Jacob Reynolds, Ph.D.

SCIENTIST III

CONTACT INFORMATION

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PROFESSIONAL PROFILE

Dr. Jacob Reynolds is a toxicologist in ToxStrategies' health sciences practice. He received his Ph.D. in Biomedical Engineering and Environmental and Integrated Toxicological Sciences from Michigan State University. His dissertation focused on applying new approach methods (NAMs) to study the etiology of structural birth defects, specifically orofacial clefting. Dr. Reynolds has experience with *in vitro* microphysiological model development, applying computer numerical control machining to create custom, microplate-based systems. Using this technique, he has worked extensively with a microphysiological model of orofacial development designed to capture the epithelial-mesenchyme interface, and has applied it to study disruption of the Sonic Hedgehog (SHH) signaling pathway. He has conducted several systematic literature reviews and has worked with the Organisation for Economic Co-operation and Development (OECD) adverse outcome pathway (AOP) development program to create and publish AOPs. He has experience using statistical analysis software, including R and GraphPad Prism, to analyze and visualize data.

Dr. Reynolds has presented his research at national and international scientific meetings and has reported his results in peer-reviewed scientific journals.

EDUCATION AND DEGREES EARNED

2025	Ph.D., Biomedical Engineering and Environmental and Integrated Toxicological Sciences Michigan State University, East Lansing MI
2019	B.S., Biomedical Engineering Wright State University, Dayton, OH

PROFESSIONAL ASSOCIATIONS

2023-Present	Society of Toxicology
	—*In Vitro* and Alternative Methods (IVAM) Specialty Section
2020-2024	Biomedical Engineering Society

HONORS/AWARDS

2025	Michigan State University Outstanding Graduate Student Award
2024	MSU Center for Research on Ingredient Safety (CRIS) Predoctoral Fellowship in Food, Nutrition, and Chronic Disease
2024	NIH Common Fund Complement Animal Research in Experimentation (Complement-ARIE) Challenge
2024	MSU Doctoral Program in Environmental and Integrative Toxicological Sciences (EITS) travel award
2023	Biomedical Engineering Graduate Student Association logo contest winner
2023	Michigan State University Outstanding Graduate Student Award—Runner up
2023	Institute for Quantitative Health Science and Engineering Microscopy image contest—4th place
2022	Michigan State University Academic Achievement Withrow Fellowship Award
2021	T2Med, Medical Technion Entrepreneurship Hackathon—3rd place
2018	Tau Beta Pi, Ohio Mu Chapter—member
2015-2019	Salutatorian Scholarship, Wright State University

PROFESSIONAL DEVELOPMENT AND SERVICE

2022-2025	Mentor, Michigan State University Biomedical Engineering Graduate Student Association Mentorship Committee
2022-2024	Shift Leader and Volunteer, Lansing Maker's Network
2018-2019	Vice President, Biomedical Research Technological Association, Wright State University
2017-2019	Member, Biomedical Research Technological Association, Wright State University

SELECTED PROFESSIONAL EXPERIENCE

New Approach Method Development

Designed and manufactured plate-based NAMs using computer numerical control (CNC) micromachining to drive collaborations, including a metabolic cage for daphnia magna, a microfluidic device to allow for an age-synchronized study of *C. elegans*, and a model of mouse aorta.

Investigated chemical perturbation of Sonic Hedgehog signaling using a 3D *in vitro* microphysiological model of orofacial development. Worked to improve humanization of the model by adding in IPSC derived cranial neural crest cells and shifting the mesenchyme to a human derived line.

Assisted in authoring winning submission to the NIH Common Fund Complement Animal Research in Experimentation (Complement-ARIE) challenge.

Applied retrospective *in silico* approach to leverage existing in vivo and in vitro datasets (ToxRefDB, ToxCast/Tox21) to attempt to find ways to predict developmental toxicants.

Systematic Review

Collaborated with the OECD Adverse Outcome Pathway Development Program under mentorship of Judy Choi to create AOPs for SHH disruption leading to orofacial clefting, guiding risk assessment of chemical toxicants.

Utilized systematic review approaches to develop two Adverse Outcome Pathways.

- AOP 460: Antagonism of smoothened receptor leads to orofacial clefting.
- AOP 491: Decreased GLI1/2 target gene expression leads to orofacial clefting.

Engineering

Studied and reported on the accuracy and precision of microfluidic features of interest could be created using machines at varying price points to assist those in the NAMs community looking to adopt CNC micromachining.

Applied design of experiment (DoE) methodology to optimize the use of a CO2 laser in welding clear-clear polystyrene leading to a full United States (US) patent application.

Developed a technology that uses small thermal gradients to drive fluid flow within or between wells of a well plate leading to a full US patent application.

Collaborated with a team of orofacial surgeons and conducted mathematical analysis to determine optimal location for repair incision for unilateral cleft lip patients displaying asymmetry in Cupid's bow.

Studied the combinatorial effects of silver nanoparticles along with a hypoxic environment in A549 cells by investigating reactive oxygen species formation and cell viability.

Investigated the effect of loading retinoic acid on electrospun scaffolds and their effectiveness at promoting healing. Characterized the spun fibers through scanning electron microscope (SEM) image analysis using ImageJ.

Supported the day-to-day manufacturing process of a peripheral nerve allograft (Avance) and a soft-tissue membrane (Avive).

Led a change of process for the sterilization of reusable and single-use materials from an offsite location to an onsite facility using ISO 10993 as guidance for acceptance criteria.

