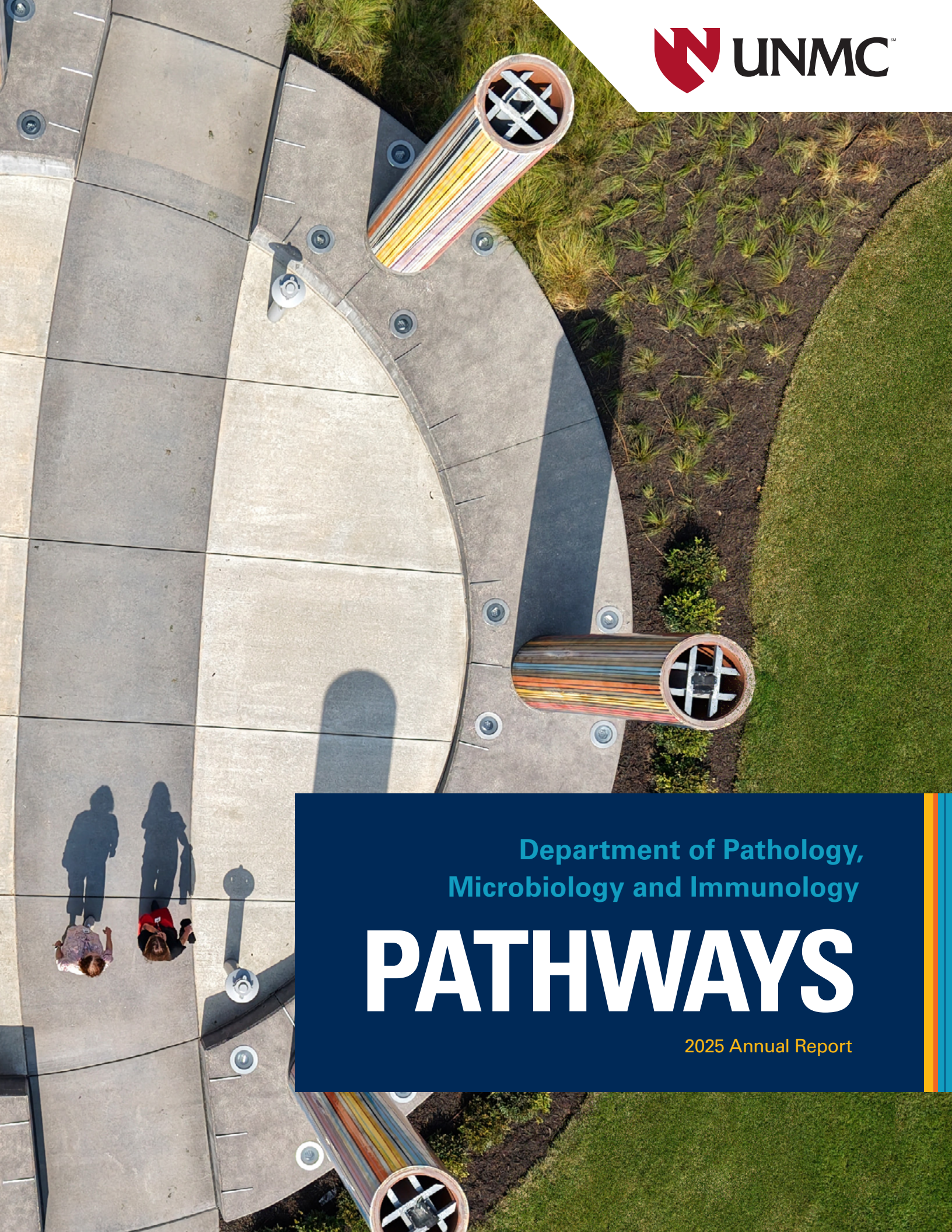

UNMC

Department of Pathology, Microbiology and Immunology

PATHWAYS

2025 Annual Report

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CHAIR'S MESSAGE

Our department sits at a vital intersection of science and medicine. Our work underpins modern diagnostics and therapeutics, drives foundational and translational discovery, supports robust and rigorous educational pathways, and plays a critical role in public health and national biopreparedness.

As I reflect on the accomplishments of the past year, I am filled with a profound sense of gratitude and admiration for the people, the purpose, and the progress that define the Department of Pathology, Microbiology, and Immunology. This report chronicles a story of growth, innovation, and impact, achieved during a period of extraordinary complexity and rapid change across health care, research, and education. It is my privilege to share this message with you – our colleagues, partners, supporters, and friends – who together advance our mission and sustain our momentum toward a shared higher purpose.

The Value of Our Clinical Services

Our clinical services are the cornerstone of patient care across the region and the state. Through timely and accurate disease detection, precision diagnostics, and lifesaving services, our pathologists, clinical scientists, and laboratory professionals touch the lives of hundreds of thousands of individuals each year, across Nebraska and beyond, with dedication, compassion, and exacting quality. Through strong outreach partnerships, our laboratory services support both rural and urban clinics, public health institutions, and communities throughout the state. The stakes are real: accurate results mean faster treatment, better outcomes, and, in many cases, lives saved. I am immensely proud of how our highly specialized teams meet this responsibility with excellence, reliability, and unwavering expertise.

Cutting-Edge Science and Innovation

Science is our engine. Across disciplines, our faculty members continue to advance our understanding of the immune system, host–microbe interactions, and the genetic foundations of disease. These advances extend well beyond the laboratory, shaping future therapies, informing public health strategies, and contributing meaningfully to society.

What distinguishes our research programs is the deliberate integration of discovery and impact. Our faculty do not work in isolation. They collaborate across departments, institutions, and borders, moving seamlessly from bench to bedside. They pursue questions that matter, secure competitive funding, publish in high-impact journals, and mentor the next generation of scientists, all while remaining grounded in a shared commitment to improving human health through the advancement of knowledge.

Excellence in Education

Education is the heart of our department and one of our most enduring contributions. This year, our faculty expanded innovative curricular approaches, embraced hybrid and experiential learning models, and continued to mentor learners spanning high school students to postdoctoral fellows with care, patience, and dedication. Our trainees are immersed in a culture that values curiosity, rigor, resilience, and excellence, and one that fosters lifelong habits of inquiry and professional growth.

People: Our Most Valuable Resource

While technologies and discoveries often capture attention, the true foundation of our success is our people. Our department is home to an extraordinary community of faculty, staff, and trainees who bring their best to their work every day.

Our clinical teams operate around the clock to ensure safe, reliable patient care. Our researchers persevere through uncertainty and celebrate discovery with humility and renewed curiosity. Our educators invest deeply in mentoring and professional development. Our administrative professionals provide the structure, coordination, and support that allow the department to function at a consistently high level.

People are the heartbeat of this department. Their commitment, collaboration, and shared values make our work not only possible, but meaningful. As chair, I am inspired daily by their example and by the collective sense of mission that propels this community forward.

Looking Ahead

In closing, I extend my sincere thanks to everyone who contributes to the work and spirit of this department. To our faculty and staff: thank you for your expertise, dedication, and unwavering pursuit of excellence. To our trainees: thank you for your curiosity, energy, and promise. To our institutional partners and supporters: thank you for your trust and investment in our future. And to the patients and communities we serve: thank you for the confidence you place in us – it is both our greatest responsibility and our deepest honor.

With optimism and resolve, I look forward to what we will accomplish together in the coming year.

Sincerely,

Joseph D. Khoury, MD
Chair, Department of Pathology, Microbiology and Immunology

BY THE NUMBERS

72
Faculty

446
Nebraska Medicine Employees

291
UNMC Employees

33M
Clinical Pathology Tests

5.7M
1.3M Microbiology and Virology
1.5M Point of care
1.4M Service center
1.5M Urinanalysis

3.3M
other CP services

13M
Chemistry

11M
Hematology & Coagulation

898K
Anatomical Pathology Tests

285K
Blocks

395K
H&E

83K
Surgicals

29K
other AP

116K
IPOX & IHC

Research

- 4 primary research topics: microbiology, cancer biology, immunology, and bioinformatics
- 23 cutting-edge laboratories working on both translational and basic science topics
- 368 publications by faculty
- 82 GRANTS (16 new):
- $16.8M in extramural research funding (direct and indirect)
- $4.8M in new grants (direct and indirect)

Antimicrobial peptide database is expanded and improved

Research on antimicrobial peptides has come a long way in the past 45 years. And the Antimicrobial Peptide Database created by the laboratory of Guangshun Wang, PhD, a professor in UNMC's Department of Pathology, Microbiology and Immunology, has been embraced around the globe by scientists, who have cited it thousands of times in their research.

The professor's research focuses on innate immune antimicrobial peptides and their potential application as novel antimicrobials to combat drug-resistant pathogens. To promote research and education, his lab has been updating and expanding the Antimicrobial Peptide Database for two decades. This unique and comprehensive tool laid the foundation for his lab to decipher design principles of antimicrobial peptides and develop the database filtering technology for designing potent, selective and stable peptides with demonstrated efficacy in animal models.

Dr. Wang said that early in the database development, he wanted to understand natural peptides. "I thought if we understand that, even partially, we might be able to design better peptides. That's why we limited our scope and initially restricted inclusion of synthetic peptides into our database." The number of peptides discovered has increased through the succeeding versions of the APD, but it has been gradual, he said, because discovery of natural peptides is not easy.

What's new:

- Version 6 of the database contains more peptides, 5,680 as of September 2025, including 3,351 natural AMPs, 1,733 synthetic AMPs, and 329 AI-predicted AMPs.
- APD6 provides the first systematic classification of synthetic and predicted peptides.
- Also included in version 6 is an expanded wheel of peptide functions, which records 32 peptide functions or activities, such as antibacterial, anti-MRSA, anti-TB, antiviral, anti-HIV, anti-fungal, antiparasitic, anti-cancer, and anti-diabetic. The wheel of functions may open new opportunities for developing other types of peptide therapeutics in those areas.
- And an information pipeline (AMPIP) was created to facilitate future development of peptides in silico (by computer), thereby minimizing the use of research resources, including human labor and experimental animals.

After the international symposium in 2023 marking the 20th anniversary of the database, Dr. Wang and Dr. Joseph Khoury, department chairman, turned their eye to the future. "We started to think maybe we should expand the scope of data we can collect in this database" and make it even more useful. Therefore, this year brought a new version of the database, APD6. "After database reconfiguration, we can now add a representative set of synthetic peptides without losing the search power for natural antimicrobial peptides. The AI-predicted peptides will be included if they have actually been made in the lab and confirmed to have antimicrobial activity."

The success of AlphaFold in protein structure prediction has stimulated the interest in predicting novel antibiotics in the same manner. While much progress has been made, Dr. Wang said there is a long way to go before AI-predicted peptides reach the market, calling the work in its early stages. "One of the major contributions of the APD6 is that we outlined a blueprint for advanced AI predictions. The database collects information for the entire information pipeline, from peptide discovery through all the procedures—at the end you will do in vivo assay, in vivo toxicity, then you will do efficacy and production, then you have clinical trials. Step by step, that's the pipeline. And information for all these steps can be searched in the database."

Further, Dr. Wang identified: "The data types can determine AI prediction quality. We don't collect everything into the database. There's a saying, garbage in, garbage out, or GIGO in computing science. We are doing it relatively conservatively by establishing a set of criteria for data registration." The APD6 also proposes data filtering to remove noises, thereby improving AI prediction quality. Dr. Wang plans to report such filtering procedures in future database versions with the establishment of the AI prediction pipeline in collaboration with colleagues.

Guangshun Wang, PhD

Next-generation sequencing has had a huge impact on molecular pathology lab

Allison Cushman-Vokoun, MD, PhD, (center), with members of her laboratory team

Allison Cushman-Vokoun, MD, PhD, professor and director of Diagnostic Molecular Pathology and Human Genetics, has seen next-generation sequencing (NGS) transform the molecular pathology laboratory in the 10 years since it was launched.

"When I started in 2009, everything was a single-gene test," she said. "Which meant you had one gene where you were looking at a specific mutation or a specific change and those assays were time-consuming, but you would do all this work for one change or one mutation in one gene. And that was kind of how molecular worked."

But she said change was on the horizon. Two companies, Ion Torrent and Illumina, were starting to introduce their technologies into the clinical lab space, "and clinical labs especially in the bigger cancer centers were starting to bring these technologies in and developing these next-generation sequencing panels using what we call high-throughput sequencing, where you would pick out several targets in 50 different genes or even 100 different genes. Now we're doing up to 300 genes, and some people are doing up to 700 some genes where you could use this high-throughput technology to really assess mutations throughout all these different cancer-related genes."

They launched the first assay in 2015 on an Ion Torrent system called PGEN, and ran that for a few years before adding NGS assays for acute myeloid leukemia.

They have been increasingly busy as their capabilities grew. "We've moved from maybe doing one run to maybe two runs a week on patients up to doing one run a day now because it's become so important to classifying and treating these myeloid neoplasms," she said, adding that there are targeted therapies now for some of the gene mutations.

