We will miss her immensely, both as a person who was beloved by all and as a valuable member of our OT team."

She is survived by two sons, Travis Abel and Bryan Hobbs; her sister, Trudy Stewart; and 12 grandchildren. Her daughter, Sheila King, preceded her in death in 2016.



Lawrence A. Coben, MD, emeritus associate professor of neurology, who with his colleagues at the School of Medicine developed a widely used scale that characterizes and tracks impairment in dementia patients, died of cancer Wednesday, Oct. 7, 2020, in Dedham, Mass. He was 94.

Coben retired in 1991. He first arrived at the School of Medicine in 1954 as an intern in neurology. He completed his internship, residency and a fellowship at the school before joining the neurology faculty in 1961. Initially, he specialized in sleep disorders and directed the electroencephalogram (EEG) lab at Barnes Hospital, now Barnes-Jewish Hospital.

He soon turned to Alzheimer's disease. In 1979, he helped establish the Memory and Aging Project, one of the earliest studies of what was then known as senile dementia. The project is ongoing at Washington University's Knight Alzheimer's Disease Research Center (ADRC). With colleagues, including Leonard Berg, MD, the founder of the Knight ADRC, Coben helped develop the Clinical Dementia Rating Scale, which remains widely used by neurologists as a tool to measure dementia patients' levels of impairment.



Luis Glaser, PhD, a beloved mentor and former head of the then-Department of Biological Chemistry at the School of Medicine, died Wednesday, Dec. 23, 2020, in Miami after a long illness. He was 88.

Glaser spent the latter years of his career, from 1986 to 2005, as executive vice president and provost at the University of Miami.

At Washington University, where he earned a PhD in biochemistry, Glaser studied in the laboratory of Nobel laureates Carl and Gerty Cori. He joined the faculty as an instructor in 1956 and rose to head of the biological chemistry department, precursor to the Department of Biochemistry and Molecular Biophysics; he held that position from 1975 to 1986. He also became director of the Division of Biology & Biomedical Sciences in 1980. He retired from Washington University in 1986 but remained affiliated with the School of Medicine as an adjunct professor through 1989.



Michael Evan Hughes, PhD, a neuroscientist and chronobiologist highly respected for his research at the School of Medicine, died Tuesday, May 4, 2021, at his St. Louis home after a six-year battle with brain cancer. He was 41. His blog “bachforthebrain” chronicled his cancer survivorship with eloquence and deep humanism.

An assistant professor in the Division of Pulmonary and Critical Care Medicine, Hughes was married to Jing Hughes, MD, PhD, assistant professor in the Division of Endocrinology, Metabolism & Lipid Research. They had three daughters: Sophie, 12; Quinn, 9; and Carolyn, 6.

Hughes opened a lab at the School of Medicine in 2017 and became an expert in circadian genomics, stemming from his research on the 24-hour sleep-wake cycle during healthy and diseased conditions.

He spearheaded efforts to establish standards for data collection, analysis and sharing in circadian biology and medicine. He collaborated with scientists nationwide on initiatives that included respected studies of skeletal muscle biology and function in aging and chronic disease. He helped develop JTK Cycle, a widely used algorithm that collects large-scale genomic data on biological rhythms. Hughes also helped lead the Hope Center for Neurological Disorders Clocks & Sleep Club, which promotes research on biological cycles and sleep in neurodegenerative diseases.

Jing called her husband an “accidental scientist.” He started as a political science major while they were undergraduates at Stanford University during the late 1990s and early 2000s. “That is, until he decided to court a premed student — me — and switched his major to biology to impress her,” she said. “He never looked back, and I’m still impressed by him.”

In addition to his wife and daughters, Hughes is survived by his parents, Nancy and Richard Hughes, and his sister, Laura Hughes.

Memorial contributions may be made in care of Jing Hughes to the Hughes Children Education Fund at First Community Credit Union, 17151 Chesterfield Airport Road, Chesterfield, MO 63005.



Charles J. Kilo, MD, a former professor of clinical medicine in the Division of Endocrinology, Metabolism & Lipid Research at the School of Medicine, died of pneumonia on Monday, March 15, 2021, in Naples, Fla. He was 94.

Kilo and collaborators at the School of Medicine were among the first to demonstrate that diabetes complications are linked to the duration of the disease and the degree of blood sugar control. An early advocate for aggressive monitoring and control of blood glucose, Kilo challenged past treatment methods and the safety of blood glucose lowering agents. He pushed for regular measurement of glycated hemoglobin to track glucose levels in the blood. In subsequent years, measurement of so-called hemoglobin A1c became the standard in diabetes care.

In 1972, Kilo and Joseph R. Williamson, MD, founded the Kilo Diabetes & Vascular Research Foundation, a philanthropic organization committed to research and education. With the goal of finding a cure for Type 1 diabetes, which Kilo referred to as “a metabolic cancer,” the foundation has since supported the Kilo Diabetes and Vascular Research Laboratory and the Charles Kilo Chair for Type 2 Diabetes and Nutrition at Washington University, as well as the annual Kilo Diabetes Symposium, a forum to educate the medical community about research and clinical practice in diabetes, as well as other endocrine and cardiovascular diseases.