Collaborated with a team of five undergraduate students to design, prototype, and test a flotation device for a toddler with Type I spinal muscular atrophy to facilitate aquatic therapy and enjoyment in the water.

PUBLICATIONS

Reynolds JI, Johnson BP. 2025. AOP 460: Antagonism of smoothened receptor leads to orofacial clefting. Submitted to ALTEX. Accepted July 2025; in press.

Reynolds JI, Choi J, Johnson BP. 2024. Crowdsourcing AOP development: Leveraging the thesis literature review to identify knowledge gaps and facilitate research translation. Curr Res Toxicol 7(Aug 8):100191; doi: 10.1016/j.crtox.2024.100191. PMID: 39205829.

Reynolds JI, Gschwendtner E, Figueroa A, Smith M, Johnson B, Polley J. 2024. The asymmetry within: A renewed look at Cupids bow in unilateral cleft lip. J Craniofac Surg 35(4):1096–1100; doi: 10.1097/SCS.0000000000010282. PMID: 38743277.

Reynolds JI, Vitek RA, Geiger PG, Johnson BP. 2022. Engineering epithelial-mesenchymal microtissues to study cell-cell interactions in development. Methods Med Biol 2403:201-213; doi: 10.1007/978-1-0716-1847-9_13. PMID: 34913124.

ABSTRACTS AND PRESENTATIONS

Reynolds JI*, Yelleti A, Johnson BP. Bridging data gaps in sonic hedgehog signaling: A novel microphysiological model approach. Abstract 3234, Society for Toxicology 64th Annual Meeting, Orlando, FL, March 2025.

Chado V*, Malbouef E, **Reynolds JI,** Johnson BP. Quantifying and functionalizing fluid dynamics in microfluidic devices laminar flow in a microchannel. Mid-Michigan Symposium for Undergraduate Research Experiences, East Lansing, MI, 2024.

Malbouef E*, Gardner K, **Reynolds JI**, Johnson BP. Quantifying and analyzing CNC chip measurements to improve material quality. Mid-Michigan Symposium for Undergraduate Research Experiences, East Lansing, MI, 2024.

Reynolds JI*, Adams M, Johnson BP. Microplate micromachining for microphysiological model fabrication. Abstract 561, Microphysiological Systems (MPS) World Summit, Seattle, WA, 2024. https://proceedings.altex.org/data/2024_01/altex_MPS03.pdf.

Reynolds JI*, Johnson B. AOP Network: Disruption of sonic hedgehog leading to orofacial clefts. Abstract 3625, Society of Toxicology 63rd Annual Meeting, Salt Lake City, 2024.

Singh DK*, **Reynolds JI**, Alobaydan Q, Johnson BP. Microplate microfluidics: Integrating CO2 laser welding in the rapid prototyping pipeline. Michigan State University Undergraduate Research & Arts Forum (UURAF), East Lansing, MI, 2024.

Singh DK*, **Reynolds JI**, Johnson BP. Low-cost laser welding for rapid prototyping of microfluidic, Lab-on-a-Chip, and microphysiological models. Mid-Michigan Symposium for Undergraduate Research Experiences, East Lansing, MI, 2024.

Johnson BP*, **Reynolds JI**. Crowdsourcing AOP development: Leveraging the thesis literature review to identify knowledge gaps and facilitate research translation. Society for Birth Defects Research and Prevention 63rd Annual Meeting, Charleston, SC, 2023.

Reynolds JI*, Adams M, Johnson BP. Performance micromachining for creation of well plate based microphysiological models. Oral platform at Biomedical Engineering Society Annual Meeting, Seattle, WA, 2023.

Alobaydan Q*, **Reynolds JI**, Johnson BP. Design of experiment to investigate CO2 laser bonding of polystyrene to polystyrene. Mid-Michigan Symposium for Undergraduate Research Experiences, East Lansing, MI, 2022.

Reynolds JI*, Johnson BP, Gschwendtner E, Smith M, Dietze-Fiedler M, Polley J. The asymmetry within: A renewed look at Cupids bow in unilateral cleft lip. Poster presented at Precision Health Symposium, Michigan State University, East Lansing, MI, 2022.

Reynolds JI*, Johnson BP. Harnessing CNC micromilling to engineer epithelial – mesenchyme microtissues to study cell –cell signaling. Poster presented at Biomedical Engineering Society Annual Meeting, San Antonio, TX, 2022.

Reynolds JI*, Johnson BP. Harnessing CNC micromilling to engineer epithelial – mesenchyme microtissues to study cell–cell signaling. Poster presented at Michigan State University Center for PFAS Research Annual Symposium: Emerging Technologies in PFAS Remediation and Toxicity, East Lansing, MI, 2022.

Reynolds JI, Johnson B, Gschwendtner E*, Smith M, Dietze-Fiedler M, Polley J. The asymmetry within: A renewed look at Cupids bow in unilateral cleft lip. Michigan Academy of Plastic Surgeons Biennial Scientific Meeting, Mackinac Island, MI, 2022.

Bolt A*, **Reynolds JI**, Saparastzardroudi M, Alan J, Sing K, Lee S, Johnson BP. Rapid prototyping of microfluidic devices using micromachining. Mid-Michigan Symposium for Undergraduate Research Experiences, East Lansing, MI, 2021.

Reynolds JI*, Saparastzardroudi M, Alan J, Sing K, Lee S, Johnson BP. WormPlate: A micromilled microfluidic device for studying lipid signaling in *C. elegans*. Poster presented at Biomedical Engineering Society Annual Meeting, Virtual, 2021.

**denotes presenting author*