"Our hospital has been very, very supportive of the lab in doing this. But I think what also has really benefited us in being able to do this was having so many wonderful technologists…We would not have been able to do this without their support and knowledge and dedication to this."

The lab acquired an Illumina sequencer called the NET-Seq and started developing a large gene panel. "We completed that validation not quite two years ago. We are running about 337 genes off that now," she said. "That's being used for a lot broader cancers, things like pancreatic cancer, prostate cancer, more genital-urinary cancers, female cancers where there's different targets not on the smaller panels. And also for potential clinical trial enrollment. There are more targeted therapies now, more clinical trials, so this larger panel is really geared for that, in certain kinds of cancers.

"We also transitioned from that smaller 50-gene (assay) to a different type of 50-gene assay that does a lot more targets and is very rapid—we can get it done in a day or two. We can really rapidly profile solid tumors like melanomas or lung cancers and the myeloid neoplasms, and within 3 to 5 days we can have answers. Going from one single-gene assay that took a couple days to run

to now being able to do anywhere from 50 to 300 genes in a week or two depending on the panel is really kind of amazing. It's really done a lot of good."

She said next-generation sequencing is also being used in the HLA lab, looking at bone marrow transplant candidates and for some high-resolution typing, so there has been tremendous growth over the past 10 years. "I think it is pretty impressive. We couldn't do it without all of our technologists, the support of the department, the support of the hospital, the support of the cancer center," she said. "The oncologists have been really great partners to work with. They like having it here; if they have questions they can call us. So it's been a large group of people and programs that have helped us be able to do this and continue to do this."

She said third-generation NGS is in use in the Nebraska Public Health Laboratory. "Pete Iwen and Emily McCutchen have been using Nanopore sequencers for quite a while now. It's really amazing technology. We aren't doing that here yet. We're still using the Illumina and the Ion Torrent." But she said Dr. Jesse Cox is looking into Nanopore sequencers for his lab.

Dr. Cushman-Vokoun said she's looking forward to expanding their big panel to an even bigger panel. "The Illumina, the next year and a half, they have a new version of the assay. In that will be something called homologous recombinant deficiency or HRD, which is looking at DNA repair within the cell and if you have problems with DNA repair and genetic instability and telomeric imbalance, all these different things that can tell you if you have recombination, and there's a certain drug class that's being used in tumors that have what we call HRD. So that will be in the assay. So that's one of our targets, growing that assay.

"We've also been evaluating lymphoma panels to complement our myeloid panel. And so Dr. Ketav Desai, who joined us this summer and who was my fellow last year, he is going to be hopefully working on that."

She said they are also using next-generation sequencing now to do single-gene assays. "We can run a whole big panel of different genes that we've developed through a computer and bioinformatic, Dr. Zhang, what we call bioinformatically masking, where we only look at data for a single gene. So it saves money because you're running a bunch of genes at the same time, so you only have to develop one assay, but you can analyze the different genes. We're actually moving a lot of our single genes to next-generation sequencing as well."

The lab is also looking at an assay for circulating tumor DNA, in which tumors release DNA into the blood especially after treatment. Next-generation sequencing can be used to evaluate the blood for variations or mutations in genes. "It's a very difficult validation; it takes a very highly sensitive assay. But if you can't get tissue on a patient, or if there's not enough tissue, you can just do a blood draw. And there are companies doing that right now that we send to. But that's something on our radar that we might think about doing.

"So we have lots of things on the agenda," she said. "But as we bring on more assays and they get higher volumes, so you got to keep up with all the clinical work, so we're very busy right now, and trying to validate assays and bring on assays while you're trying to keep the current assays running is challenging. But we have great staff. We have about eight or nine technologists trained in next-generation sequencing. And we have HLA technologists trained in the next-generation sequencing that they're doing." It's also helpful that companies have streamlined the assays, adding automation that gives technologists more time for developing new assays or learning.

Dr. Cushman-Vokoun said her lab now has four types of NGS sequencers, two Illumina and two Ion Torrent." "These instruments aren't cheap. Some places choose to send this out because they don't want to spend the money, but our hospital has been very, very supportive of the lab in doing this. But I think what also has really benefited us in being able to do this was having so many wonderful technologists, and Sharlene Rapp, who was our NGS coordinator and now is our lead technologist. We would not have been able to do this without their support and knowledge and dedication to this."

Another key was adding Dr. Weiwei Zhang as bio informaticist. "You can't do this without having a bio informaticist to help with all the complex software and data analysis and that sort of thing," Dr. Cushman-Vokoun said. "So we really did invest in the program."

Department makes significant strides forward on new lab information system

Ben Swanson, MD, PhD

The Department of Pathology, Microbiology, and Immunology made major progress in 2025 on installation of the new laboratory information system (LIS). The more than two years of work leading up to the launch of Beaker LIS will be worth it and is an important step forward for the department. The move was precipitated because Cerner CoPath was sunsetting, and many of the department's legacy or older LIS systems were no longer modern or meeting the department's needs.

Ben Swanson, MD, PhD, associate professor and medical director of the anatomic pathology division, said phase one of clinical content validation was completed in September on the Beaker LIS, which will be fully integrated with the Epic One Chart electronic medical record. The second validation phase should be completed by year's end, he said, with the third and final phase complete early in 2026, followed by several months of staff training before the go-live date of June 6.

Phase one dealt mostly with test definitions, he said. "Say you draw a sodium level. What kind of tubes could be drawn from a line that the system would accept, or what is the billing code associated with sodium that would drop within our system?

"Our next phase will be clinical content validation phase 2. This is looking at and validating complex workflows. So examples of that would be coagulation that a clinical pathologist signs off, another straightforward example that's complex is hematopathology including bone marrows, including peripheral blood smears as well as hematopathology cases, bone marrows that include flow cytometry as well as molecular or other ancillary findings. An example in surgical pathology that we would be reviewing would be a biopsy or a section that also has FISH testing or fluorescence in situ hybridization. Those are the types of things; there are dozens of complex workflows that we're going to be working on both with our pathologists as well as our subject matter experts to look at. I think we'll have a lot more people understanding what the work looks like in Beaker.

"We're testing every combination and every possibility. We're testing orders coming in, we're testing results going out. We're testing can we bill appropriately? Can we collect charges? We're testing that things are linked. Let's say somebody has a Pap smear. We need to make sure that's linked to their HPV test. Many examples like that. We have to test the system, make sure it's robust."

Epic and Beaker have done this installation many times at many institutions, and that experience has informed the design of their base system, called Foundation. "As much as possible we want to stay with the base, with the Foundation system," Dr. Swanson said. "But there are certainly many examples where we need customization. And that's where we work really closely with our IT partners, our LIS partners, to make sure the software product meets our needs. Obvious examples of this would be our outreach business, our Regional Pathology Services. That's a unique workflow that maybe not a lot of Epic/Beaker customers have presented to the company before. That's where a lot of customization is happening."

The months before the go-live date in June will be busy, too. "There's going to be a lot of teaching, both to pathologists, to our support staff as well as to the hospital as large in how you work in Beaker, to our clinicians, to our providers, to our nurses," he said. "There will be slightly different ways that they enter orders, print labels and send specimens, be it blood, be it tissue to our lab. And then on the pathologists and clinical pathology side, there will be significant changes in how we enter and report out data. Because we will be working in an entirely new computer system. So the last six months will be heavy on

"There will be significant changes in how we enter and report out data. Because we will be working in an entirely new computer system. So the last six months will be heavy on education and training. And also about understanding what the new workflows look like."

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Extra help will be available during the transition. "We're going to have a command center," he said. "We hope everything goes smoothly but there's always bumps in the road. So there will be a command center to fix any pressing issues that need to be taken care of. We're going to be working with our consultant as well as our Epic partners, and they will be working at our elbows the first couple of weeks to really make sure the transition to Beaker goes smoothly."

In addition to the cutting-edge software system, they're going live June 6 with an upgraded digital image management software (IMS) program. "It is equivalent in many respects to what is called a PACS system, PACS system in radiology. We are going with Sectra as our IMS. We have currently hired a consultant who will be helping us install the program and make sure that the connections are going live. We will continue to use our Leica GT450s for high-throughput scanning as well as the Leica CS2s for remote frozen sections. And that will be integrated with our Sectra system."

They are also planning another change—going to a cloud-based storage system for digital images. "Much like we access things on OneDrive or if you have a Google account and there's Google Drive, rather than keep our images on a computer server on campus or somewhere in the Omaha area, it will be going to the cloud. So we're going to be upgrading our data storage to Microsoft Azure cloud storage, that's part of our Sectra build.

"We'd have servers over at the 4230 building across Leavenworth to store our images, and it was quite expensive. So this is a cost-effective way. And this is where the field is headed, both within pathology as well as radiology."

Dr. Swanson said one big advantage of the new IMS is that it will have direct connections to AI and machine learning algorithms. "So for instance if we want to start to scan let's say breast cancers with R2, ER and PR, Sectra would be able to directly integrate to a third-party AI program that could help us quantitate. So rather than eyeballing, using standardized metrics but really using a computer program to be consistent and have better accuracy with what we call various biomarkers for tumors. Another exciting development that this will allow us to do is prescreening. So there are for example prostate cancer AI algorithms that will look at the biopsy before a pathologist gets to it and say I think there might be cancer here. Maybe you ought to look here first. And it's just a way to help increase efficiency, increase patient safety so that no cancer is missed. There are lots of other tools, but that's really our gateway into working with all of these computer programs that are coming down the pipeline."

NPHL provides a host of services to Nebraska and beyond

Sometimes it can be difficult to grasp all the work being performed by the Nebraska Public Health Laboratory (NPHL). The lab is a cooperative partnership among the University of Nebraska Medical Center, Nebraska Department of Health and Human Services and Nebraska Medicine. This partnership was formed in 1997 when the state legislature and governor established the lab in Omaha.

The original focus of testing was to provide support for state-sponsored prevention programs for the detection of sexually transmitted diseases, enteric diseases such as salmonellosis, and respiratory diseases such as influenza. In 1999, testing at NPHL was expanded to include testing for biothreat agents in environmental samples and the detection of chemical agents in human specimens through grant funding from the Centers for Disease Control and Prevention (CDC). The lab also has an extensive outreach and education program throughout Nebraska.

NPHL is hosted by the UNMC Department of Pathology, Microbiology, and Immunology. Peter Iwen, MS, PhD, D(ABMM), F(AAM), a professor in the department, serves as NPHL director. Emily McCutchen, MS, was recently promoted from laboratory manager to deputy director.

"Two things to recognize that make us unique from other public health lab," Dr. Iwen said. "First, we are on an academic health center campus and under administrative support of the university. Other public health labs (PHLs) are co-located on campuses, but they are separate from the administrative side.

"The second is that 90% of our support is federal dollars through contracts that filter through the state department of health and human services. These federal dollars are available to support public health laboratory testing, but not research. So, we are not federally funded to perform basic or translational research activities." That does not mean research opportunities don't present themselves from time to time. "For instance, all the Salmonella isolates that are detected in clinical laboratories in the state are submitted to us for further characterization to support federal programs. Identification of unique isolates allows for us to present our findings in through research publications," McCutchen said. "An instance we recently had a patient with salmonellosis that occurred after exposure to a colonized pet bearded dragon that had a unique resistance profile that ended up being a rare finding. The recognition of a unique species came from the testing that was federally supported, which resulted in a published report."

NPHL welcomes the opportunity to share its experiences with other researchers and colleagues who work in other PHLs, Dr. Iwen said. "Working in the PHL we are able to experience a lot of unique cases. Arguably we are the only PHL in the nation who provided laboratory testing to support multiple patients who had Ebola virus and to confirm a case of Lassa fever in a traveler. We also were one of the first labs in the nation to test for SARS-CoV-2 in travelers admitted to the National Quarantine Unit. As a PHL that supports facilities that care for patients with the potential to have a high-consequence pathogen, we are in a unique position to get these unusual cases."

"Researchers may only rarely observe these organisms, especially these rare ones that might be observed in our laboratory. We thus look for opportunities to share with others who may have an interest in advancing on our findings," McCutchen said.

Dr. Iwen said one example of how NPHL has help support researchers is in the study of tularemia with Dr. Marilynn Larson, an associate professor within the department. Tularemia is caused by a high-consequence pathogen, Francisella tularensis, that is endemic in Nebraska and can cause severe illness when contracted. This pathogen is only found in a few select environments in the U.S. and has also been classified as a biothreat agent requiring not only high-level containment to handle but also special permission from the federal government to perform research in the laboratory (Tier 1 Select Agent Registered Laboratory)," he said. "Dr. Larson obtains isolates that we detect and performs molecular genomic studies on those."

They also collaborate with a UNL researcher to study antibiotic resistance by providing whole-genome sequencing data. Having the instruments available to provide automated WGS for a reasonable cost in a timely manner has allowed NPHL to provide a fee for service to support researchers within the university system.

