

Spatial Transcriptomic Atlas of Mouse Intervertebral Disc Reveals Rarity and Distribution of Nucleus Pulposus Progenitor Cells

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Abstract

Loss of refreshment in nucleus pulposus (NP) cellularity leads to intervertebral disc (IVD) degeneration. Nevertheless, the cellular sequence of NP cell differentiation remains unclear, although an increasing body of literature has identified markers of NP progenitor cells (NPPCs). Notably, due to their fragility, the physical enrichment of NP-derived cells has limited conventional transcriptomic approaches in multiple studies. To overcome this limitation, a spatially resolved transcriptional atlas of the mouse IVD is generated via the 10x Genomics Visium platform dividing NP spots into two clusters. Based on this, most reported NPPC-markers, including Cathepsin K (Ctsk), are rare and predominantly located within the NP-outer subset. Cell lineage tracing further evidence that a small number of Ctsk-expressing cells generate the entire adult NP tissue. In contrast, Tie2, which has long suggested labeling NPPCs, is actually neither expressed in NP subsets nor labels NPPCs and their descendants in mouse models; consistent with this, an in situ sequencing (ISS) analysis validated the absence of Tie2 in NP tissue. Similarly, no Tie2-cre-mediated labeling of NPPCs is observed in an IVD degenerative mouse model. Altogether, in this study, the first spatial transcriptomic map of the IVD is established, thereby providing a public resource for bone biology.

Biography

Dr. Ren Xu is a Professor at the State Key Laboratory of Cellular Stress Biology and School of Medicine at Xiamen University. Dr. Xu earned his Ph.D. in the Department of Orthopedic and Spinal Surgery at Tokyo Medical and Dental University in 2013. He completed postdoctoral training in bone biology at Weill Cornell Medical College, Cornell University co-mentored by Dr. Laurie Glimcher and Matthew Greenblatt. In 2019, Dr. Xu came to the School of Medicine at Xiamen University and set up a bone biology lab as an independent PI. His studies focus on skeletal stem cells, bone remodeling, and other bone-related metabolic diseases. Dr. Xu is a young talent in the field of skeletal research and published more than 50 research papers and reviews in academic journals including *The Lancet*, *Nature*, *Nature Medicine* and *Nature Communications*. He has won several international academic awards such as the John Haddad Young Investigator Award and held support from NSFC. He also served as an invited reviewer of more than 40 international journals and a lifetime member of the International Chinese Musculoskeletal Research Society.

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