

OGAN K. KUMOVA, PHD

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RESEARCH SUMMARY

Immunologist specializing in neonatal host defense, respiratory viral immunity, and vaccine development. Doctoral and postdoctoral research established foundational mechanisms by which neonatal immune systems fail to control influenza infection — identifying roles for type I interferons, oxidative stress, cathelicidin antimicrobial peptides, and TLR2 signaling in neonatal immunopathology. Postdoctoral work at the FDA focused on *Neisseria* spp. vaccine platforms (liposome and OMV-based) under the NIH-U19 Gonorrhea Vaccine Cooperative Research Center. Fifteen peer-reviewed publications; two National Academies editorial volumes on vaccine safety. BD-certified in flow cytometry; experienced in murine model systems and animal husbandry.

RESEARCH INTERESTS

Neonatal innate and adaptive immunity | Influenza virus pathogenesis | Mucosal immunology | Vaccine development (bacterial and viral) | Outer membrane vesicle (OMV) platforms | Type I interferon biology | T-cell immunology | *Legionella* pathogenesis

TECHNICAL SKILLS & CERTIFICATIONS

Flow Cytometry

- BD-certified in flow cytometry; extensive experience with multi-parameter panel design, instrument operation, and data analysis (FlowJo).
- Applied to characterization of neonatal T cell subsets, activation markers (CD31, IFN- γ , CD8), and innate immune populations.

Animal Husbandry & In Vivo Models

- Experienced in murine colony management, breeding, genotyping, and daily health monitoring in AAALAC-accredited facilities.
- Performed intranasal influenza infection models, murine ascending gonorrhea infection models, and neonatal immunization studies.
- Skilled in murine tissue harvest (lung, spleen, lymph nodes, blood), BAL collection, and neonatal handling.

Immunological & Molecular Techniques

- ELISA, ELISpot, cytokine multiplex assays, Western blot, SDS-PAGE, immunofluorescence/immunohistochemistry.
- RNA extraction, qRT-PCR, bulk RNA-seq analysis, transcriptomic data interpretation.
- Cell culture (primary cells and cell lines), PBMC isolation, T cell stimulation assays.
- Liposome formulation and outer membrane vesicle (OMV) preparation for vaccine platforms.
- Bacterial culture and intracellular infection assays (*Legionella*, *Neisseria*).
- Biofilm assays, confocal microscopy.

Bioinformatics & Data Analysis

- Background in bioinformatics (BS, University of the Sciences); RNA-seq pipeline analysis, TCR repertoire analysis.
- Statistical analysis and data visualization (R, GraphPad Prism).

Laboratory Administration

- Grant budget management, supply ordering, credit card reconciliation, regulatory compliance (IACUC, IBC).
- Personnel supervision, onboarding, and training of graduate students and research staff.

EDUCATION

Doctor of Philosophy in Microbiology & Immunology

August 2015 – July 2020

Drexel University College of Medicine, Philadelphia, PA | GPA: 4.0

Dissertation: Altered Innate Immune Responses to Influenza in the Neonate

Minor: Health Administration | Laboratory of Dr. Alison Carey, MD

Master of Science in Infectious Diseases

January 2013 – May 2015

Drexel University College of Medicine, Philadelphia, PA | GPA: 3.97

Bachelor of Science in Biochemistry & Bachelor of Science in Bioinformatics

August 2005 – May 2009

University of the Sciences in Philadelphia, PA | Minor in Mathematics

RESEARCH EXPERIENCE

Program Officer, Vaccine Safety

February 2023 – Present

National Academies of Sciences, Engineering, and Medicine, Washington, D.C.

- Leads expert committee reviews synthesizing vaccine safety and adverse event evidence for federal agencies (CDC, FDA).
- Edited: Evidence Review of the Adverse Effects of COVID-19 Vaccination (2024) and Vaccine Risk Monitoring and Evaluation at the CDC (2025), National Academies Press.

ORISE Postdoctoral Research Fellow

October 2020 – February 2023

U.S. Food and Drug Administration, Silver Spring, MD | PI: Margaret C. Bash, MD, MPH

- Developed and characterized liposome- and outer membrane vesicle (OMV)-based *Neisseria gonorrhoeae* vaccine candidates.
- Designed and executed murine ascending infection models, including animal husbandry, colony management, inoculation, tissue harvest, and endpoint analysis.
- Evaluated immunization route and adjuvant formulation for induction of anti-gonococcal mucosal and systemic immune responses.
- Collaborated across NIH-U19 Gonorrhea Vaccine Cooperative Research Center multi-site team.

