

## Curriculum Vitae

**Updated:** October 2025

**Full name:** David Alan Kitzenberg

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### Education

M.D., 2025  
Ph.D., Molecular Biology, 2022  
**University of Colorado School of Medicine—Medical Scientist Training Program**

B.A., *Summa Cum Laude*, Integrative Physiology, 2012  
Certificate, Interdisciplinary Undergraduate Program in Neuroscience  
**University of Colorado Boulder**

### Experience Timeline

2022 – Present	Cofounder & CEO, Primer Pharmaceuticals Corp
2023 – 2024	Denver Scale Up Network (DENSUN) Blackstone Entrepreneurship Network - Executive Entrepreneurial Growth and Development Program
2016 – 2025	Medical and Graduate Student, University of Colorado School of Medicine
2014 – 2016	Professional Research Assistant, Lab of Sean Colgan, Department of Medicine, University of Colorado School of Medicine
2015	Scientific Consultant, Dowd & Dowd P.C., St Louis, MO

2013 – 2014	Professional Research Assistant, Lab of Wallace Chick, Cell and Developmental Biology, University of Colorado School of Medicine
2012	Certified Nurse Aide (CNA), St. Paul Health Short-term Rehab & Long-term Care Facility, Denver, CO
2010 – 2012	Undergraduate Research Assistant, Lab of Thomas E. Johnson, Institute for Behavioral Genetics, University of Colorado Boulder
2007 – 2012	Undergraduate Student, Integrative Physiology, University of Colorado Boulder

## Narrative Work and Research Experience

### Cofounder & CEO, January 2022 – Current

Primer Pharmaceuticals Corp

I founded Primer Pharmaceuticals based on concepts and technologies developed during my doctoral research. The company's scientific foundation builds on emerging research demonstrating that antibiotic tolerant and persistent bacteria contribute to treatment failure, recurrent and chronic infections, and the acquisition of antibiotic resistance. To address this, we employ proprietary high-throughput screening platforms to identify and develop novel small molecule antibiotic adjuvants that enhance drug efficacy against these difficult-to-treat bacterial populations.

As CEO, I have overseen both the scientific and business strategy of the company, requiring broad expertise and leadership across multiple domains:

- **Scientific Leadership:** Functioned as CSO, driving the research strategy by designing and executing experiments, improving data workflows, and advancing drug screening technologies.
- **Corporate Formation & Compliance:** Established the company as a C-corporation, ensured laboratory and legal compliance, and successfully negotiated technology acquisition from the University of Colorado Anschutz Medical Campus CU Innovations technology transfer office.
- **Business Development & Finance:** Directed company finances, including procurement, budgeting, and bookkeeping. Led fundraising initiatives through investor presentations, state and federal grant submissions, and private funding proposals.
- **Infrastructure Building:** Managed the buildout of our research laboratory and office space. Recruited a team of experienced business advisors, strengthening the company's long-term strategic foundation.

This role has provided me with cross-disciplinary experience spanning biotechnology innovation, business strategy, and organizational leadership. It has strengthened my ability to translate complex scientific insights into actionable strategies.

### **Graduate Student, June 2018 – July 2022**

Labs of Dr. Daniel J. Kao, and Dr. Sean P. Colgan, Mucosal Inflammation Program, Division of Gastroenterology and Hepatology, University of Colorado School of Medicine

My primary research focused on strategies to eradicate antibiotic tolerant and persistent bacteria by targeting bacterial metabolism. Key findings and contributions include:

- **Mechanistic Discovery:** Demonstrated that extracellular adenosine is actively taken up by diverse bacterial species via the purine salvage pathway, driving respiration in both aerobic and anaerobic conditions. This metabolic activation increased ATP, GTP, and rRNA synthesis, counteracting hallmarks of bacterial tolerance and persistence.
- **Therapeutic Implications:** Showed that coadministration of select small molecules with multiple classes of antibiotics significantly enhanced the killing of tolerant and persister bacterial pathogens.
- **Technology Development:** Designed and implemented a high-throughput screening platform to identify structurally diverse compounds capable of targeting tolerant and persister bacteria.
- **Resistance Studies:** Investigated the emergence of antibiotic resistance through both in vitro evolution assays and in vivo germ-free mouse models to assess long-term therapeutic impact.