John W. Turk, MD, PhD, a pioneer in mass spectrometry research and a deeply respected faculty member for more than 40 years at the School of Medicine, died Wednesday, May

26, 2021, in Eureka, Mo., after a brief illness. He was 73.

The Alan A. and Edith L. Wolff Professor of Endocrinology, Turk was a pioneer in lipid biochemistry, defining key mechanisms of phospholipid signaling that contribute to diabetes. His work first drew international attention when he used tandem mass spectrometry to determine the molecular structures of complex lipids such as phosphatidylcholines, one of the fundamental lipid building blocks of cells.

Also a professor of pathology & immunology, Turk was among the discoverers of a phospholipase enzyme, iPLA2b, that participates in the control of insulin secretion and the survival of pancreatic beta cells. He and his collaborators demonstrated that this enzyme also is involved in cell proliferation, cell death, membrane biochemistry and a wide range of conditions, including infertility, metabolic syndrome, chronic inflammation and neurodegenerative disorders such as Parkinsonism. His work has been held in such high regard by the metabolic disease community that he twice received a National Institutes of Health (NIH) MERIT Award, a prestigious honor designed to provide stable, long-term funding to exceptional, experienced investigators.

He is survived by his beloved companion, Carol Thompson; ex-wife, Alice Turk; daughter, Amy Turk (Justin Prien); son, Andrew Turk; brother, Jim Turk; and three grandchildren.

1940s

MacDonald Bonebrake, MD '46; Feb. '21
James T. Chamness, HS; Feb. '21
Betty Jean Dirks, NU '48; Jan. '21
James T. Duncan, MD '49; Aug. '20
Peggy Dale Ericson, NU '46; Dec. '20
Harry L. Glassman, DE '48; July '20
Marion R. Kienker, OT '49; Oct. '20
Katharine L. Kilpatric, NU '46; Sept. '20
Leonard Leight, LA '42, MD '45; March '21
Velva Rose McGavock, NU '48; Jan. '21
Mary Ellen Simpson, NU '46, NU '49; July '20
Warren H. Speiser, DE '48, GD '62; Oct. '20
Betty G. Uzman, MD '45; Dec. '20
Stanley M. Wald, MD '46, HS '53; June '20

1950s

James L. Amos, DE '54; Feb. '21
Emma Jean Barker, NU '50; Nov. '20
Zoe Ann Braner, NU '50; Aug. '20
William R. Cheek, MD '51; Jan. '21
Arlan P. Cohn, LA '52, HS '58; Jan. '21
Helen Ferguson Crockett, PT '53; March '21
Bertram V. Dannheisser, DE '52; Sept. '20
John D. Davidson, LA '48, MD '52, HS '55; Jan. '21
Raymond A. Everitt, DE '54; Nov. '20
Robert M. Filler, MD '56; July '20
Arnold M. Goldman, MD '59; Nov. '20
Wilbur R. Gregory, PT '53; Feb. '21
Richard T. Haruki, DE '58; Feb. '21
Dorwin E. Hawthorne, DE '52; June '20
Jewell Henderson, NU '59, GN '61; Dec. '20
Gerald M. Hoxworth, MD '54; July '20
Richard W. Hudgens, MD '56; Dec. '20
Alice A. Kerr, NU '56; Nov. '20
Robert E. Kuhlman, LA '53, MD '56, HS '59, HS '63; Jan. '21
Robert T. Maletich, HS '59; Aug. '20
Robert F. Malison, LA '56, MD '59; Aug. '20
Robert J. McHugh, DE '56; Jan. '21
Roger J. Meyer, MD '55; Dec. '20
Walter L. Meyer, MD '50; Oct. '20
Alexander V. Monto, MD '57; Aug. '20
Norma F. Padgett, NU '56; Oct. '20
Brent M. Parker, MD '52; Feb. '21
Joanne Parrott, NU '50; July '20
Gerald F. Peppers, MD '59; Jan. '21

L. Juden Reed, LA '55, MD '59; Dec. '20
Frances Hrbacek Sanner, NU '50; Sept. '20
Jane Ann Sawyer, NU '50; Feb. '21
Marilyn Schneider, NU '57; July '20
William E. Shoemake Jr., DE '53; Jan. '21
Donald L. Shrader, DE '55; Feb. '21
Lucille Elaine Kennard Syers, NU '50; July '20
William W. Taylor, MD '57; Jan. '21
W. Yates Trotter Jr., MD '55; Jan. '21
Esther Turner, NU '53; Oct. '20
Irving J. Weigensberg, LA '53, MD '56; Dec. '20
Thomas W. Williams, MD '54; June '20
Jessie Wilson, NU '59; Dec. '20