As a public health laboratory, NPHL has multiple opportunities to provide information to complete the story that might arise

NPHL's director, Peter Iwen, MS, PhD, D(ABMM), F(AAM), at the Association of Public Health Laboratories (APHL) annual conference, where he received the Leadership in Biosafety and Biosecurity Award.

in an outbreak. One example was a 2022 salmonellosis outbreak linked to alfalfa sprouts. NPHL interacted with a host of state and federal agencies to determine the source of infection and link that source to a multi-state outbreak from Nebraska. "We provided the sequencing for both clinical and environmental samples and were able to link a food-borne pathogen to its food source," McCutchen said.

She said state law requires specific food-borne and other unique isolates be forwarded to NPHL. This provides a bank of archived isolates that are available for additional studies if needed. Finding something unique in that bank provides for us an opportunity to share with other laboratory partners," she said. "We use this as an opportunity to provide an additional resource to support public health within the state."

Fortunately, federal funding has remained consistent for NPHL, Dr. Iwen said, particularly for bioterrorism preparedness—an area where UNMC has become a leader. With the patient care biocontainment unit at Nebraska Medicine and the availability of the Nation Quarantine Unit on campus, NPHL supports these programs by providing testing for the diagnosis of high-consequence pathogens (HCP). NPHL also has trained other public health labs on how to safely handle and test specimens that might contain an HCP.

The takeaway is the breadth of expertise, in areas such as antimicrobial resistance, bio preparedness, biosafety and biosecurity, laboratory leadership, high-consequence pathogens, and food-borne outbreaks, McCutchen said. "With the opportunities that we have working in the PHL, we cover a broad range of expertise, which allows us to share our knowledge."

Dr. Iwen said NPHL provided some of the first articles pertaining to Ebola and SARS-CoV-2 safety in the laboratory. In addition, NPHL also is vitally important to clinical laboratory partners across the state. "Laboratorians that support rural clinical laboratories in Nebraska look to NPHL for training to provide guidance when dealing with pathogens of public health concern," he said.

NPHL also assists the state by providing laboratory information for health alert network releases. Probably 90% of these alerts deal with infectious diseases, McCutchen said.

"As we start our workday, we joke among ourselves on what is our day going to be like today," Dr. Iwen said. "We usually start with a planned agenda but frequently need to recalculate as our day's priorities might change after the phone starts to ring. It might be a request for testing for a unique disease such as measles or mpox. As a laboratory that supports the national Laboratory Response Network (LRN), we work with our federal partners and frequently become the only source within the region to provide laboratory testing for these unique pathogens."

McCutchen said they used to send measles testing to a regional CDC lab in Minnesota. "However, now that measles volumes are up around the country, the request for testing has increased and the potential for outbreaks occurring does require a more rapid approach for testing which is where the PHLs come in to provide state support."

When it came to mpox (formally called monkeypox), NPHL was one of the few public health labs in the U.S. that had available an orthopoxvirus assay as a regional test site for the smallpox virus, Dr. Iwen said. This assay allowed NPHL to provide regional support during the early stages of the mpox outbreak. Currently, NPHL has verified a recently FDA-cleared assay to provide for mpox diagnostic testing to support testing for Nebraska. NPHL also tests for biothreat agents that might be present in environmental samples, such as the bacterium that causes anthrax. "If any individual were to open a suspect letter that might contain a white powder, NPHL provides a team to respond in the middle of the night to provide testing to identify a potential biothreat agent," McCutchen said.

Dr. Iwen said NPHL as a member of the LRN also provides testing for several other states, including Kansas, Iowa, South Dakota, Wyoming, Colorado, and Oklahoma.

2025 Highlights

- Expanded the respiratory testing program by adding instrumentation that paved the way for a significant increase in influenza-positive sample submissions. "We went from annually doing 70 submissions to over 2,000 last year," McCutchen said. "Laboratorians across the state now submit influenza-positive samples to NPHL so we can test the samples to characterize exactly which influenza viruses are circulating acr
- Supported the avian influenza (H5) order from the federal government to request that all influenza positive specimens from hospitalized patients be subtyped within 24 hours to provide expanded surveillance for public health. Laboratory staff brought up and implemented testing within 48 hours.
- NPHL provided WGS for C auris (Candida auris), a highly resistant yeast that has become more common in the U.S., "with multiple positive cases now detected in Nebraska hospital-acquired infection outbreaks."
- NPHL had one of its busiest years ever for tularemia and for brucellosis, another HCP that has been identified in the state.
- Updated the biosafety level 3 (BSL-3) laboratory that supports the NPHL, including installation of a new electronic monitoring system for the air handler.
- NPHL hosted disaster response training that involved the Nebraska National Guard, the FBI, and civil support teams from around the nation in July.
- Validated new assays for norovirus and EV-D68 testing of wastewater.

DIVISION REPORTS

Anatomic Pathology

Looking back on 2025, Dr. Ben Swanson said he's seen a lot of growth, particularly in anatomic pathology's surgical pathology and hematopathology cases.

Achievements included bringing in DreamPath, a block and slide management system. "It basically takes a picture of all of your slides simultaneously so that you don't have to file them. And it's a significant way to move and store efficiently the blocks and slides that anatomic pathology creates," he said.

Swanson thanked Dr. Joseph Khoury, the department chair, for securing storage space for their blocks in Annex 22.

And he was looking forward to opening a fine needle aspiration clinic, where pathologists will do procedures on biopsy masses taken from patients, at AP's apheresis clinic in the Fred & Pamela Buffett Cancer Center. "That's something that's upcoming that we're very excited about."

"I would say another thing that continues to increase is a cytology service called Rapid Onsite Specimen Evaluation, or ROSE. And that is primarily due to the lung cancer screening that we do."

The Institutional Biospecimen Bank (IBB) was created in 2025, with Dr. Kurt Fisher named as director. "This is a really nice, centralized location for both archived as well as fresh tissue specimen processing," Dr. Swanson said. "We're also going to be doing blood specimen processing to help with clinical trial requests."

In digital pathology, we are building our image management software (IMS) program, Sectra. "We'll go live June 6, 2026, which is the same time as the Beaker go-live. We are hiring a contractor who will help build the connections between our digital scanners and the program that we use to view the images," he said. "And then the other really important piece is cloud-based storage. We will be using Microsoft Azure cloud storage to access those images. That's our most active area of digital pathology."

He said their technical-only cases have been a major success in digital pathology. "This is when an outside pathologist sends a paraffin block to us. We do an immunostain, and then we scan it and send back that digital image to the pathology so that they can interpret it."

"We continue to have a very robust use of digital pathology also for remote locations," he said. "We primarily serve Village Pointe and Bellevue Medical Center, using our three Leica CS2s and two Mikroscans to look at both skin as well as ENT specimens and whatever things are done. That's like our most used digital service, actually."

Swanson said a significant portion of their time is being devoted to Beaker, the Laboratory Information System (LIS) with Epic (Nebraska Medicine's electronic medical record). This state-of-the-art LIS will replace CoPath and Soft, along with numerous other legacy systems. "It's really what we're working on, is just thinking ahead to what our work is going to look like in 2026," he said. "I think what we're really thinking about at AP is the beginning of how a clinician orders a biopsy. And then what that looks like for processing it in our labs, and how that's going to change in Beaker, both in the gross room as well as in our histology and IPOX labs. And then we're also really doing deep dives of how we write up a report within Beaker. These are all of the workflow things that will affect anatomic pathology on a daily, minute-by-minute basis."

Ben Swanson, MD, PhD, at the department's anatomic pathology conference in October

Clinical Pathology

Scott Koepsell, MD, PhD, vice chair of clinical operations, in the core lab

Dr. Scott Koepsell, vice chair of clinical operations, said the mass spectrometer has been turned on in Special Chemistry and is functioning, and they are offering a new test in house called PeTH. "That is going to be a huge cost savings for the organization now that it's turned on and functioning here." The test screens potential liver transplant patients for alcohol use. "That's a decision point whether they get a liver transplant or not," he said. "Having faster turnaround and access to that and spending a lot less money is huge. That just got turned on a couple of weeks ago."

Big changes are coming on their automated line in the core lab, he said. Upgrades to their amino assay analyzers required the line to be shut down in October, but when complete it should decrease turnaround time and allow them to offer more and more tests that they have been unable to offer in an automated way, "so we're very excited about that."

Another change in 2025 came when they took over medical direction for the Kearney cancer center laboratory. "This will allow us to better coordinate testing services in central Nebraska as well as expand what is offered in Kearney," he said.

The division also is working hard on implementing Beaker, the new Laboratory Information System (LIS). "All these thousands of tests that we do in the clinical laboratory have to be created, tested and validated in the Beaker system. That initial phase has been completed, so we're excited about that," he said. "It's tough, because we still need to bring up new platforms and new tests, and coordinating between the legacy system and the new system is complex. Two examples we are bringing up any day include a new set of immunochemistry analyzers, a protein electrophoresis device, and a new hemoglobin electrophoresis device, so we've got a lot of things cooking while we're building everything in Beaker."

Dr. Koepsell said 2025 also saw an expansion of the division's industry contracts for research. One, with the emergency department at Nebraska Medicine for Werfen, involves collecting plasma from people with suspected blood clots. "Basically what we can do is thorough a follow-up with these patients that agree to be part of this study. We follow up with them and learn whether they had a blood clot or not. The clinical findings will help the company develop an assay for blood clots. "So that's kind of an exciting partnership that we have."

He noted another partnership with Scynexis, which has a new antifungal drug. "We're doing some in vitro work assessing how that drug affects blood clotting. "And then with Werfen, we're wrapping up a couple of additional studies with them on a disease called Antiphospholipid syndrome. So 2025 has been a very busy year partnering with industry. Getting a lot of grants done that way."

A big test of their new quality unit came in 2025 with the CAP inspection, held this past summer. The comprehensive inspection looked at almost 10,000 data points across the laboratory operation. The 2023 inspection showed deficiencies in 1.13% of those data points. But in 2025, the deficiencies dropped to 0.36% of those data points. "The quality team was instrumental in dropping the number of citations down to one of our lowest rates that we've ever had," he said. "The team worked with all the sections and the medical directors to review all the things that were going to be inspected and bolstered up that compliance and really did a lot of work trying to standardize things across the laboratory, and I think that, from an external standpoint with CAP, with a team coming from Jefferson Hospital in Philadelphia, validating that we are actually doing a better job with quality than before, that was a really big accomplishment." He also noted that with the inspection, "our laboratory in Grand Island is now CAP-certified for the first time."

An unexpected test for them came earlier in the year, when the microbiology lab flooded. "I would like to highlight how well the faculty and staff stepped up to overcome that," he said. "We had people coordinating boxing up specimens and shipping them to other, different labs across the region, trying to get our patient care done and getting all these manual test results back and typing them in and coordinating all that. And the machines that were damaged in the flood had to be replaced or repaired. And there's a whole step of validation and re-running samples on that to make sure it's running the way we expect. That they had to bounce back from. On top of that, our send-out laboratory had to absorb all this mass of testing and send it out as well on top of that. So it was a huge effort that took multiple people to overcome, but they did it with a lot of resiliency."

Diagnostic Molecular Pathology and Human Genetics

Dr. Allison Cushman-Vokoun, director of the Division of Diagnostic Molecular Pathology and Human Genetics, said new assays in 2025 included:

- T-cell beta gene rearrangements, which complements other T-cell gamma gene rearrangement testing. "Having both of those has been more useful in the diagnosis of atypical lymphoid aggregates and lymphomas, especially in skin biopsies, bone marrows and lymph nodes." In October, they converted several single-gene assays to a Next Generation Sequencing (NGS) platform using the UNMCeq panel for both hematopathology and solid tumor cases. "Streamlining these assays into one panel will bring costs down for the assays and allow us to do more testing in formalin-fixed paraffin embedded tissues. For instance, we can test mantle cell lymphomas for TP53 mutations, or a clot section from a bone marrow for JAK2 mutations. I think that will be very helpful for the pathologists and oncologists, and also hopefully make it cheaper for patients and the laboratory."

- "We're going to be launching, hopefully in the next six months, another four assays: POLE mutations in endometrial cancer, EZH2 for follicular lymphoma treatment, UBA1 to diagnose VEXAS syndrome, and STAT3 for some T-cell proliferations, all using the UNMCeq panel."

The UNMCeq panel was designed by Dr. Terrance Lynn while he was a molecular genetic pathology fellow here at UNMC. "It is exciting to see his hard work come to fruition," Dr. Cushman-Vokoun said.

She said they are starting to work on upgrading their 300-gene panel to 500 genes and adding homologous recombination deficiency (HRD) analysis to the assay. It will hopefully be in the next year, and it will be an improvement upon the current assay. Efforts will also be made to develop a lymphoma panel to assist lymphoma oncologists and hematopathologists in clinical trial enrollment and lymphoma diagnosis, respectively, in the future, she said.