This work provided novel insights into bacterial tolerance and persistence, identified potential adjuvant therapies to improve antibiotic efficacy, and established innovative experimental platforms for drug discovery and translational research.

### **Scientific Consultant, 2015**

Dowd & Dowd P.C., St Louis, MO

Consulted as a scientific expert for a wrongful death case involving a rare fungal infection at a regional hospital. Responsibilities and contributions included:

- **Literature & Evidence Review:** Researched and identified primary scientific literature linking a rare fungal infection to contaminated water sources, providing critical context for the case.
- **Medical Chart Analysis:** Conducted in-depth review of 2,000+ pages of medical records to reconstruct clinical events and assess the progression of infection.
- **Expert Communication:** Translated complex medical and scientific findings into clear, accessible explanations for the legal team, enabling effective litigation strategy.

- **On-Demand Expertise:** Served as the point of contact for all technical scientific and medical inquiries during discovery, providing timely and well-supported answers.

This role required integrating scientific literature discovery with effective communication, bridging the gap between technical research and legal strategy.

### **Professional Research Assistant, September 2014 – June 2016**

Lab of Dr. Sean P. Colgan, Mucosal Inflammation Program, Department of Medicine, Division of Gastroenterology and Hepatology, University of Colorado School of Medicine

Project 1: This project investigated the role of HIF1 $\beta$  in regulating mitophagy and xenophagy in intestinal epithelial cells, and included:

- **Molecular Regulation:** Profiled mRNA and protein expression of autophagy-associated proteins (PARKIN, BNIP3, p62, LC3) in wild-type, HIF-1 $\beta^{\Delta IEC}$ , and ODD-luciferase mice.
- **In Vivo Pathogen Studies:** Performed *Salmonella* Typhimurium murine infection assays, which included inoculation, dissection, and tissue processing to quantifying bacterial load in intestine, spleen, and liver of wild-type vs. HIF-1 $\beta^{\Delta IEC}$  mice.
- **In Vitro Functional Studies:** Conducted bacterial invasion assays in cultured epithelial cells under conditions of autophagy inhibition and stimulation.
- **Assay Development:** Cloned and applied fluorescent-LC3 constructs with immunofluorescence microscopy to visualize autophagosome-bacteria colocalization.
- **Key Finding:** Demonstrated that HIF1 $\beta$  regulates multiple autophagy proteins critical for mitochondrial clearance and intracellular bacteria during host cell infection.

Project 2: HIF1 $\beta$  regulation of claudin-1 and barrier function. This project explored the regulatory role of HIF1 $\beta$  on the tight junction protein claudin-1 (CLDN1) and its contribution to intestinal epithelial barrier integrity. This work included:

- **Gene Silencing:** Generated lentiviral shRNA constructs targeting HIF1 $\beta$  and CLDN1 to create stable cell lines and subsequently validate knockdown via RT-qPCR and western blot.
- **Cell Junction Characterization:** Assessed epithelial junction morphology using immunofluorescence staining of junctional proteins.
- **Barrier Function Assays:** Evaluated epithelial barrier integrity through FITC-dextran flux assays and calcium switch transepithelial resistance measurements.
- **Key Finding:** Identified HIF1 $\beta$  as a regulator of CLDN1, demonstrating its role in epithelial junction formation and maintenance of barrier function.

