

March 2023

Congratulations 2023 JOR Spine Early Career Award Winners!



Rebecca Wachs, PhD University of Nebraska

"Axial hypersensitivity is associated with aberrant nerve sprouting in a novel model of disc degeneration in female Sprague Dawley rats"

Ben Walter, PhD The Ohio State University

<u>"Pericellular Heparan Sulfate</u> <u>Proteoglycans :Role in Regulating the</u> <u>Biosynthetic Response of Nucleus</u> <u>Pulposus Cells to Osmotic Loading"</u>

Did you fill out the Spine Symposium Survey?

We hope you enjoyed the 2023 ORS Spine Section Symposium! We are always looking for ways to improve our meetings so that we can reach more people interested in the ORS! We have a short survey, and we'd love to hear from you! If you have any questions about the survey, please don't hesitate to reach out. Thank you for attending the 2023 ORS annual meeting!

Fill out the Survey



Pictured: Kyle Kuchynsky, B.S.

Research Section Member Spotlight

This issue features **Kyle Kuchynsky, B.S. (he/him)** - Ph.D. Student, Department of Biomedical Engineering, Ohio State University

Undergraduate Degree: B.S., Biomedical Engineering (Ohio State University)

Who do you consider your mentors?

I consider a lot of people in my lab as my mentors, but especially my advisor **Dr. Devina Purmessur**, **Dr. Ben Walter**, and **Nina Tang**.

What is your specific area of interest in research?

I'm interested in the role that cartilage endplate cells may play in mediating spine health and disease.

What are you currently working on?

I'm finishing optimizations for an upcoming cell culture study, mechanical testing of motion segments, and analyzing transcriptomics data.

What has been the biggest challenge for you lately in your research?

Time and focus. I'm working on multiple projects and there can be so many different directions that each of them can go in...it can be overwhelming and tough to prioritize which project to work on in the moment, plus making sure I don't fall into rabbit holes while reading papers or as we collect new data.

What are projects are you looking forward to?

I'm very close to getting a long-awaited cell culture experiment off the ground, so I'm excited for that and seeing how the results turn out.

What do you like to do outside of your work?

My hobbies are running and playing Nintendo games like Smash Bros and Pikmin. I ran competitively with Ohio State's Running Club and ran in marathons until the start of the ongoing Covid-19 pandemic. I haven't competed since then, but I still run routinely.

What is the last book you read?

It's been a few years, but I think the last book I read was <u>"Eat and Run"</u> by Scott Jurek. It's an ultramarathoner's account of how he transitioned to a more plant-based diet and how he felt it impacted his running and wellbeing. It actually motivated me to be vegetarian for a year; I am eating meat again, but that experience forced me to learn how to cook, and I cook almost exclusively vegetarian dishes at home now.

What is the most unusual/unexpected item sitting on your desk right now?

I don't have anything super unusual right now, so I put a can of corn there just for this question. I'm going to put it back now.



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educational content for potential use in LearnORS? We regularly accept suggestions for content which might be implemented into training to be made available throughout the year on the ORS website.

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Paper Review

Kyle also contributed to this paper review...

<u>Spinal cord sensitization and spinal inflammation from an in vivo rat endplate injury</u> <u>associated with painful intervertebral disc degeneration</u>. *International Journal of Molecular Sciences*, 2023 Feb 8;24(4):3425. doi: 10.3390/ijms24043425.

Alon Lai, **Denise Iliff**, Kashaf Zaheer, Dalin Wang, **Jennifer Gansau**, Damien M Laudier, Venetia Zachariou, **James C latridis**

Herniation of the nucleus pulposus (NP) through structural defects in either the annulus fibrosus (AF) or cartilage endplate (EP) is associated with painful disc degeneration. These disruptions depressurize the nucleus pulposus, which alters disc biomechanics and exposes the extradiscal space to the inner disc material. Such interactions have been proposed as a cause of pain, such as in Modic changes, though the mechanisms of pain generation are still unclear. Spinal cord sensitization and neuroinflammation are mediators of neuropathic pain in nerve injury models, and thus was seen as a possible source of discogenic pain. As a result, the authors hypothesized that endplate injury would induce pain via sensitization and neuroinflammation of the spinal cord.

A recently validated in vivo rat endplate injury model was used to study the effects of trans-endplate injury on 1) the development of neuroinflammation and sensitization of the spinal cord, 2) the invasion of CD68+ macrophages into the disc and adjacent structures, and 3) whether these spinal cord and immune cell changes correlate with pain behaviors and disc degeneration. Male skeletally mature Sprague-Dawley rats received either trans-endplate injury, via puncture of the cranial endplate through the superior vertebrae, or sham surgeries. After 8 weeks post-surgery, the rats were euthanized and the lumbar spine and spinal cord were collected. Von Frey and grip force assays were conducted to assess pain pre-surgery and prior to euthanasia. Lumbar spines were imaged using μ CT, then stained to assess degeneration and identification of CD68+ macrophages. Spinal cords were stained for SubP, Iba1, and GFAP to assess activation of nerves, microglia, and astrocytes, respectively. Pain, disc measures, and spinal cord histology were correlated using Spearman's correlation coefficients.

Rats with injured endplates displayed increased pain behaviors and signs of increased disc degeneration relative to sham rats. Similarly, SubP, Iba1, and GFAP expression in the spinal cord were upregulated in spinal cords from injured rats, suggesting increased spinal cord sensitization and neuroinflammation. Macrophage infiltration into the injured endplates and vertebrae was also reported. Pain measures were significantly correlated with spinal cord changes and disc degeneration. Further, spinal cord changes were significantly correlated with disc degeneration. Taken together, these results highlight that endplate injury induces disc degeneration and could contribute to discogenic pain via changes within the spinal cord. These results may also inform the development of new analgesic therapies that target chronic changes within the spinal cord in response to endplate injury.



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