

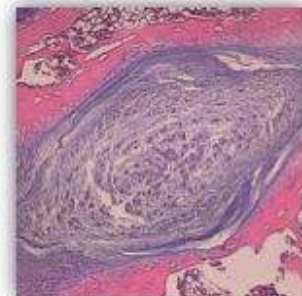


香港大學  
THE UNIVERSITY OF HONG KONG



# DISCOGENIC LOW BACK PAIN

A BME Grand Challenge



# What is LBP?

- a musculoskeletal disorder involving the back
- a common, long-term disorder, especially among the middle-aged group
- 2 people out 3 will suffer from LBP
- a major social burden

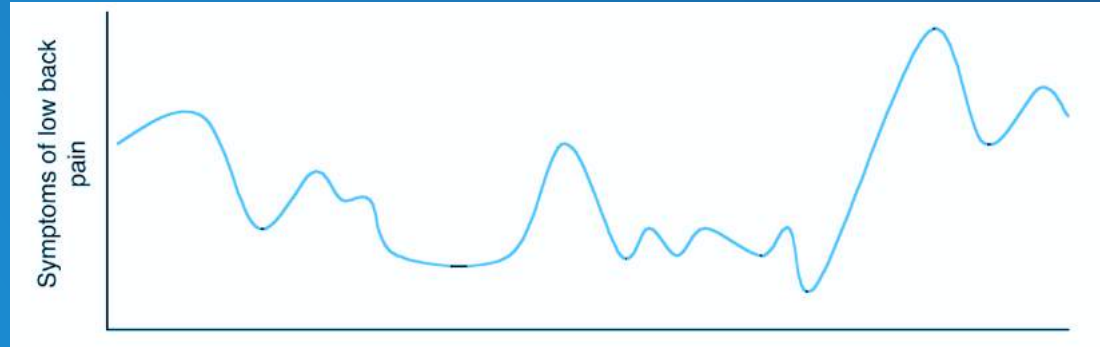
# Social Burden

	United Kingdom		Sweden		Netherlands	
Costs	Costs in US \$ million (% of total)	Costs/ capita	Costs in US \$ million (% of total)	Costs/ capita	Costs in US \$ million (% of total)	Costs/ capita
Direct costs	385 (11.5)	7	213 (8)	24	368 (7.4)	24
Indirect costs	2948 (88.5)	113	2262 (92)	266	4600 (92.6)	299
Total costs	3333 (100)	120	2475 (100)	290	4968 (100)	323

Figure 2. Costs of LBP in the UK, Sweden and the Netherlands (in US \$. Tulder et al., 2002).

# Most significant symptoms

- pain
- disability



symptoms usually do not last long, LBP may fluctuate over time, with recurrence and exacerbation