### **Professional Research Assistant, January 2013 – August 2014**

Lab of Dr. Wallace S. Chick, Cell and Developmental Biology, University of Colorado School of Medicine

Project 1: Developed a protocol to differentiate mutant mouse embryonic stem cells into neural stem cells and neurons to determine if mutant phenotype is maintained in neural lineage cells. Techniques for this project included:

- Stem cell culture and stem cell differentiation.
- Optimize differentiation protocols
- Immunocytochemistry
- Fluorescent microscopy

Project 2: Explored and characterized NADPH oxidase (Nox) enzyme family in mouse embryonic stem cells and determined how Nox isoforms respond to various environmental stressors. Techniques for this project included:

- Cloned luciferase-reporter plasmids and gene overexpression plasmids (Primer design, PCR amplification, restriction digestion, ligation)
- Stem cell transfection, electroporation and chemical approaches
- Luciferase-based luminescence assays
- Semi-quantitative reverse transcription PCR
- RNA isolation & RNA to cDNA reverse transcription
- Tissue homogenization
- Chemiluminescent protein activity assays
- Stem cell and fibroblast culture

Project 3: This project required phenotypic characterization of single-gene stem cell mutants identified by a forward genetic screen. This included developing a profile on individual genes identified through the screen. Techniques for this project included:

- Flow cytometry
- Cell viability assays: fluorescence and absorbance
- Reactive oxygen species assays
- Drug utilization for pathway & gene manipulation

### **Undergraduate Research Assistant, December 2010 – June 2012**

Lab of Dr. Thomas E. Johnson, Institute for Behavioral Genetics, University of Colorado Boulder

Project: My thesis work focused on the genetic aspects of stress and aging with regards to sarcopenia, healthspan, and lifespan in *Caenorhabditis elegans*.

- Utilized *C. elegans* for genetic studies
- Worked with a small team of researchers to execute experiments
- Conducted independent research project for thesis
- *E. coli* culture
- Infection control and aseptic technique
- Developed systematic approach habits for consistent execution of procedures

## **Professional Services**

### **NIH ad hoc grant reviewer**

National Institute of Allergy and Infectious Diseases, SBIR Study Section for Small Business Anti-Infective Therapeutics, July 2025

## **Awards & Honors**

- Catalyst Award recipient, National Academy of Medicine, Healthy Longevity Global Competition, 2023
- Molecular Pathogenesis of Infectious Diseases T32 Award recipient, National Institute of Allergy and Infectious Diseases, 2021
- Best overall poster presentation in the Molecular Biology Program, 2019
- ASIP Sobel Scholar Award, American Society for Investigative Pathology, 2016
- Howard Hughes Medical Institute Undergraduate Research Award, 2011

## **Publications**

Thompson NT, Kitzenberg DA, Dowdell AS, Roer RL, Lee JS, Worledge CS, Colgan SP, Kao DJ. Proton Motive Force as a driver of persister sensitization by adenosine. PNAS 2025 *in review*

Thompson NT, Kitzenberg DA, Kao DJ. Persister-mediated emergence of antimicrobial resistance in agriculture due to antibiotic growth promoters. AIMS Microbiology 2023 Nov 13;9(4):738-756. doi: 10.3934/microbiol.2023038. PMID: 38173975; PMCID: PMC10758577.

Dowdell AS, Cartwright IM, Kitzenberg DA, Kostecky RE, Mahjoob O, Saeedi BJ, Welch N, Glover LE, Colgan SP. Essential role for epithelial HIF-mediated xenophagy in control of Salmonella infection and dissemination. Cell Rep. 2022;40(13):111409. Epub 2022/09/29. doi: 10.1016/j.celrep.2022.111409. PubMed PMID: 36170839; PMCID: PMC9553003.

Kitzenberg DA, Lee JS, Mills KB, Kim JS, Liu L, Vázquez-Torres A, Colgan SP, Kao DJ. Adenosine Awakens Metabolism to Enhance Growth-Independent Killing of Tolerant and Persister Bacteria across Multiple Classes of Antibiotics. mBio. 2022 May 16:e0048022. doi: 10.1128/mbio.00480-22. Epub ahead of print. PMID: 35575513.