In July, the molecular service added Dr. Ketav Desai to their faculty as an assistant professor. Dr. Desai completed his molecular genetic pathology fellowship at UNMC in June. He also completed a hematopathology fellowship at UNMC in 2023-24. "Dr. Desai will be assisting in more molecular hematopathology test development," she said, "which will be great for increasing laboratory test offerings."

Because the lab testing is so busy, starting in July, molecular oncology divided the service into two services, molecular hematopathology and molecular solid tumors. There are four faculty that do molecular solid tumors and four faculty that do molecular hematopathology, and three overlap. "I think it's been a really good thing, just to help us get patient results out faster. I think it's better for the pathologists, it's better for the laboratory workflow."

2025 was a very busy year, Dr. Cushman-Vokoun said, with increasing volumes, bringing on new tests and improving tests to reduce turnaround time and patient costs. She also believes a lot of work in 2025 has set the foundation for bringing in some new panels in the next year or two. "We are trying to give the clinicians what they need to best treat their patients and give the pathologists what they need to make the right diagnosis. I think it's been a pretty successful year for our lab, and I'm pretty proud of everyone in the lab. The technologists work really hard. We have excellent technologists who really, really care about their work, the patients, and doing the job right."

Human Genetics Laboratory

The Human Genetics Laboratory continued making progress in 2025 toward greater automation and efficiency. Its BioDot CellWriter, implemented in December 2024, is used in the preparation of slides and application of FISH probes and hybridization of FISH probes. In addition to increasing efficiency, they saw significant cost savings.

"Since we implemented that, we ended up 19.3% below budget on the reagents that

Allison Cushman-Vokoun, MD, PhD, with Jerald Varner, PhD

we were using," said Pamela Althof, lab manager. She said the CellWriter standardizes the preparation process and allowed the lab to use smaller amounts of sample and smaller amounts of FISH probes in their assays.

Zhenya Tang, MD, PhD, FACMG, director of the lab, said the CellWriter also marked "a first step" toward semi-automation and automation in their lab.

Althof said another lab improvement was moving their microarray platform from the CytoScan HD to the Accel HD platform in March. "That allows us to improve our efficiency and our workflow. We were able to go from a three-day bench process to a two-day bench workflow—it allows us to move things through a little quicker."

In July, they updated one of their FISH panels for adult acute lymphocytic leukemia, expanding that to include additional targets that are within the WHO or the National Comprehensive Cancer Network (NCCN) guidelines. This was in response to clinician requests for a bigger panel, Dr. Tang said.

Althof said the lab also is at work creating and expanding a reflex tier for Philadelphia acute lymphocytic leukemia. "We'll go through the initial update first, and if the clinicians have interest in some of the rarer abnormalities there's an extended panel that they can order," she said.

They hope to implement an optical gene mapping system early in 2026. "We also had demos from two large companies for new cytogenetic and FISH analysis systems that will allow us to expand into automated scanning for our FISH platforms, which currently is all being done manually," Althof said. "And then we'll also look at the implementation of AI-assisted karyotyping that will take some of the manual manipulation out of the karyotyping process and allow the technologists to focus more heavily on the interpretation of that karyotype."

Dr. Tang said those latter changes would come after implementation of the Beaker LIS in June 2026. "Once the Beaker is implemented, we can start to think about it, because at the end all new equipment or technology must be compatible with the Beaker system."

Zhenya Tang, MD, PhD, FACMG, (second row, center) with members of his laboratory team

"We're hoping to have it on site for validation in the fall of 2026," Althof said.

Also this year:

- The lab fared well in its CAP inspection. "We had no section-specific deficiencies for our cytogenetics or our molecular biology checklists," Althof said. "The CAP inspection is a big deal for all our clinical laboratories," Dr. Tang said.
- The lab's application for a laboratory genetics and genomics fellowship was approved this year by the Accreditation Council for Graduate Medical Education (ACGME), and their first fellow, Phassawan Rungsiprakarn, started in July. The primary goal of the 24-month program is to train prospective laboratory directors to be proficient in overseeing both clinical cytogenetic/genomic and clinical molecular genetic/genomic analyses. Dr. Tang said ACGME will do an on-site inspection sometime in the next year, a necessary step if the lab is to expand to two fellows in the program.
- A new technologist in the lab became ASCP-certified in September. "That means every technologist in our laboratory is ASCP-certified now. That brings us to a total of 24 ASCP-certified techs, three with dual cytogenetics and molecular biology, 18 with cytogenetics and three with certifications in other ASCP disciplines," Althof said. "It's not an accreditation requirement to have everybody certified, but from our perspective we think that enhances our knowledge and capability in the lab, to have all of our technologists certified in the role that they are performing."
- During 2024-2025, they had a number of 10 learners come through the lab: four pathology residents (two from Creighton/two from UNMC), two heme path fellows, two heme oncology fellows, and one molecular pathology fellow.
- The lab worked with fellows on three quality improvement projects, one resulting in publication.

Human Leukocyte Antigen Laboratory

In 2025, the Human Leukocyte Antigen (HLA) laboratory brought in a new flow cytometry instrument. "We're going to start transitioning from CDC crossmatches to flow cytometry-based crossmatches, which should bring us into parity with other HLA laboratories across the country," said Dr. Jesse Cox, HLA lab director. "We've been validating that instrument. That validation is essentially done now."

Dr. Cox said the lab continues to support Nebraska Medicine transplant programs. "In 2024, we set a record for the number of kidney transplants we performed, 186. I would anticipate that number (for 2025) would be at that level if not higher. Our lung and heart transplant programs also are increasing the number of transplants. And we continue to support all our bone marrow transplant programs."

He said that in 2026 the lab probably will look to add Nanopore-based sequencing methodologies for rapid HLA typing for deceased donors. "Right now we use a technique called real-time PCR melt curve analysis. It provides intermediate resolution HLA typing—it's more or less the industry standard across the country. The field is going to be moving toward this Nanopore sequencing, where we can get specific high-resolution type in the matter of a few hours, in the time frame similar to what we're doing, but it provides a lot more information."

Also on the horizon: donor-derived cell-free DNA, one of the new testing modalities that Dr. Cox said a lot of transplant programs have started using to better monitor the health of donor organs. Their clinicians have been sending out a lot of this type of testing, he said, but manufacturers are developing kits that would allow laboratories perform this type of testing in-house. "So it's probably something we'll be looking at as well in 2026."

Human DNA Identification Laboratory

"This year, we basically set a record for the number of outside cases we tested for other pathology departments, for specimen mix-ups, tissue floaters, those types of things," Dr. Cox said. The lab had about 100 such cases in both 2024 and 2025, up from about 40 in previous years.

"We've been working with the Omaha Police Department on a cold case grant, where we're using next-generation sequencing for genetic genealogy testing. Some of the data that's come out of that has led to additional, new investigative leads for the Omaha Police Department.

"Otherwise, we continue to do a lot of casework for the Omaha Police Department and other local law enforcement agencies, towards our original mission to support them to provide fast turnaround times on criminal cases." The lab worked on about 200 forensic DNA cases in all in 2025.

Nebraska Public Service Laboratory

The Nebraska Public Service Laboratory (NPSL), which tests drugs seized by law enforcement agencies, gained a major client in 2025 with the addition of Douglas County. "They had formerly been a competitor if you will. They have shut down their seized drug lab, and they are now sending all their materials to us," Dr. Cox said. "Another client that we've acquired recently is the Nebraska Attorney General's Office. They have a few initiatives that we're working with them towards.

"Some of the other law enforcement agencies we routinely work with include the Bellevue Police Department, Sarpy County Sheriff's Office, La Vista Police Department, Ralston's police department. We'll occasionally do testing for Lincoln's police department if they need a faster turnaround time than the State Patrol provides," he said. "We've actually done a few items for the Nebraska State Patrol as well, in particular THC quantitation assays. So we oftentimes will do testing on different waxes and vape pens and that type of thing. The State Patrol doesn't really offer that type of testing."

Jesse Cox, MD, PhD, director of HLA, Human DNA Identification Laboratory and Nebraska Public Service Laboratory

Regional Pathology Services continues mission of service to the state

Oleg Bobr, MD, medical director

Kirk Hansen, RPS director

Regional Pathology Services (RPS), which began 51 years ago, continues to fulfill its mission of providing cutting-edge laboratory testing and consultation for doctors, clinics, and hospitals across Nebraska.

In addition, RPS provides marketing, client services, specimen triaging and billing services for the Department of Pathology, Microbiology and Immunology and for the Nebraska Medicine clinical laboratories.

In 2024, Regional Pathology Services reached a major milestone, for the first time performing over 1 million laboratory procedures for its clients. In 2025, the number climbed to over 1.1 million. "I am really proud of that," said Kirk Hansen, who has seen steady growth in his 15 years as RPS director.

Dr. Oleg Bobr, medical director of RPS, said the business model results in "win-win" situations all around. "The hospital has an additional volume of laboratory testing that allows it to keep the cost of testing down," he said, and "residents and other trainees have access to additional specimens to enhance their training."

Hansen said hospitals across the state have their own labs and they will do whatever they can there. But there is a lot of specialized testing that they cannot do, he said. "And we have the capability to provide such testing at a very high level. Because of the complexity of the work we do on campus, including the cancer and transplant centers, we partner with hospitals and clinicians across the Midwest to provide this specialized testing."

Dr. Bobr said RPS offers community hospitals expert laboratory direction by academic pathologists in addition to access to a wide variety of testing. "Community providers are enabled to perform procedures that otherwise would not be possible without laboratory support," he said.

RPS also provides business development and account management for the Nebraska Public Health Laboratory. The lab—a cooperative partnership among UNMC, Nebraska Medicine, and the Nebraska Department of Health and Human Services—performs human diagnostic, epidemiological, and environmental testing, and promotes public health education across the state. Regional Pathology Service's close ties to NPHL keeps open the lines of communication with many rural hospitals and clinics, which pays off in better detection and tracking of emerging diseases.

Some other 2025 highlights:

- RPS can count over 600 clients in 23 different states.
- "The department started sending digital images to clients as part of the quality of service we provide," Hansen said. Clinicians will have the ability to share and discuss images with patients along with results and treatment of recent biopsies.
- RPS developed a "smart draw tool" available on its website, www.reglab.org. This tool helps clients understand collection procedures and other information, such as which tubes to draw for blood collections, and the proper temperature for storing and shipping specimens back to campus.

Dr. Ouellette advances understanding of Chlamydia development

In my lab, we study Chlamydia, which causes sexually transmitted diseases as well as a blinding disease, Trachoma. Chlamydia is a unique bacterium, because it's not something that grows on surfaces like E. coli or Staphylococcus does. It has to grow inside of a cell. So, it's what we call an obligate intracellular bacterium, and in addition to that it has this unusual developmental cycle, where it alternates between two different forms. There's an infectious form that doesn't divide, and then there's a non-infectious form that does divide. The EB form infects the cell. It becomes the RB, which divides within the cell inside a specialized compartment called an inclusion. The RBs divide multiple times and then they asynchronously start to differentiate to EBs at the end of the cycle. And ultimately, they blow up the cell, typically, and start a new round of infection.

There are a lot of unique features to it. It's also much smaller in terms of its chromosome compared to other organisms like E. coli or TB or even Staphylococcus. What's always fascinated me about Chlamydia is that it's actually missing a lot of genes that would be considered essential in other bacteria. But on the other hand, it's also kept certain genes that you would not necessarily expect it to have kept - oftentimes genes that are more typically associated with extracellular bacteria and what we call Gram-positive bacteria—Chlamydia is a Gram-negative bacteria for comparison.

My lab has three broad areas of interest. One is how Chlamydia divides, in other words, the simple act of going from one to two. Most bacteria engage a process that's called binary fission, where they basically grow and split in the middle and you have two equal daughter cells at all times as that process occurs, and it relies on a particular protein that's called FtsZ. Chlamydia does not have FtsZ, so already that's an interesting question because almost every other bacterium that's been characterized on earth has that protein.

We have some collaborators we work with at UT Health Science Center in Memphis, and we've shown that Chlamydia has this unique division process where they rely on a different protein called MreB, and they don't engage binary fission, they do more of a budding process like yeast. When certain yeast divide, they actually have a bud that comes out from one side and then it gradually grows, and you end up with two daughter cells that are equal. Chlamydia does something very similar using completely different machinery. It's totally unique to Chlamydia—other bacteria don't seem to do this. And so this is one area of interest that we're really focused on because there's lots of unique aspects to that process.

