

PRIMIR in the News: Featured by the NIH

The Wake Forest University School of Medicine's Preclinical Imaging and Irradiation (PRIMIR) Facility was recently highlighted by the NIH Office of Research Infrastructure Programs (ORIP) as a state-of-the-art center advancing preclinical imaging and radiation research. The facility integrates PET/CT, MRI, and irradiation technologies in a single location, supporting innovative studies in aging, Alzheimer's disease, neuro-oncology, diabetes, substance use disorders, and radiation research. Since opening, PRIMIR has strengthened collaboration, improved research efficiency, and enhanced animal welfare by consolidating imaging and treatment capabilities on one campus.

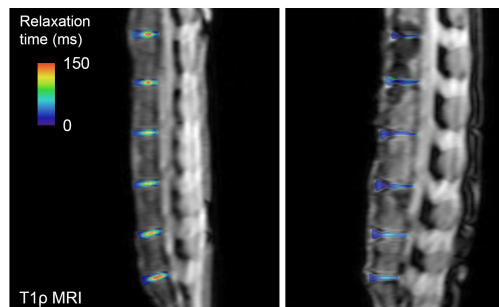
Read the NIH Feature:

<https://orip.nih.gov/about-orip/research-highlights/orips-co6-builds-powerhouse-preclinical-imaging-and-irradiation>

Research in Action at PRIMIR...

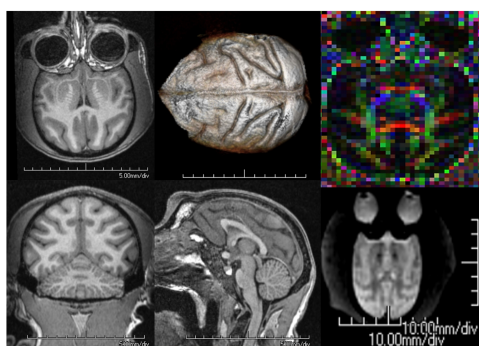
Researchers from WFUSM and Atrium Health Charlotte are launching a new study at the PRIMIR facility to investigate how aging and radiation exposure affect spinal disc health. Using advanced quantitative MRI techniques, the team will evaluate biochemical changes associated with disc degeneration in NHP from the Radiation Late Effects Cohort (RLEC). The study aims to define normal patterns of disc aging, assess the effects of radiation exposure, and improve our understanding of changes associated with chronic low back pain.

Investigators: **Noah Bonnheim**, PhD., Dept of Orthopedic Surgery, Atrium Health Musculoskeletal Institute, WFUSM (Charlotte campus); **Megan Lipford**, PhD, Department of Radiology; **George W. Schaaf**, DVM, Department of Radiation Oncology; and **J. Mark Cline**, DVM, PhD, Department of Pathology and the WFPRC. Special thanks to Dr. Lipford for her contributions to the development of this project.



Relaxation time maps from T1p MRI of the lumbar intervertebral discs from two 15-year-old male rhesus macaques. **Left:** Healthy lumbar discs with minimal degeneration. **Right:** Extensive disc degeneration. T1p relaxation times associate with levels of proteoglycans and water, providing virtual biopsies of cartilage composition.

... And More Projects

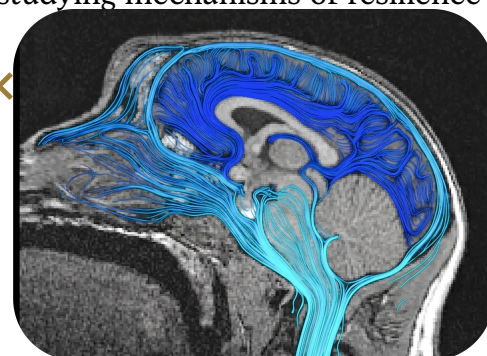


Investigator: **J. Mark Cline**, DVM, PhD
Representative multimodal brain MRI acquired in a rhesus macaque at the PRIMIR facility.

throughout the ventricular system and surrounding spaces, providing new insights into cerebrospinal fluid circulation and its potential role in aging and neurological health. This emerging approach offers exciting opportunities for collaborative research in neuroimaging, brain aging, and translational neuroscience.