Doctoral Researcher

August 2015 – July 2020

Drexel University College of Medicine, Philadelphia, PA | PI: Alison Carey, MD

- Defined mechanisms underlying increased mortality in neonatal influenza infection: type I IFN overactivation, oxidative stress, and innate immune hyperresponsiveness (*Mucosal Immunology* 2022, *PLoS Pathogens* 2019).
- Maintained murine breeding colonies, performed neonatal infection models, and conducted longitudinal survival studies with daily health monitoring.
- Demonstrated that intranasal *Lactobacillus rhamnosus* GG restores transcriptional responsiveness and improves viral control in neonatal lungs.
- Characterized neonatal CD8⁺ T cell defects, effector CTL trafficking, and CD31 expression using multi-parameter flow cytometry (BD-certified).
- Contributed to multi-institutional studies on neonatal BPD and TCR repertoire in extremely preterm neonates.

Laboratory Manager

December 2014 – August 2015

Drexel University College of Medicine | PI: Alison Carey, MD

- Managed daily laboratory operations, regulatory compliance (IACUC, IBC), equipment maintenance, and personnel supervision.
- Coordinated supply ordering, vendor relationships, and credit card transactions for laboratory purchases.
- Assisted with grant management and budget tracking, including expenditure reconciliation and reporting.
- Handled general administrative duties including scheduling, onboarding new personnel, and maintaining laboratory records.

Laboratory Technician II

December 2012 – December 2014

Drexel University College of Medicine | PI: Shira Ninio, PhD

- Characterized biofilm regulation and OmpA-like proteins in *Legionella pneumophila*, contributing to two peer-reviewed publications (*Biomolecules* 2022, *FEMS Microbiology Letters* 2016).
- Managed supply ordering, credit card transactions, and vendor coordination for laboratory purchasing.

- Supported grant budget management and administrative duties including record-keeping and regulatory compliance documentation.

PEER-REVIEWED PUBLICATIONS

- Rao AS, Onufer AP, Kumova OK, Roberts LTN, Mossabeb R, Pascasio J, Carey AJ. Myeloid TLR2 signaling amplifies immunopathology in influenza-infected murine neonates. *American Journal of Respiratory Cell and Molecular Biology*. In press.
- Matthias KA, Connolly KL, Jerse AE, Kumova OK, Macintyre AN, Gray MC, Thomas KS, Criss AK, Zielke RA, Li L, Sikora AE, Ramirez-Bencomo F, Thistlethwaite A, Derrick JP, Lu WE, Bash MC. Evaluation of immunization route in induction of vaccine-mediated anti-gonococcal immune responses in a murine model of ascending infection. *Journal of Infectious Diseases*. 2025;232(5):e765–e777. PMID: 40971931.
- Rao AS, Ugwu N, Onufer AP, Kumova OK, Carey AJ. Cathelicidin-related antimicrobial peptide (CRAMP) is toxic during neonatal murine influenza virus infection. *Journal of Immunology*. 2025;214(5):1022–1031. PMID: 40101750.
- Kumova OK, Galani IE, Rao A, Johnson H, Triantafyllia V, Matt SM, Pascasio J, Gaskill PJ, Andreakos E, Katsikis PD, Carey AJ. Severity of neonatal influenza infection is driven by type I interferon and oxidative stress. *Mucosal Immunology*. 2022;15(6):1309–1320. PMID: 36352099.
- Marin C, Kumova OK, Ninio S. Characterization of a novel regulator of biofilm formation in the pathogen *Legionella pneumophila*. *Biomolecules*. 2022;12(2):225. PMID: 35204726.
- Das P, Acharya S, Prahaladan VM, Kumova OK, Malaeb S, Behera S, Agarwal B, Christensen DJ, Carey AJ, Bhandari V. Chitin-derived AVR-48 prevents experimental bronchopulmonary dysplasia and BPD-associated pulmonary hypertension in newborn mice. *International Journal of Molecular Sciences*. 2021;22(16):8547. PMID: 34445253.
- Chaubey S, Nader YM, Shah D, Kumova OK, Prahaladan VM, Carey AJ, Andersson S, Bhandari V. α 1,3-Fucosyltransferase-IX, an enzyme of pulmonary endogenous lung stem cell marker SSEA-1, alleviates experimental bronchopulmonary dysplasia. *Pediatric Research*. 2021;89(5):1126–1135. PMID: 32303051.
- Gary E, O'Connor M, Chakhtoura M, Tardif V, Kumova OK, Malherbe DC, Sutton WF, Haigwood NL, Kutzler MA, Haddad EK. Adenosine deaminase-1 enhances germinal center formation and functional antibody responses to HIV-1 envelope DNA and protein vaccines. *Vaccine*. 2020;38(22):3821–3831. PMID: 32280045.
- Kumova OK, Fike AJ, Thayer JL, Nguyen LT, Mell JC, Pascasio J, Stairiker C, Leon LG, Katsikis PD, Carey AJ. Lung transcriptional unresponsiveness and loss of early influenza virus control in infected neonates is prevented by intranasal *Lactobacillus rhamnosus* GG. *PLoS Pathogens*. 2019;15(10):e1008072. PMID: 31603951.
- Fike AJ, Kumova OK, Carey AJ. Dissecting the defects in the neonatal CD8⁺ T-cell response. *Journal of Leukocyte Biology*. 2019;106(5):1051–1061. PMID: 31260598. (Review)
- Fike AJ, Kumova OK, Tardif VJ, Carey AJ. Neonatal influenza-specific effector CTLs retain elevated CD31 levels at the site of infection and have decreased IFN- γ production. *Journal of Leukocyte Biology*. 2019;105(3):539–549.
- Carey AJ, Hope JL, Mueller YM, Fike AJ, Kumova OK, van Zessen DBH, Steegers EAP, van der Burg M, Katsikis PD. Public clonotypes and convergent recombination characterize the naïve CD8⁺ T-cell receptor repertoire of extremely preterm neonates. *Frontiers in Immunology*. 2017;8:1859.
- Fike AJ, Nguyen LT, Kumova OK, Carey AJ. Characterization of CD31 expression on murine and human neonatal T lymphocytes during development and activation. *Pediatric Research*. 2017;82(1):133–140.
- Goodwin IP, Kumova OK, Ninio S. A conserved OmpA-like protein in *Legionella pneumophila* required for efficient intracellular replication. *FEMS Microbiology Letters*. 2016.
- Carey AJ, Gracias DT, Thayer JL, Boesteanu AC, Kumova OK, Mueller YM, Hope JL, Fraietta JA, van Zessen DB, Katsikis PD. Rapid evolution of the CD8⁺ TCR repertoire in neonatal mice. *Journal of Immunology*. March 2016;196(6):2602–2613. PMID: 26873987.