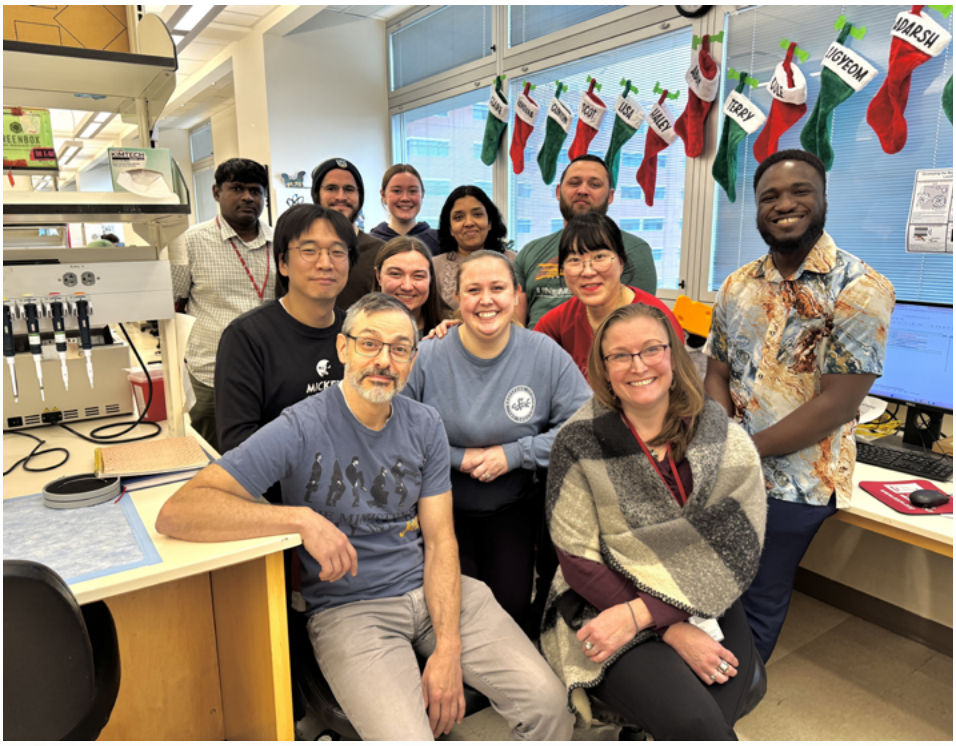
The second area has to do with how Chlamydia responds to stress, particularly amino acid stress. It lacks a system that almost all other bacteria use to respond to amino acid stress. So then the question becomes: how are they regulating their response to being in a low amino acid starvation condition? We're trying to understand how Chlamydia responds to a low tryptophan environment because Chlamydia gets tryptophan from the host cell. You can starve the host cell for tryptophan as part of your immune response to it, which means Chlamydia is starved for tryptophan. We have collaborations with Dr. Carabeo and Dr. Rucks here and Dr. Chaussee at South Dakota to address this.

The other major area we've been very excited about, particularly this past year or two, is how Chlamydia regulates its developmental cycle, that process where they go from EB to RB and then RB to EB. We've published a few papers this year and last year that for the first time, as far as I'm aware in our field, have identified factors that help drive that process from RB to EB forward. There are plenty of ways to stop the developmental cycle, but we've now published three papers where we've found we can actually push it faster and make it go faster. That's to my knowledge quite unique for our field, and it's very exciting for us because now we have a lot of things to follow up on to understand why these factors we've identified do this, why they push the developmental cycle forward.

I always have other little side projects where we're trying to develop new tools for Chlamydia and in other, what I call "secret projects", where I'm trying to see if a particular avenue of research is going to be productive or not. To a large extent I try to do some of that work myself, just so that, if I have a student or postdoc and they were to pick it up, I know it will be successful for them because I don't want to put them on something that's not going to lead anywhere.

My lab does fundamental, basic research. I have a collaborator over in Pharmaceutical Sciences, Dr. Martin Conda-Sheridan, who

"The other major area we've been very excited about, particularly this past year or two, is how Chlamydia regulates its developmental cycle. We've published a few papers that for the first time, as far as I'm aware in our field, have identified factors that help drive that process."



Scot Ouellette, PhD, and Lisa Rucks, PhD, at front, with lab team members

has worked with us in the past to develop drugs that target one of the proteins of interest to us, and those have worked to block chlamydial growth. He is now trying to get funding to further develop them to see if they can be used ultimately as a therapeutic. That's not really where my interests lie. If others want to take the work we've done and try to leverage it, then great, I'm all for it. But that doesn't fall within my area of expertise.

There's a big push now, especially for chlamydia and other sexually transmitted infections of a bacterial nature, to develop what we call targeted therapeutics - meaning a drug that would only hit Chlamydia and not the normal flora. That's particularly important for women, their microbiome in the genital tract is very diverse. If you hit them with doxycycline, then it's going to wipe out a lot of that diversity and then it makes them susceptible to other types of infections, including recurrent chlamydia infections. So, if you can specifically knock out only Chlamydia without touching those other types of bacteria, then that's highly advantageous and would be better in the long run. So again, a lot of the things we're studying could potentially be leveraged for that because we're studying unique things, unique aspects of Chlamydia and, if they can be targeted with a therapeutic, then perfect.

I have a multi-PI R01 to study protease regulation, which links to that last thing I described, the developmental cycle, and that's with a longtime collaborator at Southern Illinois University. We also have a multi-PI R21, which is investigating a different protease. My collaborator at UT recently got an R01 on which I'm a co-investigator, and then I have two R21s investigating some of these signals that drive developmental cycle progression. I have a collaborator at LSU Health Science Center in New Orleans who has an R21 on which I'm a co-investigator. I have a MIRA grant, what's called an R35. So, there's some pretty diverse funding. We're fortunate to have funding both from NIAID, which supports infectious disease research, as well as NIGMS, which supports more basic science research.

In the past I've had an NSF CAREER award and another smaller multi-PI collaborative research NSF award and have always tried to target diverse funding sources.

Of course, we're always submitting new applications and trying to renew applications. Drs. Lisa Rucks and Rey Carabeo and I had a multi-PI one that we're trying to renew right now. We're resubmitting that again in March to NIH.

2025 major papers

Harpring M, Lee J, Zhong G, Ouellette SP, Cox JV. FtsK is critical for the assembly of the unique divisome complex of the FtsZ-less Chlamydia trachomatis. Elife. 2025 Apr 7;13. doi: 10.7554/eLife.104199. PubMed PMID: 40193186; PubMed Central PMCID: PMC11975371.

Singh V, Ouellette SP. Altering the redox status of Chlamydia trachomatis directly impacts its developmental cycle progression. Elife. 2025 Jan 17;13:RP98409. doi: 10.7554/eLife.98409. PMID: 39819645; PMCID: PMC11741522.

Jensen AA, Firdous S, Lei L, Fisher DJ, Ouellette SP. Overexpressing the ClpC AAA+ unfoldase accelerates developmental cycle progression in Chlamydia trachomatis. mBio. 2025 Jan 8;16(1):e0287024. doi: 10.1128/mbio.02870-24. Epub 2024 Nov 22. PubMed PMID: 39576108; PubMed Central PMCID: PMC11708050.

Dr. Kielian studying immune response to Staphylococcus aureus biofilm

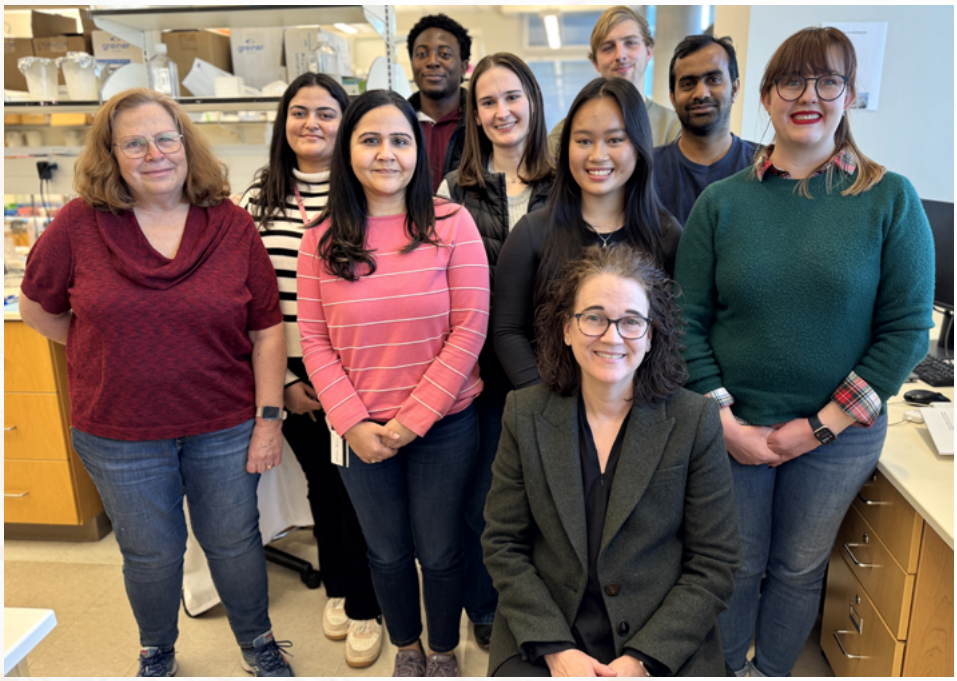
My work centers on trying to understand why the immune response cannot clear Staphylococcus aureus when it forms what we call biofilm. Biofilm refers to when bacteria coalesce into large communities that coat the surface of implanted medical devices. We study prosthetic joint infection—when people develop infections after hip and knee replacements. When this occurs, it's extremely hard to treat because those bacteria are adhered to the surface and antibiotics don't work because some of those bacteria become kind of dormant. They're still alive, but they're not growing. And our antibiotics are made to attack growing bacteria. That's a problem because antibiotics will help kill some of the bacteria, but not all. That's why it doesn't work. Because if you stop treatment, they'll start growing again over time.

The other biofilm model we study is craniotomy infection. A craniotomy is performed when people need surgery to remove a brain tumor or if they have epilepsy, and the surgeon has to go in and remove the tissue that's misfiring in the brain. When the piece of bone is placed back after the surgery is over, it can get infected. In addition to our animal models that we have for both biofilm conditions, we also collaborate with orthopedic surgeons and neurosurgeons here at the Med Center to collect specimens from patients with these infections, which has allowed us to define the immune landscape during these infections in people. We're fortunate that the immune responses we see in the patients are largely replicated in our animal model. This gives us confidence that we can use our animal model to develop new therapeutic approaches to ultimately help patients.

We received a new grant in July 2025 to try to identify genetic factors that influence prosthetic joint infection. For most of our studies, as well as other people in the field, inbred mice have been used, meaning that each mouse is genetically the same. And that doesn't reflect people. People are very diverse genetically—we're not the same. The grant I received was to use specific lines of mice where their genome is all jumbled up, meaning that they better represent the heterogeneity that people do. We are using these mice to identify lines where the outcome of prosthetic joint infection is different than what we normally see. We've already found some evidence of factors that appear to make the infection worse or less severe. Our ultimate goal is to use mapping approaches to home in on genes that are drivers of the infection, and once identified, we can develop approaches to augment these responses to help clear the infection.

I also have an ongoing NIH grant to characterize T cell responses in the craniotomy infection model, which play an important role in restricting bacterial outgrowth. Based on this apparent beneficial activity, we are currently determining how can we augment the activity of those cells or increase T cell recruitment to help reduce infection.

Towards the end of last year we had several foundational publications, two in Nature Communications, one in Cell Reports Medicine, another in Journal of Clinical Investigation. So that gave us momentum into this year. In the future I want to advance our research on S. aureus-immune crosstalk—how are the bacteria influencing immune cells and how do the immune cells respond to bacteria? We've been doing some of that, but I want to even develop that more. Our goal is to harness the immune system to better attack biofilm so that antibiotics will work, to reduce the need for prolonged treatment regimens. As examples, patients with a prosthetic joint infection have to go in for a second surgery to remove the infected device, undergo antibiotic treatment for months where they can't walk around very well because their joint is unstable. Then they have to go back in to insert a new implant, and we know that the risk for reinfection is high. For craniotomy infection, a second surgery is required where the bone is typically discarded, and



Tammy Kielian, PhD, (front) with members of her lab team

patients have to undergo months of antibiotic treatment before a third neurosurgery is performed to place a prothesis to seal the skull and protect the brain. This results in significant morbidity and decreased quality-of-life for affected patients.

This point was highlighted during a meeting that I presented at this summer at the Stevens Center in Hoboken, New Jersey, about our work on prosthetic joint infection. There was a testimonial from a young woman who, when she was 13, had an osteosarcoma (bone cancer) in her hip. To remove the tumor required surgeons to reconstruct her hip. Unfortunately, she acquired repeated infections and had to learn to walk again three times, which has affected her whole adult life. She's been on daily antibiotics because every time she had stopped, it came back, and so now she's like I don't what to do—do I stop, do I not stop? Luckily, she has not had an infection for a few years; however, bacteria can be hiding out that we cannot detect and so this testimonial was very poignant and drove the point home that this is a big problem.

