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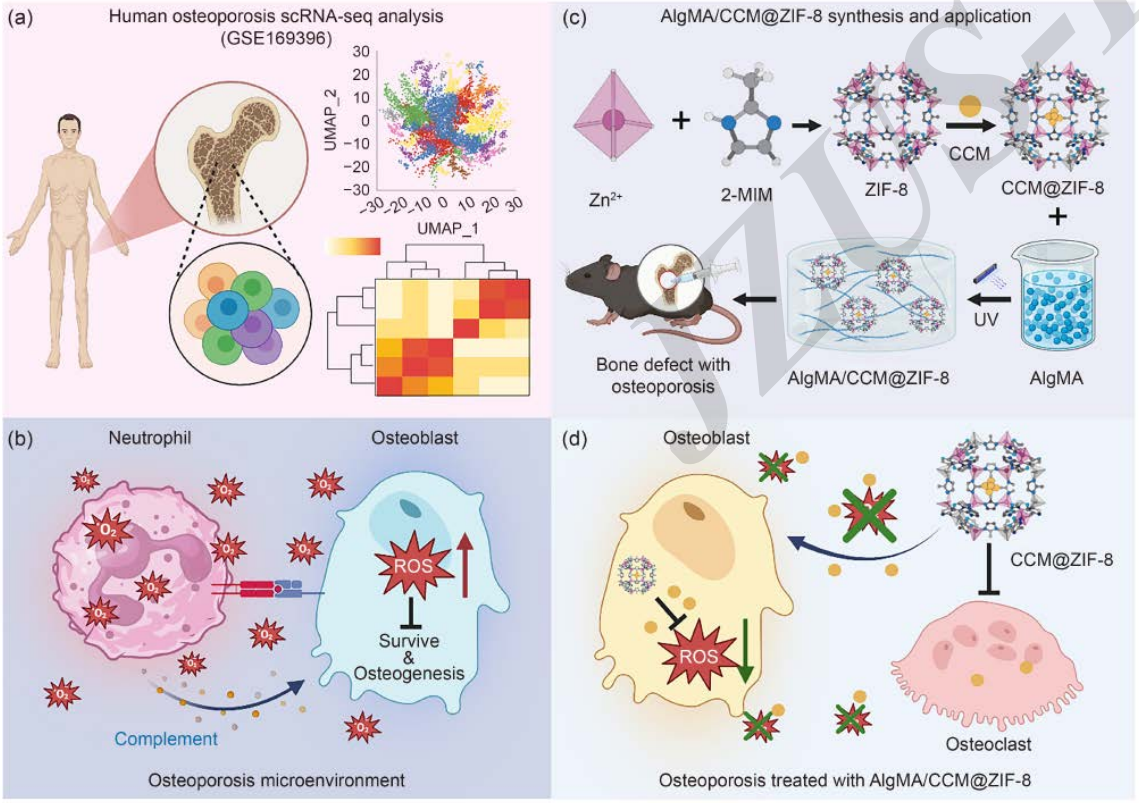
# Single-cell RNA-sequencing-guided reactive oxygen species-scavenging hydrogel design for regeneration of osteoporotic bone

**Key words:** Osteoporosis; Single-cell RNA-sequencing (scRNA-seq); Reactive oxygen species (ROS); Curcumin (CCM); Bone regeneration

# Research Summary

**This study revealed two critical findings by single-cell RNA sequencing: (1) neutrophils exhibit excessive ROS production during bone remodeling in osteoporotic conditions, and (2) osteoblasts show heightened sensitivity to ROS-mediated stress. And we engineered a microenvironment-responsive hydrogel system (AlgMA/CCM@ZIF-8).**




- **Scavenging excess ROS in osteoblasts**
- **Suppressing osteoclast differentiation**
- **Rebalancing bone remodeling dynamics.**

# *Innovation points*

●**Propose** **that neutrophil-derived ROS in the osteoporotic microenvironment likely induce ROS stress in osteoblasts, exacerbating bone loss and accelerating disease progression.**

● **Design** **a microenvironment-adaptive ROS scavenging hydrogel system (AlgMA/CCM@ZIF-8) guided by the above finding. And a combination of in vitro and in vivo studies verified the osteogenic potential of AlgMA/CCM@ZIF-8 under osteoporotic microenvironment.**