1960s

Robert H. Allen, MD '66, HS; Jan. '21
Evan L. Allred, DE '62; July '20
Bruce M. Barack, LA '63, MD '68; Dec. '20
John L. Bardsley, HS '69; April '21
Thomas R. Cate, HS '66; Nov. '20
David L. Danner, DE '68; July '20
Robert L. Ferdinand, GD '68; Sept. '20
Ted L. Grayson, HS '61; Dec. '20
Jon E. Gustafson, MD '62, HS '66; March '21
Patricia E. Krippner, NU '66; Sept. '20
Norton Stanley Kronemer, LA '58, HS '65; Sept. '20
Henry A. Lee, HS '62; Sept. '20
John Campbell Martin, HS '62; March '21
Gordon R. Miller, MD '60; Oct. '20
Ruth Louise Murray, GN '67; June '20
James R. Patton, HS '60; Nov. '20
Vincent J. Proskey, HS '67; Sept. '20
John E. Rittmann, MD '62; Nov. '20
Charles A. Sigmund, HS '66; March '21
Joseph C. Stevens, MD '61; Oct. '20
Jun M. Tanimoto, DE '65; Feb. '21
William L. Wall, DE '62; March '21

1970s

Mark Binder Edelstein, MD '75, GR '75; Jan. '21
Robert A. Feldman, HS; July '20
Randall Lane Heller, HS '79; March '21
John D. Hirsch, MD '73; July '20
Michael S. Huckman, HS '70; Jan. '21

Edward S. Hume, LA '71, MD '75; April '21
James Wesley Kessel, HS '78; Sept. '20
John William Knesevich, HS '77; Jan. '21
Edward Philip Rose, MD '71; Sept. '20

1980s

James L. Fuchs, PT '89; June '20
William C. Hollifield, GM '88, MD '88; Feb. '21
Timothy N. Kaiser, HS '87; Dec. '20
Sambath Keo, DE '89; Sept. '20
Dale M. Larson, HS '84; Sept. '20
Beverly Logan-Morrison, MD '82; Feb. '21
John Gardner Saint, MD '80; Feb. '21
H. William Schnaper, HS '82; Nov. '20
Michael Alexander Veseth, DE '86; Nov. '20
Christopher Wuertz, HS '88; Feb. '21

1990s

Debra Larae Frenchie, LA '84, MD '93, HS '96; April '21
Mark R. Nunge, MD '93; Nov. '20

2000s

Daniel Lewis Popkin, MD '04, PhD '04, HS '08; Jan. '21

In Memoriam

To read full obituaries on any of the alumni listed on this page or to submit an obituary for publication in a future issue of Outlook magazine, visit medicalumni.wustl.edu/alumni.

Queeney Tower is a memory New inpatient tower planned



Queeny Tower, which opened in 1965 with a mix of hospital beds, physician offices, hotel rooms, a restaurant and rooftop pool, is a memory now that demolition concluded this fall. Barnes-Jewish Hospital is planning to fill the void left by the iconic structure at Kingshighway and Barnes-Jewish Plaza with a 16-story inpatient bed tower. Construction is expected to begin in the fourth quarter of 2021.

The new tower is an important component of BJC HealthCare's Campus Renewal, a long-term project to transform the Washington University Medical Campus, with an overall focus on improving the patient and family experience. The tower, expected to open for patient care in mid-to-late 2025, is slated to include 224 private inpatient rooms, 56 private intensive care unit rooms, surgical prep and recovery, imaging services and a cafeteria. Plans also call for significant improvements along Barnes-Jewish Plaza to simplify arrival and wayfinding.

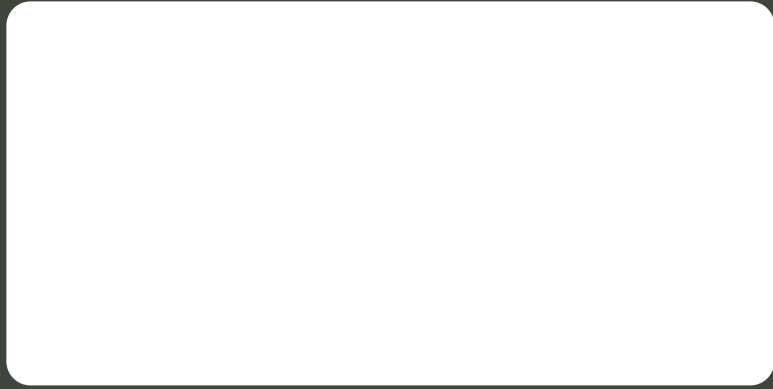
Queeney Tower was vacated in late 2019, but the pandemic put demolition plans on hold. Demolition concluded this fall.

A rendering shows the new inpatient tower at Barnes-Jewish Hospital.



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A sense of hope

The Ellen S. Clark Hope Plaza has been named a Native Garden of Excellence by Grow Native! The urban garden embraces the use of native plants, combining both a feeling of wildness and a well-planned space that serves as a calming respite for staff, trainees and patients. Its central feature, a large pool with native water lilies, is surrounded by plantings that evoke Missouri wooded habitats. Grow Native! is the native plant marketing and education program of the Missouri Prairie Foundation.