# Pathophysiology

## ⅕: Intervertebral Disc Degeneration

## Unknown Mechanism

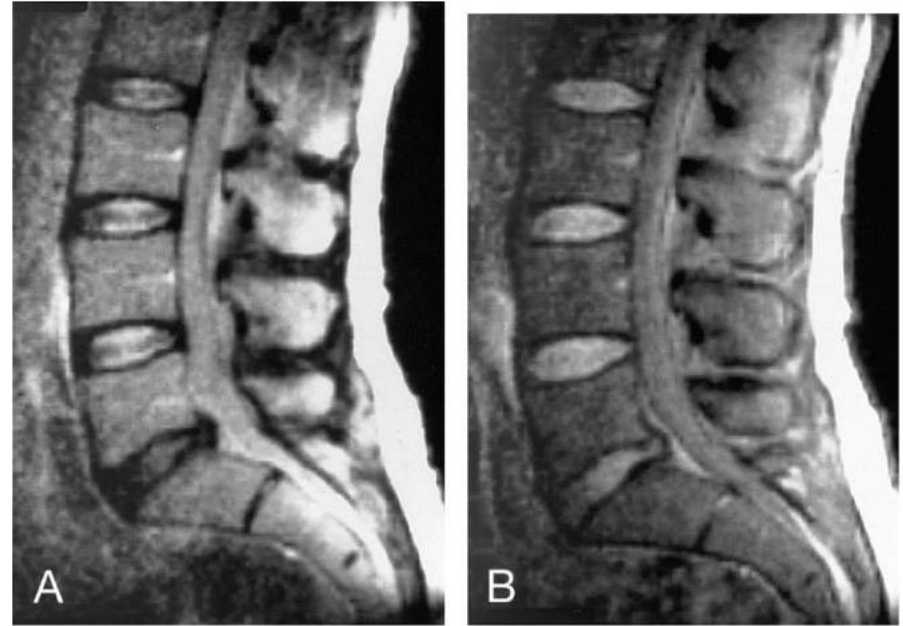
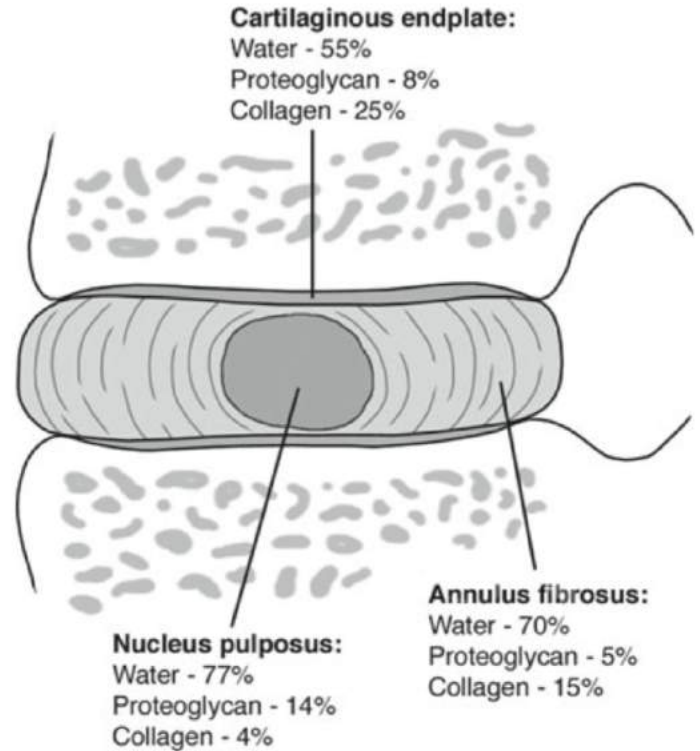
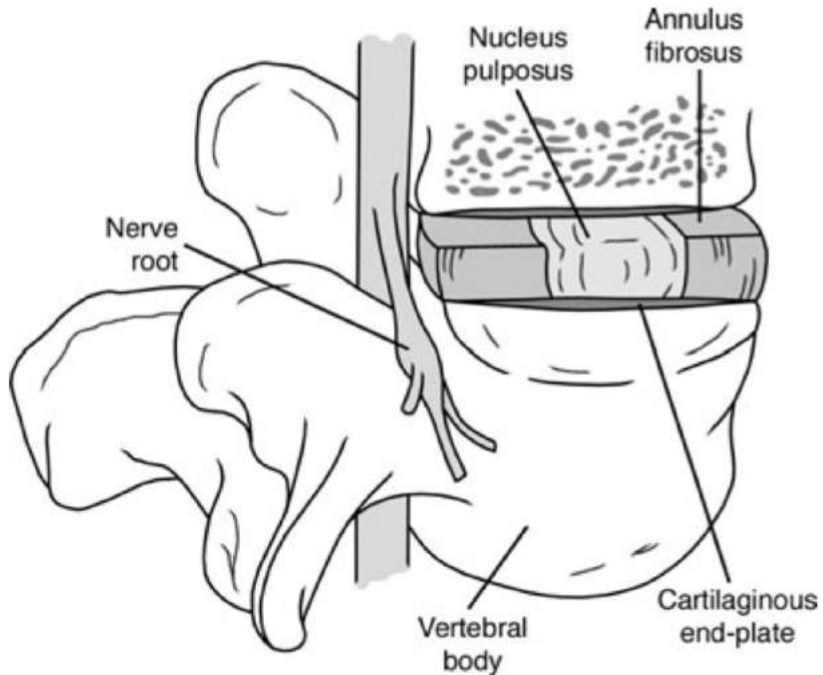


Figure 1. Decreased signal intensity of the nucleus pulposus in the L5/S1 disc in a T2-weighted image **(A)**. The posterior bulge in the L5/S1 disc was more clearly demonstrated in the proton density-weighted image **(B)**.