We're trying to find new ways to treat biofilm infections to avoid the need for long-term antibiotics. Because not only can you have issues with the gut, but bacteria also can develop antibiotic resistance, which could complicate treatment with another infection. The world is already experiencing an antimicrobial resistant crisis, but we don't want it to progress further. The other unfortunate thing is that new antibiotics haven't been introduced on the market for 10+ years. From a pharmaceutical standpoint, there hasn't been a real push to develop these because you're not going to be on them long-term. It's not like a drug for a neurodegenerative disease where someone will be taking it for multiple years or a lifetime, so for better or worse, for-profit considerations are an unfortunate reality.

There's a lot of great people, including individuals here on this campus, that are developing new antibiotics. But my laboratory approaches therapeutics from the immune system's perspective to arm it to better respond. It would be difficult for the biofilm to find a way around a combinational therapy because you're not only targeting the bacteria from an antibiotic standpoint, but also from an immune standpoint. And it would have to mutate a lot to be able to overcome that. And that's unlikely.

A new project that we're working on in the coming year is a collaboration with Dr. Kevin Garvin, Chair of Orthopaedic Surgery at UNMC/Nebraska Medicine, to identify risk factors for people who are undergoing elective hip or knee replacement. The goal is to identify markers associated with increased infection risk, so that extra precautions will occur on top of standard clinical care.

In another project, we will be identifying new biomarkers for the diagnosis of prosthetic joint infection and assessing treatment efficacy. The problem with biofilms is that in approximately 30% of samples from patients with a suspected prosthetic joint infection submitted to the clinical microbiology lab, nothing grows. This complicates treatment strategies. And so we're trying to identify other footprints, identifying other molecules that we say, OK, we've identified like six things that are changed with an infection that are not changed in someone who doesn't have an infection, and then we would use that to not only help diagnose the infection, but even I think more importantly, help the infectious disease doctors and the orthopedic surgeons know when the infection is actually gone. So we're working to better inform when the right time is for reimplantation. I don't know if we'll get there or not, but we'll try.

New funding in 2025

Grant Number: R21 AI193368

Title: Identifying novel immune determinants that influence S. aureus biofilm infection using Collaborative Cross (CC) mouse lines

Source: NIH/NIAID

Project Period: 07/1/25-06/30/27

Principal Investigator: Tammy Kielian, Ph.D.

This project will identify host determinants that transform the local immune phenotype from an anti- to proinflammatory state to affect S. aureus biofilm formation.

2024 and 2025 major papers

Horn, C.M.*, Arumugam, P.*, Van Roy, Z., Heim, C.E., Fallet, R.W., Bertrand, B.P., Romanova, S.G., Bronich, T.K., Hartman, C.W., Garvin, K.L., and Kielian, T. Granulocytic myeloid-derived suppressor cell activity during biofilm infection is regulated by a glycolysis-HIF-1a axis. J. Clin. Invest., 134(8):e174051, 2024. PMID: 38421730 *Equal contributions.

Van Roy, Z.*, Kak, G.*, Korshoj, L.E.*, Menousek, J., Heim, C.E., Campbell, J.R., Geary, C.R., Liu, B., Duan, B., Campbell, S.S., Thorell, W.E., and Kielian T. Single-cell profiling reveals a conserved role for hypoxia-inducible factor signaling in leukocytes during human craniotomy infection. Cell Rep. Med., Oct 15:101790, 2024. PMID: 39426374 *Equal contributions

Van Roy, Z., Arumugam, P., Bertrand, B.P., Shinde, D.D., Thomas, V.C., and Kielian, T. Tissue niche influences immune and metabolic profiles to Staphylococcus aureus biofilm infection. Nat. Commun., 15(1):8965, 2024. PMID: 39420209

Korshoj, L.E. and Kielian, T. Bacterial single-cell RNA sequencing captures biofilm transcriptional heterogeneity and differential responses to immune pressure. Nat. Commun., 15(1):10184, 2024. PMID: 39580490

Kak, G., Van Roy, Z., Fallet, R.W., Korshoj, L.E., and Kielian, T. CD4+ T cell-innate immune crosstalk is critical during Staphylococcus aureus biofilm infection. JCI Insight, 10(4):e183327, 2025. PMID: 39989461

Parsons, J.B., Mourad, A., Conlon, B.P., Kielian, T., and Fowler, V.G. Methicillin-resistant and susceptible Staphylococcus aureus: tolerance, immune evasion, and treatment. Nat. Rev. Microbiol., doi: 10.1038/s41579-025-01226-2, 2025. PMID: 40835978

Nebraska Lymphoma Study Group continues to drive research, Dr. Iqbal says

Our research primarily focuses on peripheral T-cell lymphomas (PTCL) and lymphomas in general. A major strength of our program has been the Nebraska Lymphoma Study Group, initiated by Dr. James Armitage and Dr. Dennis Weisenberger in the 1980s and later expanded by Dr. Julie M. Vose and Dr. W.C. Chan. This initiative enabled the collection of tissue samples from lymphoma patients across different treatment eras, creating a unique resource that has powered decades of research. These specimens allowed us to leverage evolving technologies, advance scientific understanding, and secure multiple high-impact National Institutes of Health (NIH) grants—at one point, I held more than five NIH grants simultaneously.

Building Collaborative Networks: The study group laid the foundation for major consortiums, enabling external researchers to send biospecimens for collaborative work. We established (i) LLMPP: Lymphoma Leukemia Molecular Profiling Project, (ii) International PTCL Project, and (iii) Mantle Cell Lymphoma Clinical Consortium. These efforts targeted rare and clinically challenging lymphomas to improve patient outcomes.

Advancing PTCL Diagnosis: Our primary focus is peripheral T-cell lymphoma, which is difficult to diagnose and hard to treat. By applying adaptive technologies including multi-omics profiling, we improved classification accuracy, a breakthrough first published in Blood and then for clinical adaptation in the Journal of Clinical Oncology. This work led to development of clinically applicable diagnostic methods funded by NIH, and inclusion of our disease definition in the 2024 WHO or ICC classification and resulted in expansion into NIH PO1 grants for mechanistic studies. We have further characterized these PTCL entities and are now preparing a major journal submission demonstrating that these subtypes are genetically and clinically distinct with significant difference in gender-specific patient outcomes.

"A major strength of our program has been the Nebraska Lymphoma Study Group. This initiative enabled the collection of tissue samples from lymphoma patients across different treatment eras, creating a unique resource that has powered decades of research."

Other Research Areas: We applied similar strategies using high-throughput genomics to high-grade B-cell lymphomas and mantle cell lymphomas, associated with high relapse rates. Our approach combines advanced molecular techniques, long-term data from the hematology tissue bank (dating back to 1980) and collaborative studies with institutions worldwide. This resource has positioned us as global leaders in rare lymphoma research, enabling large-scale, authentic studies that influence international classification systems.

Recent Achievements: Our lab has published 10–11 high-impact manuscripts this year (see publication section), developed genetically modified mouse models replicating human (paper under revision) and proposed diagnostic platforms adaptable to most clinical labs, validated in a 120-patient pilot study. Our goal is to make accurate classification widely accessible, improving research precision and patient care.

Future Directions: Other than basic science research, we are collaborating with other institutes for blood-based assays for T-cell lymphoma (CT-DNA) assay for defining early relapse detection methods. Unlike B-cell lymphomas, T-cell lymphomas lack standard treatment, making early detection critical. We aim to close this diagnostic gap, which currently lags by about 10 years.

Impact and Outlook: Our leadership in defining targets and diagnostic criteria has had a major global impact. Large, collaborative studies enhance authenticity, drive WHO recognition, and shape classification schemes. While there is an urgent need to improve clinical outcome, we prioritize accuracy and systematic progress to avoid misdirection. In 2025, we focused on publishing rather than applying for new grants. In 2026, we plan to pursue significant funding opportunities. In December, the National Cancer Institute (NCI) steering committee met to propose a program assessing diagnostic accuracy for CAR-T cell therapy in relapsed B-cell lymphoma patients. CAR-T therapy is costly and effective in only ~30% of cases. Our aim is to establish criteria to predict patient response, leveraging decades of T-cell research.

2025 major papers

1. Lone W, Bouska A, Herek TA, Amador C, Li X, Heavican TB, El-Gamal D, Bi C, Hartert K, Yu J1, Saumyaranjan M4, Greiner TC, Vose J, Weisenburger DD6, McKeithan TM, Fu K7, Chan WC, Green M8, Iqbal J. High Grade B-cell Lymphoma, Not Otherwise Specified (HGBL, NOS) with Diffuse Large B-cell Lymphoma Gene Expression Signatures: Genomic Features and Potential Therapeutic Targets. Am J Hematol, 2024 (accepted)

2. Amador C*, Weisenburger DD, Gomez A, Bouska A, Alshomrani A, Sharma S, Shah R, Greiner TC, Francisco Vega F, Cook JR,

Feldman AL, Jaffe ES, Ozkaya N, Rosenwald A, Ondrejka SL, Ott G, Raess PW, Savage KJ, Slack GW, Scott DW, Song JY, Campo E, Staudt LM, Rimsza LM, Khoury J, Chan WC, Iqbal J* Refining Diagnostic Subtypes of Peripheral T-cell Lymphoma Using a Multiparameter Approach. Modern Pathology, 2024 (accepted)

3. Amador C, Bouska A, Shah R, Iqbal J, Vega F. Comprehensive Characterization of Nodal Peripheral T-Cell Lymphoma, Not Otherwise Specified: A Report of the 2023 SH/EA4HP Lymphoma Workshop. Am J Clin Pathol. 2025 Jul 11;164(1):65-75.2025. (accepted)

4. Bouska A, Weiwei Zhang, Sunandini Sharma, Harald Holte, Rauf A Shah, Waseem G. Lone, Luca Vincenzo Cappelli, Danilo Fiore, Qiang Gong, Tayla B. Heavican-Foral, Jeffrey J. Cannatella, Catalina Amador, Soon Thye Lim, Choon Kiat Ong, Andrew Feldman, Ming-Qing Du, Laurence de Leval, Timothy C. Greiner, Gunhild Trøen, Daniel Vodák, Sigve Nakken, Jan Delabie, David Weinstock, Stefano Pileri, Antonella Laginestra, KyeongJin Kim, Utpal Pajvani, Julie M Vose, Dennis D Weisenburger, Sandeep Dave, Giorgio Inghirami, Wing C Chan, Javeed Iqbal. Integrative genomic and transcriptomic characterization reveals therapeutically targetable vulnerabilities in angioimmunoblastic T-cell lymphoma Am J Hematol, 2025 (accepted)

5. Collinge B, Hilton L K., Wong J, Alduaij W, Ben-Neriah S, Slack W G., Farinha P, Boyle Merrill, Meissner B, Cook , Ott G, Rosenwald A, Elias C, Amador C, Greiner TC,W. Raess WP, Song J Y., Inghirami G, Ondrejka SJ., Jaffe E S., Weisenburger D D., Chan W C., Holte Harald, Beiske Klaus, Fu K, Delabie J, Pittaluga S, Iqbal J, Wright George, Savage KJ, Mungall AJ., Staudt LM, Steidl C, Feldman A, Morin RD, Rimsza LM, Scott DW. High-grade B-cell lymphoma, not otherwise specified: an LLMPP study. Blood Advances, 2025)

6. Sunandini Sharma, Roshia Ali, Alyssa Bouska, Meghana Kesireddy, Simeon Mahov, Weiwei Zhang, Dylan Jochum, Waseem Lone, Alicia Gamboa, Vaishnavi Devarkonda, Dalia Elgamal, Adnan Mansoor, Douglas Stewart, Peter Martin, Brian K. Link, Ranjana H. Advani, Paul M. Barr, Andre H. Goy, Amitkumar Mehta, Manali Kamdar, Deborah M. Stephens, Veronika Bachanova, Lynette Smith, Ryan Morin, Prasath Pararajalingam, Matthew A. Lunning, Kai Fu, Dennis Wiesenberger, Wing C Chan, Joseph Khoury, Timothy C. Greiner, Julie M Vose, Akil Merchant, Bi Chengfeng, Javeed Iqbal; Functional genomics and tumor microenvironment analysis reveal prognostic biological subtypes in Mantle cell lymphoma. Nature Communication, 2025 (accepted)

7. Waseem Lone, Jiayu Yu, Xuxiang Liu, Dylan Jochum, Alyssa Bouska, Kunal Shetty, Tyler Herek, Sunandini Sharma, Chengfeng Bi, Ab Rauf Shah, Zaina W Nasser, Catalina Amador Aiza Arif, Yuping Li, Tayla B. Heavican-Foral, Jacob Robinson , R. Katherine Hyde, Mamiko Sakata Yanagimoto, Satyanarayana Rachagani, Timothy W. McKeithan, David W Scott, Louis M Staudt, Giorgio Inghirami, Andrew Feldman, Timothy Greiner, Julie M Vose, Lisa Rimsza, Wing C. Chan, Javeed Iqbal Cooperative role of distinctive TP53 and PTEN combined loss in the peripheral T-cell lymphoma-GATA3 molecular subgroup. Science Advances, 2025 (accepted)