Kelly CJ, Alexeev EE, Farb L, Vickery TW, Zheng L, Eric L C, Kitzenberg DA, Battista KD, Kominsky DJ, Robertson CE, Frank DN, Stabler SP, Colgan SP. Oral vitamin B<sub>12</sub> supplement is delivered to the distal gut, altering the corrinoid profile and selectively depleting *Bacteroides* in C57BL/6 mice. Gut Microbes. 2019;10(6):654-662. doi: 10.1080/19490976.2019.1597667. Epub 2019 May 7. PMID: 31062653; PMCID: PMC6866687.

Tengesdal IW, Kitzenberg D, Li S, Nyuydzefe MS, Chen W, Weiss JM, Zhang J, Waksal SD, Zanin-Zhorov A, Dinarello CA. The selective ROCK2 inhibitor KD025 reduces IL-17 secretion in human peripheral blood mononuclear cells independent of IL-1 and IL-6. *Eur J Immunol.* 2018 Oct;48(10):1679-1686. doi: 10.1002/eji.201847652. Epub 2018 Sep 21. PMID: 30098001.

Nguyen N, Fernando SD, Biette KA, Hammer JA, Capocelli KE, Kitzenberg DA, Glover LE, Colgan SP, Furuta GT, Masterson JC. TGF- $\beta$ 1 alters esophageal epithelial barrier function by attenuation of claudin-7 in eosinophilic esophagitis. *Mucosal Immunol.* 2018 Mar;11(2):415-426. doi: 10.1038/mi.2017.72. Epub 2017 Aug 23. PMID: 28832026; PMCID: PMC5825237.

Newell Stamper BL, Cypser JR, Kechris K, Kitzenberg DA, Tedesco PM, Johnson TE. Movement decline across lifespan of *Caenorhabditis elegans* mutants in the insulin/insulin-like signaling pathway. *Aging Cell.* 2018 Feb;17(1):e12704. doi: 10.1111/accel.12704. Epub 2017 Dec 7. PMID: 29214707; PMCID: PMC5770877.

Kao DJ, Saeedi BJ, Kitzenberg D, Burney KM, Dobrinskikh E, Battista KD, Vázquez-Torres A, Colgan SP, Kominsky DJ. Intestinal Epithelial Ecto-5'-Nucleotidase (CD73) Regulates Intestinal Colonization and Infection by Nontyphoidal Salmonella. *Infect Immun.* 2017 Sep 20;85(10):e01022-16. doi: 10.1128/IAI.01022-16. PMID: 28717030; PMCID: PMC5607412.

Lanis JM, Alexeev EE, Curtis VF, Kitzenberg DA, Kao DJ, Battista KD, Gerich ME, Glover LE, Kominsky DJ, Colgan SP. Tryptophan metabolite activation of the aryl hydrocarbon receptor regulates IL-10 receptor expression on intestinal epithelia. *Mucosal Immunol.* 2017 Sep;10(5):1133-1144. doi: 10.1038/mi.2016.133. Epub 2017 Jan 18. PMID: 28098246; PMCID: PMC5515702.

Kitzenberg D, Colgan SP, Glover LE. Creatine kinase in ischemic and inflammatory disorders. *Clin Transl Med.* 2016 Dec;5(1):31. doi: 10.1186/s40169-016-0114-5. Epub 2016 Aug 15. PMID: 27527620; PMCID: PMC4987751.

Ludwig M, Kitzenberg D, Chick WS. Forward Genetic Approach to Uncover Stress Resistance Genes in Mice - A High-throughput Screen in ES Cells. *J Vis Exp.* 2015 Nov 11;(105):53062. doi: 10.3791/53062. PMID: 26649459; PMCID: PMC4692703.

Saeedi BJ, Kao DJ, Kitzenberg DA, Dobrinskikh E, Schwisow KD, Masterson JC, Kendrick AA, Kelly CJ, Bayless AJ, Kominsky DJ, Campbell EL, Kuhn KA, Furuta GT, Colgan SP, Glover LE. HIF-dependent regulation of claudin-1 is central to intestinal epithelial tight junction integrity. *Mol Biol Cell.* 2015 Jun 15;26(12):2252-62. doi: 10.1091/mbc.E14-07-1194. Epub 2015 Apr 22. PMID: 25904334; PMCID: PMC4462943.