# Anatomy



# Early and Middle Stages Solutions



# Analgesics

- Paracetamol
- NSAIDs
- Opioids





# Physiotherapy

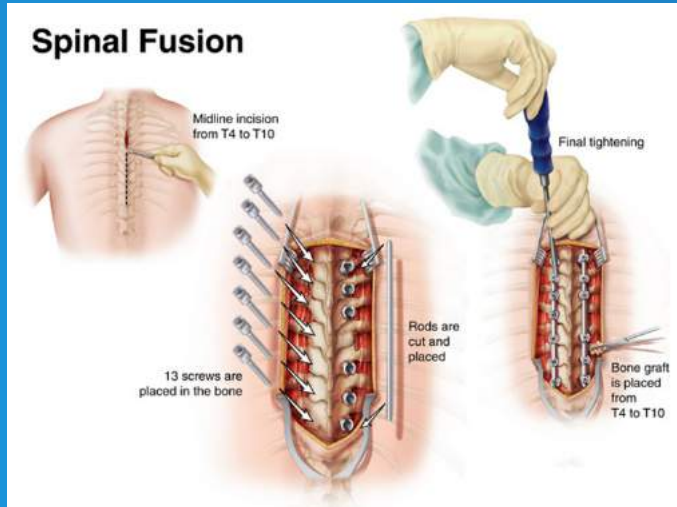
- Chiropractic
- Alexander Technique



# Late Stage Treatments

# Spinal Fusion

- Joins two or more adjacent vertebrae
- Immobilizes the degenerated vertebrae
- Reduces the flexibility of movement



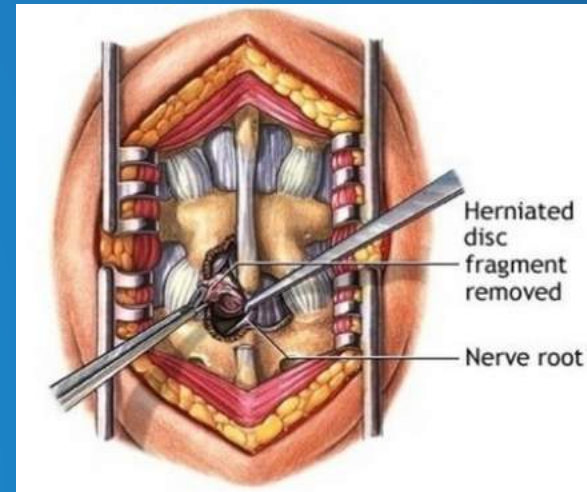
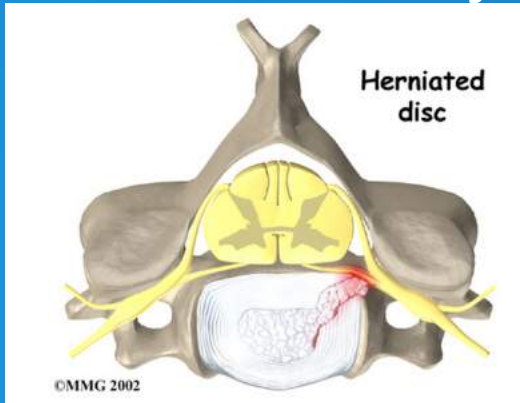
# Total Disc Replacement

- Painful disc is removed and replaced by an prosthetic or donated disc
- Mobility in motion segment can be retained
- Ability of metal components are in doubt
- Rejection towards disc cells