The RLEC provides a unique multimodal MRI resource for investigating how radiation exposure and aging influence the brain across the lifespan. Structural, diffusion, and perfusion imaging offer complementary measures of brain anatomy, white matter integrity, and cerebral blood flow, creating a powerful platform for studying mechanisms of resilience and decline.

Dr. **Jeongchul Kim**, PhD is utilizing the RLEC to advance MRI methods for studying cerebrospinal fluid (CSF) dynamics in the aging brain. Using phase-contrast MRI, researchers can visualize and quantify fluid motion



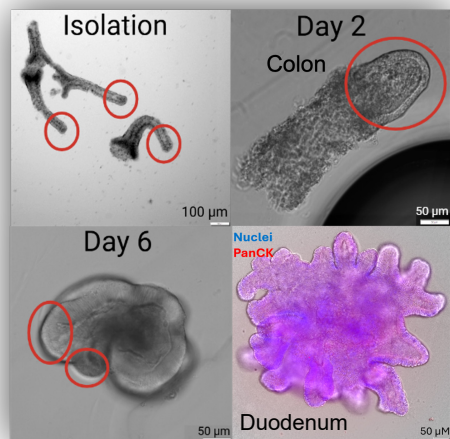
Phase-contrast MRI visualization of CSF flow pathways in the rhesus macaque brain, illustrating patterns of fluid movement and circulation.

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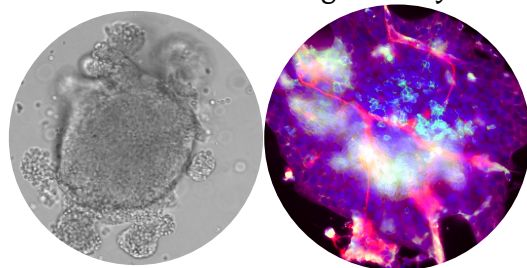
From Cells to Solutions: Organoid Innovation at WFPRC

WFPRC researchers are developing NHP organoid models as innovative platforms that complement in vivo studies and support the advancement of NAMs. Led by Dr. **Cecilia Schaaf**, DVM, PhD., an intestinal epithelial organoid project funded through the WFPRC pilot program is examining how radiation exposure affects epithelial stem cell regeneration and barrier function. Preliminary analyses of organoids derived from RLEC animal colonoscopy biopsies suggest a trend toward reduced initial growth in organoids from previously irradiated animals, providing new insights into long-term effects on intestinal tissue regeneration.



Isolation and culture of NHP intestinal organoids. Stem cell-containing crypts (red circles) were isolated from intestinal tissue and developed into organoid structures by Day 2, with further growth and maturation by Day 6. A duodenal organoid is shown stained for nuclei (blue) and pan-cytokeratin (PanCK, red).

Complementing this work, Drs. **C. Schaaf**, **David Caudell** and **Gaya Balamayooran** are developing thymic organoids to recreate the thymic microenvironment and investigate radiation-induced changes in thymic function. This emerging platform is designed to support mechanistic studies of tissue injury and provide a rapid screening tool for potential medical countermeasures before advancing to in vivo testing. Together, these efforts are creating powerful new tools for studying tissue regeneration, disease mechanisms, and future therapeutic strategies.



Novel NHP thymic microenvironment organoid model for investigating long-term radiation effects on immune and thymic function. Day 10 3D organoid showing nuclei (blue), epithelial cells (EpCAM⁺, magenta), thymocytes (CD45⁺, green), and fibroblasts (Vimentin⁺, red).

New Research Highlights a Potential Treatment for Alcohol Use Disorder

A study led by Prof. **Paul W. Czoty**, PhD, and colleagues identified a promising approach for reducing alcohol consumption using a highly translational NHP model. The team evaluated medications that target acetylcholine receptors, including FDA-approved compounds with potential to be rapidly repurposed



Prof. P. Czoty
Translational Neuroscience

for clinical use. A combination of xanomeline/trospium significantly reduced alcohol drinking without the side effects observed with xanomeline alone. Because this drug combination is already FDA-approved as Cobenfy™ for schizophrenia, the findings may accelerate its evaluation as a treatment for alcohol use disorder.

www.sciencedirect.com/science/article

WFPRC in the Media

Dr. **Michael A. Nader**, PhD, Prof. of Translational Neuroscience and Co-Director of the Center for Addiction Research at WFUSM, was recently a guest on Northwest AHEC's *Healthcare Insights* podcast. In the episode, "Behavioral Models for Understanding Drugs of Abuse," Dr. Nader discusses how NHP models and advanced brain imaging approaches have helped improve our understanding of addiction, dopamine receptor function, sex differences, and individual variability in responses to drugs of abuse. Drawing on more than three decades of research with NHP models, Dr. Nader highlights the role of translational neuroscience in developing more effective strategies for preventing and treating substance use disorders.