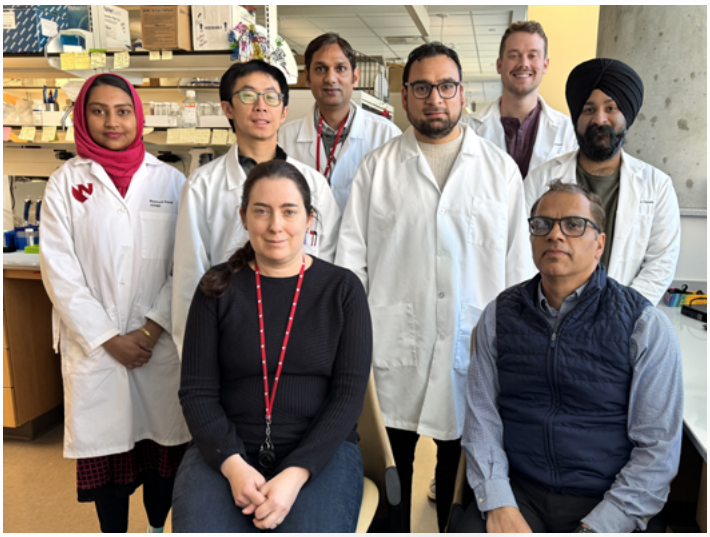
8. Xuxiang Liu, Yunfei Shi, Jibin Zhang1, Kunal Shetty, Krystie Chew, Can Küçük, Qiang Gong1, Esra Esmeray, Haiqing Li, Ru Chen, Sheng Pan, Katarzyna Dabrowska, Roger E. Moore, Krystine Garcia-Mansfield, Patrick Pirrotte, Jinhui Wang, Yuping Li, Gehong Dong, Logan Lee, Timothy W. McKeithan, Javeed Iqbal, Wing C. Chan. Key regulatory roles of PRDM1 in human NK-cell differentiation and activation. Leukemia, 2025

9. Feldman AL, Dasari S, Rimsza LM, Scott DW, Oishi N, Hu G, Farinha P, Amador C, Campo E, Chan WC, Cook JR, Delabie J, Fu K, Greiner TC, Hilton LK, Inghirami GG, Iqbal J, Jaffe ES, Morin R, Ondrejka SL, Ott G, Pittaluga S, Raess PW, Rosenwald A, Savage KJ, Slack GW, Slager SL, Song JY, Wright G, Wang HW, Zeng Y, Yoshino T, Wu X, Wilcox RA, Wang X, Shi M, Satou A, Perry AM, Miranda RN, Medeiros LJJ, Maurer MJ, Mou E, Ko YH, Karube K, Kahl BS, Jiang L, Jaye DL, Gru A, de Leval LL, Chen W, Chapman JR, Cerhan JR, Barrionuevo C, Ansell SM, Aljudi A. Gene expression profiling reveals two overarching types of ALCL with distinct targetable biology: an LLMPP study. Blood. 2025 Nov 21. Epub ahead of print. PMID: 41329859.

Invited review

1. Iqbal J, Inghirami G, Chan WC. New insights into the biology of T-cell lymphomas. Blood. 2024 ;144(18):1873-1886.

2. Pichler, A.S., Amador, C., Fujimoto, A., Takeuchi, K., de Jong, D., Iqbal, J., and Staber, P.B. (2025), Advances in peripheral T cell lymphomas: pathogenesis, genetic landscapes and emerging therapeutic targets. Histopathology, 86: 119-133.



Alyssa C. Bouska, PhD, and Javeed Iqbal, PhD, front, with members of the lab team

Supporting public service labs and translational research 'incredibly rewarding' for McClure

Shania McClure, assistant director of Public Service Laboratories and Translational Research, came to the department in December 2024 from the MD Anderson Cancer Center in Houston. She works with the Institutional Biospecimen Bank, Tissue Sciences Facility and Electron Microscopy Research Core, Nebraska Public Health Laboratory and Nebraska Public Safety Laboratory, and the Human DNA Identification Laboratory.

"This year has been incredibly rewarding as I've worked alongside our talented core laboratory teams, medical directors and leadership. Together, we've strengthened operations, expanded services, and supported meaningful growth," McClure said.

Shania McClure, MBA

Key areas of focus in 2025 included:

- The department integrated the Electron Microscopy (EM) Core administratively under the Tissue Science Facility (TSF), strengthening operational alignment, resource sharing, and support for investigators.
- The Institutional Biobank (IBB) also reached several exciting milestones. The core moved into a new location, with a new team, and adopted improved workflow processes that have already enhanced efficiency and clarity. "It has been incredibly rewarding to support these changes and see the positive momentum surrounding the IBB's growth," McClure said.
- Clinical trial specimen workflows were improved, leading to fewer hold-ups and clearer communication between teams.
- McClure oversaw the implementation of Stratocore PPMS, a centralized online platform that streamlines core service requests, scheduling, and billing. McClure said the new system, in place for both TSF, EM Research Core (falling under TSF) and IBB, brings greater efficiency, transparency, and consistency to ordering, billing, and sample management processes.

"It has been inspiring to collaborate with such dedicated professionals across cores, each contributing their expertise and commitment to improving the experience for our researchers," McClure said. "I'm grateful for the progress we've made, the relationships we've built, and the shared focus on continuous improvement. I look forward to the year ahead as we continue building on this momentum and supporting the important work happening across programs. "

Tissue Sciences Facility changes to provide even better research support

The UNMC Tissue Sciences Facility (TSF) saw significant changes in 2025, welcoming a new director, expanding the team's capacity, and upgrading equipment.

Dinesh Pradhan, MD, an associate professor in the department, now oversees TSF, which was established to provide basic and specialized histology, staining, immunohistochemistry, and imaging techniques to support the research community at UNMC for studies on animal and human tissue. The facility offers a full range of services including tissue preparation, processing, embedding, sectioning, standard and special stains for paraffin and frozen samples, single or multiplex immunohistochemistry/immunofluorescence, digital bright field slide scanning, tissue microarray construction, as well as client-use instrumentation with technical support.

TSF brought on an additional histology technologist in 2025, looking to strengthen turnaround times and improve service quality. Kylee Frassato joins the TSF team, which in addition to Dr. Pradhan includes Ember Eldridge, supervisor, and histology technologists Lauren Higgins and Kathleen McCon.

The Electron Microscopy Research Core officially transferred to the oversight of the Department of Pathology, Microbiology, and Immunology in 2025. This core remains a designated core facility but now operates administratively under the TSF as an additional service. Dr. Pradhan will now provide oversight as director with a designated research staff member, Deepti Negi, available to continue taking requests.

Dinesh Pradhan, MD, and Kurt Fisher, MD, PhD (back row center) with TSF and IBB team members

Institutional Biospecimen Bank: New name, expanded role

In 2025, the department completed its merger of the former Tissue Procurement Service with the Nebraska Biobank and expanded it into a more comprehensive operation, now known as the Institutional Biospecimen Bank (IBB). In the fall, the IBB moved from a small space in the Eppley Cancer Institute into larger quarters on the fifth floor of the Fred & Pamela Buffett Cancer Center.

Kurt Fisher, MD, PhD, who was named director of the new entity in the fall of 2024, said he and his team have been busy consolidating those two operations into the new space and starting to process additional samples, predominantly blood samples, in addition to the tissue samples previously handled by the Tissue Procurement Service.

"It is a lot. This represents an expansion of our biobanking operation and moving into the new space, and taking on the Nebraska Biobank and adding employees, and training a new supervisor has been a big step for us," he said. Our tissue procurement person operated mostly out of the TSF and was kind of considered a TSF employee. To understand that we're doing something different, and it has its own name, and it exists in a different location is fundamentally a change for us. Moving outside of tissue to blood and other things is different for us as well."

Team members include Yimin Sun, a research technologist who had worked for the Tissue Procurement Service; Gary Dobesh, a research technologist from the Nebraska Biobank, and Artem Pachikov, in the newly created position of IBB supervisor. "Now we've got a structure similar to the TSF, which is essentially the right hand to our left hand," Dr. Fisher said.

He said one goal for 2026 is gaining biospecimen repository accreditation from the College of American Pathologists (CAP). This is different from the CAP inspections that take place every two years in the department's clinical labs.

"Our CAP inspection will be as a UNMC facility and not a Nebraska Medicine facility. It's a stamp of the highest quality of the right processes, the right equipment, the right systems to make sure everything goes OK. But it's a voluntary program. If we never did it, life would still go on just fine. But that is our goal. So that when someone wants to know how good we are, we can say we have the highest level of accreditation. We're going to initiate the process in January 2026. It could be feasible that it ends in 2026, but I wouldn't be surprised if it's early 2027 when it's all said and done."

2025-2026 pathology residents and fellows

Drs. Singh, Talmon celebrate educational successes, note challenges

The department hosts the Immunology, Pathology & Infectious Disease (IPID) Graduate Program, which is part of the Interdisciplinary Graduate Program in Biomedical Sciences. Dr. Rakesh Singh, vice chair for graduate education for the department, said 2025 was a banner year. "We have the highest number of students in our program that we've ever had," 48 in all, including MS, PhD, and MD/PhD students.

"But the reality is it's going to go down," he said, because of problems with obtaining visas for international students and reductions in federal research funding. "It all depends on faculty and funding. If you have more faculty, if you have more funding, we have more students. Everything is supported by funding."

Dr. Geoff Talmon, senior associate dean of medical education for the UNMC College of Medicine and vice chair of medical education for the department, said funding isn't an issue for the residency and fellowship programs. "The visa problem may be something we have for fellowships, but comparatively it impacts us much less," he said. "What will affect medical students are changes to student loans. Elimination of Grad PLUS, the debt borrowing cap, will definitely affect medical students."

The department can boast two new fellowships. The Human Genetics Laboratory's application for a laboratory genetics and genomics fellowship was approved this year by the Accreditation Council for Graduate Medical Education (ACGME), and their first fellow, Phassawan Rungsiprakarn, started in July. The primary goal of the 24-month program is to train prospective laboratory directors to be proficient in overseeing both clinical cytogenetic/genomic and clinical molecular genetic/genomic analyses. Recruiting is going on for another new fellowship, in Blood Banking and Transfusion Medicine. This one-year fellowship, approved by the ACGME last year, provides comprehensive exposure to all areas of transfusion medicine with special focus on cellular therapy, apheresis, and blood banking in the hospital setting.

The department also has increased its number of pathology residents in the past two years from 12 to 16. "That process is continuing. Our goal is to begin taking four per year and ultimately have 20," Dr. Talmon said. "That means taking five per year. We're continuing the path of growth. We have the case mix to support all these trainees and, as well as everything infrastructurally and faculty mix."

If you're on faculty, "you will have some teaching responsibility," he said. "Whether that be just on the bench as part of a research program, here as part of clinical service—because residents and fellows rotate through the services, you will be teaching in some

way, shape or form. Many of our faculty have leadership roles, too, running a rotation, running a course in the medical school, something of that type. Every faculty member does something educationally related."

One of their goals in 2025 was to begin to involve junior faculty more in education. "These are incredible opportunities for younger or new colleagues carve out a niche for themselves, and it's great for promotion and tenure, too."

Another goal, he said, was to continue to push for more quality improvement projects within the resident and fellowship trainee pool. "It is an ACGME requirement, but the work that has been done has been trying to make that more front and center. We had our second annual QI symposium this last year, which is a great example. We're also recognizing trainees for the best quality improvement projects at our graduation banquet.

"Another thing we're working on strategically is feedback to faculty, making it more timely, making it more transparent, making it more valuable and actionable. We are still in the initial stages of planning."

What is IPID looking at in 2026?

"We are going to continue to recruit," Dr. Singh said. "We are still getting applications."

Strong support from the department has been key to their success, he said. For example, if a lab has a student for several years and then loses funding, the department steps in with funding so the student doesn't have to change labs.

Another positive development was the establishment of the Dr. Thomas L. McDonald Graduate Student Travel Fund. A generous endowment from the estate of the longtime department faculty member helps IPID students travel to national or international conferences.

Dr. Singh said that aside from awards, success in the IPID program is simple. "For me, they have to have good publications and get into a good fellowship wherever they want to go next in their career."

Graduating residents and fellows in 2025 gave a total of 20 presentations in 2024-2025, "which shows their productivity in that regard," Dr. Talmon said. "I think also our board pass rate, our ASCP (American Society for Clinical Pathology) board pass rate, which I think is 100% for the past whatever years. I think those are lower-level metrics of success. High-level metrics of success for me are basically one, are we able to entice, recruit, interest medical students in going into pathology as a career. I think that shows that we're doing our job in that domain. That we're able to recruit residency classes, good residency classes, because that's an external metric of how our program is viewed by applicants, that's viewed as a positive thing, we're going to get a good education there. But I think the ultimate one is, are they able to successfully get fellowships and take their next steps, and are they successful in their careers? Ultimately, I think those are our metrics of success," he said. "The fact that we do have such a high retention rate of our residents speaks to the fact that especially when they go away to fellowship and come back that it's a place that they want to be, it's a place they want to work."