Chick WS, Ludwig M, Zhao X, Kitzenberg D, Williams K, Johnson TE. Screening for stress-resistance mutations in the mouse. *Front Genet.* 2014 Sep 8;5:310. doi: 10.3389/fgene.2014.00310. PMID: 25250048; PMCID: PMC4157564.

Cypser JR, Kitzenberg D, Park SK. Dietary restriction in *C. elegans*: recent advances. *Exp Gerontol*. 2013 Oct;48(10):1014-7. doi: 10.1016/j.exger.2013.02.018. Epub 2013 Feb 24. PMID: 23462461.

## **Theses**

Kitzenberg DA: Strategies to potentiate antibiotics against tolerant and persister bacteria. Doctorate dissertation. University of Colorado School of Medicine, July 2022

Kitzenberg DA: Modeling healthspan and lifespan in *C. elegans*. Undergraduate honors thesis, *Summa Cum Laude*, University of Colorado Boulder, May 2012

## **Oral & Poster Presentations**

Kitzenberg, DA, Strategies to potentiate antibiotics against tolerant and persister Bacteria. Doctorate Dissertation. University of Colorado School of Medicine, Aurora, CO, July 2022

Kitzenberg DA, Lee JS, Mills KB, Kim JS, Vázquez-Torres A, Colgan SP, Kao DJ. Adenosine activates metabolism to enhance killing of persister bacteria across multiple classes of antibiotics. Poster presentation at University of Colorado Program in Molecular Biology Retreat, Grandby, CO, October 2019

Kitzenberg DA, Lee JS, Mills KB, Kim JS, Vázquez-Torres A, Colgan SP, Kao DJ. Adenosine inhibits the stringent response during nutrient stress. Poster presentation at University of Colorado Program in Molecular Biology Retreat, Grandby, CO, October 2018

Kitzenberg DA, Kominsky D.J., Kelly, C.J., Campbell, E.L., Kao, D.J., Lanis, J.M., Curtis, V., Colgan, S.P., Glover, L.E., Metabolic Regulation of Epithelial Autophagy in Mucosal Inflammation. Oral Presentation at Experimental Biology, San Diego, CA, April 2016

Kao, D.J., Kitzenberg, D., Schwisow, K., Saeedi, B.J., Colgan, S.P., Kominsky, D.J., Intestinal epithelial ecto-5'-nucleotidase CD73 regulates the homeostasis of *Salmonella typhimurium* and commensal bacteria. Oral Presentation at Experimental Biology, Boston, MA, March 2015

Kao, D.J., Kitzenberg, D., Schwisow, K., Saeedi, B.J., Colgan, S.P., Kominsky, D.J., Intestinal epithelial ecto-5'-nucleotidase CD73 regulates the homeostasis of *Salmonella typhimurium* and commensal bacteria. Poster presented at Experimental Biology, Boston, MA, March 2015

## **Other Work Experience**

### **Certified Nurse Aide**

St. Paul Health Short-term Rehab & Long-term Care Facility, Denver, CO, 2012

- Communicate effectively with people of all ages—residents from 19 to 98 years of age
- Assist with activities of daily living such as eating, bathing, and toileting
- Use interviews and observation to identify changes in residents' chronic pain and skin conditions
- Assist in the management of various medical conditions
- Relay the residents' needs and concerns to the charge nurse and care team
- Responsible for measuring and charting vital signs daily
- Practice infection control, clean technique and sterile technique

### **Restaurant Server**

Beau Jo's Pizzeria, Boulder, CO, 2009

## **Volunteer Experiences**

- Internship training program, preclinical drug development pathways, Primer Pharmaceuticals, 2025
- High school lecture and Q&A session for science and medicine careers, 2024
- Lab tour and Q&A for high school students interested in STEM careers, 2023 & 2024

## **References**

Sean Colgan, Ph.D.

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Emily Dowd, J.D., LLM

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