Listen to the podcast: SoundCloud Healthcare Insights Episode 156



Research Spotlight

VRC Research in the Spotlight

✦ Dr. **Brett M. Frye** received an Honorable Mention in the 2026 GeroScience Outstanding Original Research Paper Award, presented at the American Aging Association's 54th Annual Meeting in Provo, Utah. The recognition highlights the impact of research conducted through the Vervet Research Colony (VRC).

✦ VRC research was featured at the 2026 American Society of Primatologists Annual Meeting in Arlington, Virginia. In addition to Frye's presentation, **Sydney Deal**, a former VRC summer student in Dr. **Carol Shively's** laboratory, presented a poster, while **Sarah Marion**, presented her research during a podium session. Together, these accomplishments reflect both the scientific impact of the VRC and its commitment to training future researchers.



The Wake Forest Vervet Research Colony, led by Prof. **Matthew Jorgensen**, PhD, is a national NHP research resource supported by NIH grant P40-OD010965.

ASP 2026 (left to right): Sydney Deal, Sarah Marion, and Brett Frye

WFPRC at Scientific Meetings

WFPRC continues to share its research and expertise through presentations, posters, and collaborations at scientific meetings and conferences:

"Program for Lung Health Research Symposium" (June 8, 2026; Biotech Place, Winston-Salem, NC), WFPRC members participated in scientific sessions, and the poster session, with faculty, postdoctoral fellows, and graduate students presenting their research.

52nd Annual Southeastern Veterinary Pathology Conference (SEVPAC) (May 15-16, 2026; Tifton, GA): Dr. **Gayathriy Balamayooran**, DVM, PhD and Dr. **Clemer Abad**, DVM presented scientific talks, sharing their research with colleagues from the veterinary and comparative pathology community.



*G. Balamayooran, DVM, PhD
52nd SEVPAC, 2026*



*Ellen Quillen, PhD Lung
Health Symposium*

Virginia Tech College of Veterinary Medicine

(June 15-16, 2026; Blacksburg, VA): **J. Mark Cline**, DVM, PhD presented two invited talks, including a career development session for veterinary students and a primate pathology lecture for the pathology group.

Radiation Research Society Annual Meeting, Waikoloa, Hawaii (Oct. 4-7, 2026): WFPRC researchers and collaborators had eight abstracts accepted (1 oral presentation, 7 posters), highlighting radiation-induced late effects, imaging biomarkers, cardiovascular and CNS complications, intestinal regeneration, and cellular resilience in NHP models. Dr. **G. Schaaf** also received a Travel Award.



DID YOU KNOW?

Clarkson Campus Tours: Inspiring the Next Generation of Scientists

Clarkson Campus Tours provide students, educators, and community members with a unique opportunity to explore biomedical research, animal welfare programs, and the dedicated professionals who support scientific discovery. Visitors gain insight into research oversight, species-specific housing and enrichment practices, and the career opportunities available in animal care, veterinary medicine, and research. Through engaging educational experiences and firsthand exposure to the campus, the program fosters curiosity, learning, and a deeper understanding of the research enterprise.

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PUBLICATIONS

From April through September 2026, WFPRC investigators published more than 20 PubMed-indexed studies involving nonhuman primate models, highlighting the continued breadth and impact of WFPRC research. Selected publications are listed below:

Attrill E, Krainiak S, Santiago M, Kavanagh K. **Contrast enhanced ultrasound and laser doppler flowmetry capture distinct aspects of tissue microvascular perfusion in nonhuman primates.** *Physiol Rep.* 2026 Aug;14(15):e71038. doi: 10.14814/phy2.71038. PMID: 42568181; PMCID: PMC13451646.