The department's three newest faculty members all have strong UNMC ties. Pranav Renavikar was a resident and fellow here; Ketav Desai completed two fellowships here. Ashley Hein was a medical student and resident at UNMC. "I was an alum, too," Dr. Talmon said. "You can walk around the halls, and you can point to numerous former alums that are now on faculty. I think it shows it's a good place to be, it's a good place to work. The fact that the trainees that we keep also tend to stay for long periods of time shows that the institution in general does a good job of fostering career growth. I can't think of a time that I've ever been told 'no' when I wanted to do something."

Drs. Talmon and Singh said the many educational achievements would not be possible without their staff. "Our team does an incredible job," Dr. Talmon said, noting Dani Blum and Kim Martin, GME senior program coordinators, along with Brianna Templeton, GME/UME program coordinator, and Tuire Cechin, graduate program coordinator.

"Why is it we have two new fellowships now? Because Dani and Kim worked their butts off," Dr. Talmon said. "They did an incredible job. Why is it we're so successful in recruitment? Because the work they do logistically on the back end. Everything we do is in no small part due to the work that they do."

Dr. Singh noted that Martin recently received the Excellence in Program Coordination Award from UNMC's Graduate Medical Education Office. The award recognizes her initiative, hard work and leadership in the department's residency program. And Cechin was a finalist for the award last year, he said.

Sujata Chaudhari, PhD, and doctoral student Claire Garman at an entomological conference

GRADUATE STUDIES

48 IPID STUDENTS
5 MS, 40 PHD, AND 3 MD/PHD)

10 external fellowships

29 peer-reviewed publications

(14 in which graduate students were first author)

18 honors

24 conference presentations

Thomas L. McDonald Travel Award

- Cole Holderjano, Chlamydia Basic Research Society (CBRS), Berlin, Germany
- Haley Knowles, CBRS, Berlin, Germany
- Tyler Zimmerman, CBRS, Berlin, Germany
- Taylor Burke, Staphylococcal Diseases conference, Barcelona, Spain
- Abigail Hall, Staphylococcal Diseases conference, Barcelona, Spain
- Ihyama Gurung, Research Society on Alcohol (RSA) Scientific Meeting/ISBRA Congress, New Orleans
- Mason Mandolfo, Digestive Disease Week, San Diego
- Ashley Peer, Alcohol-Induced End Organ Diseases Seminar & Conference, Ventura, California
- Reegan Sturgeon, American Association for Cancer Research, Chicago

Thomas L. McDonald Distinguished Graduate Student Award

- Francis Fontanilla, for the Chlamydia Basic Research Society (CBRS) Conference in Berlin, Germany
- Gabrielle Schulze, for the Staphylococcal Diseases conference in Barcelona, Spain

Other graduate student award winners from 2024-2025:

- Taylor Burke and Reegan Sturgeon, Outstanding Performance in PAMM 992 – Advanced Topics
- Dylan George and Gabrielle Schulze, Best Oral Presentation and Best Poster Presentation at the Midwest Student Biomedical Research Forum
- Arif Sadi, Best Performance in IPID comprehensive examination
- Taylor Burke and Madison Love, first and second place, Best Presentation at the Graduate Student Research Seminar

Nichole Brandquist, a PhD student and IPID graduate representative, at orientation

RESIDENTS AND FELLOWS

Residents

PGY-4

Thomas Auen, DO, chief resident
Esther Habib, DO
Richard Laye, MD
Casey Schwee, DO

PGY-3

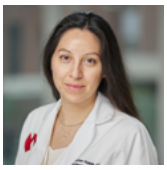
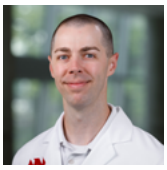
Nila Jones, MD
Rebecca Manzo, DO
Kristina Sevcik, MD

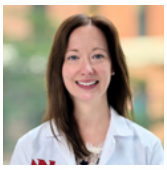
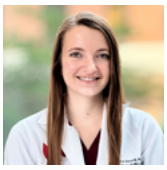
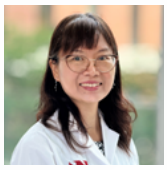
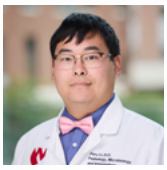
PGY-2

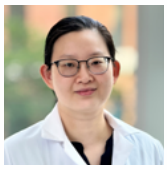
Lili Guo, MD, PhD
Rory Li, DO
Holly Mitzel, MD
Jacqueline Peck, MD
Pauline Xu, MD, PhD

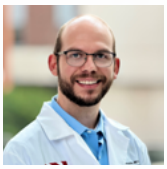
PGY-1

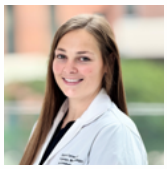
Matthew Carr, DO
Austyn Frassato, MD
Larissa Leiva Pelaez, MD
Sabrina Turner, DO





Fellows

Scott Stevenson, PhD, clinical microbiology

Shawn Freed, PhD, clinical microbiology

Tory Durkin, MD, gastrointestinal/liver & transplant

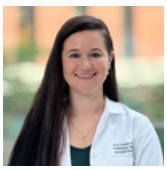
Ahmed Ahmed, MBBCh, hematopathology

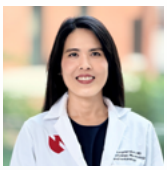
Phassawan Rungsiprakarn, MD, laboratory genetics and genomics

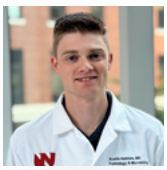
Marika Forsythe, MD, molecular genetic pathology

Austin Helmink, MD, surgical pathology









STATS FOR GRADUATING RESIDENTS AND FELLOWS

49 peer-reviewed publications

(19 in which they were first author)

12 honors

20 conference presentations

Research Grant Awards

- **Ahmed Ahmed, MBBCh, Hematopathology fellow.**

  Study title: AI-based prediction of TP53 immunohistochemical expression from H&E images in myeloid neoplasms. Mentor faculty: Dr. John Cannatella

- **Marika Forsythe, MD, Molecular Genetic Pathology fellow.**

  Study title: Molecular classification of aggressive pituitary neuroendocrine tumors (PitNETs). Mentor faculty is Dr. Allison Cushman-Vokoun.

- **Rebecca Manzo, DO, PGY-3.**

  Study title: Clinicopathologic and molecular characterization of conjunctival melanoma in a multi-institutional study. Mentor faculty is Dr. Dinesh Pradhan.

- **Holly Mitzel, MD, PGY-2.**

  Study title: Exploration of the role of aberrant T-lymphocytes in lymphocyte-rich thymomas and correlation with clinical outcomes. Mentor faculty is Dr. Pranav Renavikar.

- **Phassawan Rungsiprakarn, MD, Laboratory Genetics and Genomics fellow.**

  Study title: Studies of LHX2 as the partner for immunoglobulin gene rearrangement in chronic myeloid leukemia. Mentor faculty is Dr. Zhenya Tang.

- **Pauline Xu, MD, PhD, PGY-2.**

  Study title: Clinicopathologic and molecular characterization of primary gastrointestinal melanoma. Mentor faculty is Dr. Dinesh Pradhan.

- **Nila Jones, MD, PGY-3.**

  Study title: Pathological response for invasive carcinoma of the breast following neoadjuvant therapy: The University of Nebraska Medical Center experience. Mentor faculty is Dr. Mary Edgerton.

- **Jacqueline Peck, MD, PGY-2.**

  Study title: Investigating the mechanisms of beta-lactam resistance in Haemophilus influenzae. Mentor faculty is Dr. Yolande A. Chan.

Other resident and fellowship award winners in 2025 included:

- Nila Jones, MD, Excellence in Peer Resident Teaching Award
- Pranav Renavikar, MBBS, Excellence in Fellow Teaching Award
- Chunyi Zhou, MD, PhD, and Scott Stevenson, PhD, Quality Improvement Project
- Thomas Auen, DO, Best AP Manuscript and Best CP Manuscript
- Pauline Xu, MD, PhD, Best AP Poster/Abstract
- Jacqueline Peck, MD, Best CP Poster/Abstract

2025 GRADUATES

Fellows

Clinical microbiology:

Chunyi Zhou, MD, PhD, Senior Scientist, Department of Pathology, Microbiology and Immunology, University of Nebraska Medical Center, Omaha, NE

Gastrointestinal/liver & transplant:

Zaid Khreefa, MBChB, Staff Pathologist, AmeriPath, Cleveland, OH

Hematopathology:

Kayla Hoerschgen, MD, Hematopathologist, Sanford USD Medical Center, Sioux Falls, SD

Ahmed Sabri, MD, Assistant Professor, Creighton University School of Medicine, Omaha, NE

Molecular genetic pathology:

Ketav Desai, MD, Assistant Professor, Department of Pathology, Microbiology and Immunology, University of Nebraska Medical Center, Omaha, NE

Surgical pathology:

Pranav Renavikar, MBBS, Assistant Professor, Department of Pathology, Microbiology and Immunology, University of Nebraska Medical Center, Omaha, NE

Graduating Residents

- Austin Helmink, MD, Surgical Pathology Fellowship, University of Nebraska Medical Center, Omaha, NE
- Jordan Burr, DO, Cytopathology Fellowship, Duke University, Durham, NC

MS and PhD Graduates

- Aaron Jensen, PhD / Advisor: Dr. Scot Ouellette / Dissertation: “The unfolding saga: The role of the ClpC unfoldase in the development and differentiation of Chlamydia trachomatis”
- Aramis Pereira, PhD / Advisor: Dr. Martin Conda-Sheridan / Dissertation: “Study of peptide amphiphiles as antimicrobial agents”
- Benjamin Girardo, PhD / Advisor: Dr. Marilynn Larson / Dissertation: “Characterization of the Francisella tularensis universal stress protein”
- Dania Sahtout, MS, Fulbright Scholar / Advisor: Dr. Maher Abdalla / Thesis: “Targeting metabolic and heme degradation pathways in prostate cancer: A new therapeutic strategy”
- Elizabeth Klug, PhD / Advisor: Dr. St. Patrick Reid; Co-Advisor: Dr. Joshua Santarpia / Dissertation: “Intrinsic and extrinsic drivers of bioaerosol decay: Investigating pathogen stability of Bacteriophage MS2, Sin Nombre Virus, and SARS-CoV-2 in simulated environments”
- Emily Heaton, MS / Advisor: Dr. Stacey Gilk / Non Thesis Program
- Itidal Reslane, PhD / Advisor: Dr. Paul Fey / Dissertation: “Adaptation through mutation: Arginine auxotrophy in Staphylococcus aureus”
- Jampa (Jhyama) Gurung, MS / Advisor: Dr. Benita McVicker / Thesis: “Role of stabilin-1 expressing macrophages in colorectal liver metastasis”
- Ramia Salloom, PhD / Advisor: Dr. Maher Abdalla / Dissertation: “Therapeutic effects of targeting the heme degradation pathway in prostate cancer”
- Ray Widner, PhD / Advisor: Dr. Lisa Rucks / Dissertation: "The Chlamydia trachomatis inclusion membrane as the confluence between a pathogen and its host"
- Zachary Van Roy, PhD / Advisor: Dr. Tammy Kielian / Dissertation: “Immunoplasticity: A Key Determinant in the Outcome of Neurosurgical Biofilm Infection”

FACULTY

New Faculty

Ketav Desai, MD, assistant professor

Ashley Hein, MD, assistant professor

Pranav Renavikar, MBBS, assistant professor

Promotion and Tenure

Sujata Chaudhari, PhD, promoted to associate professor

Jared Evans, PhD, promoted to associate professor with tenure

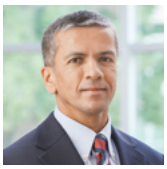
Kurt Fisher, MD, PhD, promoted to associate professor with tenure

Zhenya Tang, MD, PhD, FACMG, professor, awarded tenure

Department Awards

James Newland Distinguished Pathology Educator

Subodh Lele, MD, and David Wagner, MD




Mentorship Excellence Award, Clinical Faculty

Scott Koepsell, MD, PhD

Mentorship Excellence Award, Research Faculty

Stacey Gilk, PhD

Mentorship Excellence Award

Tammy Kielian, PhD

Heart of Clinical Care Award

Subodh Lele, MD

Exemplary Citizenship Medal

Ana Yuil-Valdes, MD

Harold M. Maurer Outstanding Resident Educator

Audrey Lazenby, MD

UNMC Awards

Outstanding Teacher Award

Geoff Talmon, MD

ITEACH Distinguished Mentor Award

Vinai Thomas, PhD

New Investigators

Maher Abdalla, PhD, and Kurt Fisher, MD, PhD

Distinguished Scientist

Stacey Gilk, PhD

University of Nebraska Medical Center

Department of Pathology,
Microbiology and Immunology
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Omaha, NE 68198-5900
402-559-6442 | unmc.edu/pathology