EDITORIAL WORK

Vaccine Risk Monitoring and Evaluation at the CDC. Editor. National Academies Press, 2025.

Evidence Review of the Adverse Effects of COVID-19 Vaccination. Editor. National Academies Press, 2024.

TEACHING EXPERIENCE

Senior Adjunct Faculty

August 2020 – Present

Rowan University / Rowan College at Burlington County – STEM Division

- Creator and lead instructor for BIO 112: Health and Human Microbiology, designed from the ground up for health-profession students.
- Teaches BIO 155: Basic Microbiology; BIO 120: Biology I; BIO 122: Biology II.
- Delivers all courses across in-person, hybrid, and fully asynchronous online formats.

Visiting Lecturer

March 2022 – 2025

Uniformed Services University Medical College

- Delivered graduate and medical school lectures in Molecular Pathogenesis.

Lecturer & Graduate Teaching Assistant

March 2015 – Present

Drexel University College of Medicine – Graduate School of Biomedical Sciences

- Lectures for PhD and medical students: Vaccine Development (MIIM-524), Medical Microbiology, Immunology I (MIIM-607): Antiviral Immunity, CD8+ T Cells, NK Cells, Apoptosis.
- TA for MIIM-512 & MIIM-521 (Molecular Pathogenesis I & II); CRLA Level II Certified Tutor.
- Guest lecturer: Introduction to Infectious Diseases; Clinical Correlations in Infectious Diseases; Clinical Correlation in Immunology.

Adjunct Faculty

January 2012 – June 2013

Drexel University – School of Arts and Sciences & Goodwin College of Professional Studies

- Taught Chemistry II, Physical Chemistry Lab, Organic Chemistry Lab, Analytical Chemistry/Instrumental Analysis, Chemistry for Engineers, Chemistry for Health Science.

Adjunct Faculty

December 2010 – 2015

Philadelphia University – School of Science and Health

- Chemistry I & II (lecture and laboratory). Developed curricula for chemistry labs and Critical Evaluation of Primary Scientific Literature. Consulted on laboratory facility redesign.

Teaching Assistant & Instructor

August 2007 – September 2010

University of the Sciences – Departments of Chemistry & Biochemistry and Biological Sciences

- Instructor: General Chemistry Labs CH 102 & CH 104; Critical Evaluation of Primary Scientific Literature.
- TA: Principles of Chemistry Lab, Biochemistry Lab, Chemical Sciences Orientation, Organic/Physical/Analytical Chemistry Labs; Forensic Anthropology (UPenn Museum of Archaeology and Anthropology).

Museum Educator

May 2003 – March 2020

Franklin Institute Science Museum, Philadelphia, PA

- Delivered inquiry-based science programming for diverse public audiences; developed curriculum and summer camp activities.