Cronin EA, Galbo-Thomma LK, Epperly PM, Blough BE, Landavazo A, Gould RW, Czoty PW. **Effects of chronic treatment with acetylcholine receptor agonists on ethanol self-administration in male cynomolgus monkeys.** *Eur J Pharmacol.* 2026 Aug 6;1032:179199. doi: 10.1016/j.ejphar.2026.179199. PMID: 42562046.

Crofts KF, Holbrook BC, Page CL, Hendrix CJ, Caudell D, Gillespie RA, D'Agostino RB Jr, Moin SM, Sangesland M, Ornelles DA, Kanekiyo M, Alexander-Miller MA. **A dual-adjuvanted HA stem nanoparticle vaccine elicits a multifunctional antibody response that is associated with protection in newborn monkeys.** *Cell Rep Med.* 2026 May 19;7(5):102746. doi: 10.1016/j.xcrm.2026.102746. PMID: 41997140; PMCID: PMC13198238.

Stapleton-Kotloski J, Rowland J, Davenport A, Epperly P, Blevins M, Godwin D, Ewing D, Liang Z, Sundaram A, Petrovsky N, Porter K, Sanders J, Daunais J. **Magnetoencephalography Reveals Neuroprotection of COVID-19 Vaccination in Nonhuman Primates.** *Vaccines (Basel).* 2026 Jun 20;14(6):543. doi: 10.3390/vaccines14060543. PMID: 42347664; PMCID: PMC13307603.

Czoty PW, Solingapuram Sai KK, Miller MD, Moore MD, Myburgh PJ, Grace LR, Prete JN, Epperly PM. **Sex-Specific Relationships Between Nociceptin/Orphanin FQ Peptide (NOP) Receptors and Alcohol Drinking: Longitudinal PET Studies in Cynomolgus Monkeys.** *Basic Clin Pharmacol Toxicol.* 2026 Sep;139(3):e70282. doi: 10.1111/bcpt.70282. PMID: 42587351.

Lyke MM, Bagwell A, Newman D, Galindo S, Church T, Christensen C, Gray SB, Cox LA, Ross CN, Kaushal D, Cheeseman IH, Cole SA. **Mergers and migrations: drivers of population genetic structure in a captive rhesus macaque colony.** *BMC Genomics.* 2026 Jun 18. doi: 10.1186/s12864-026-13090-2. PMID: 42316366.

Bennett RF, Speiser JL, Olson JD, Schaaf GW, Register TC, Cox LA, Cline JM, Quillen EE. **Developing and internally validating AI-based aging resilience biomarkers in non-human primates.** *J Gerontol A Biol Sci Med Sci.* 2026 May 7;81(6):glag112. doi: 10.1093/gerona/glag112. PMID: 42093008; PMCID: PMC13195804.

Prakash B, Chang Z, Rajan S, Scarberry SR, Gangula B, Hossain MM, Prakashmurthy C, Valmiki S, Pulatov O, Yadav PK, Carsons SE, Temel RE, Kavanagh K, Sheng J, Hussain MM. **MicroRNA-30c analog C2 decreases plasma cholesterol and atherosclerosis without causing liver injury in preclinical studies.** *Nat Commun.* 2026 Apr 24;17(1):5655. doi: 10.1038/s41467-026-72276-0. PMID: 42026066; PMCID: PMC13315606.

Johnson BJ, Lipford ME, Barcus RA, Schaaf GW, Andrews RN, Kim J, Olson JD, Deycmar S, Reed CA, Whitlow CT, Cline JM. **Total-body Irradiation Reduces Cerebrovascular Reactivity in Rhesus Macaques (Macaca mulatta).** *Int J Radiat Oncol Biol Phys.* 2026 Jul 15;125(4):1190-1201. doi: 10.1016/j.ijrobp.2026.01.043. PMID: 41690557; PMCID: PMC13088117.

Stay Connected

We welcome your feedback and suggestions for future issues, including topics, facilities, and research highlights you would like to see featured in upcoming newsletters.

We also invite you to participate in our **Journal Club Series**, developed in collaboration with Prof. Carol Shively, focusing on Nonhuman Primate Models of Aging and Brain Health. Sessions are held monthly (first Tuesday, 3-4 PM, virtual), and all members and collaborators are welcome.

Contact us: Alessandro.Gonzalezsalerno@wfusm.edu or primates@wfusm.edu



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