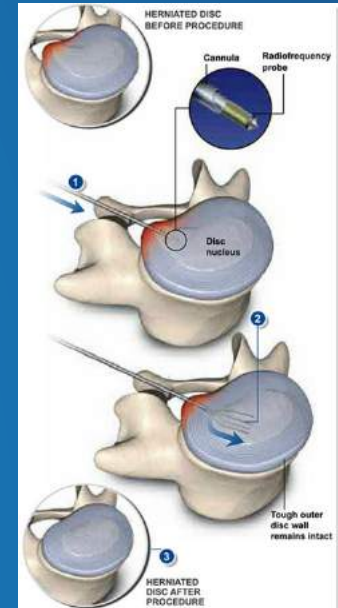
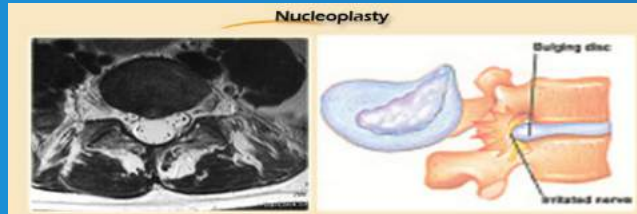
# Discectomy

- Removes a herniated disc
- Recurrent herniation
- Endoscopic micro-discectomy is better than open discectomy



# Nucleoplasty

- Inserts special probe into faulty disc
- Small portion of nucleus material will be eliminated by emitting Coblation®
- Nerve root tension can be reduced
- Minimally invasive
- Cannot be applied to injured disc



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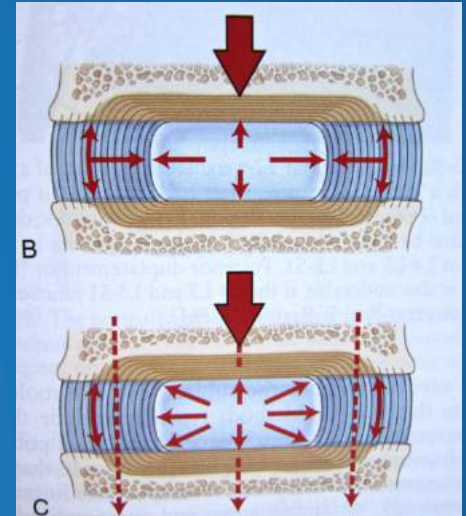
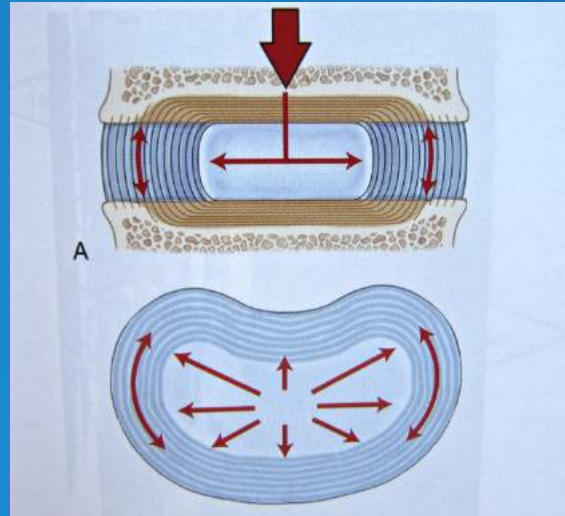
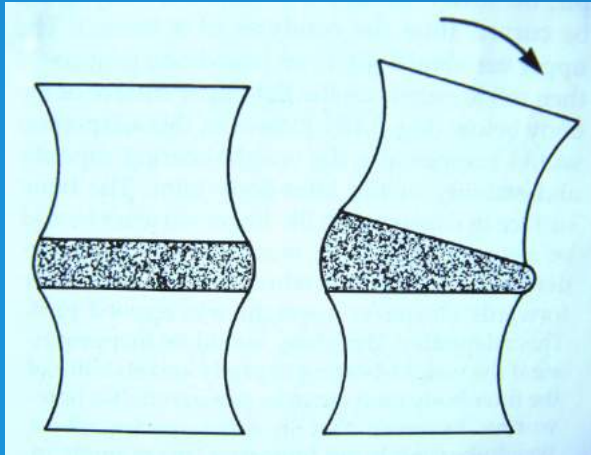
# Tissue Engineering

A Proposed Solution



# Goal

- Restore/Improve IVD's physiological & biomechanical properties

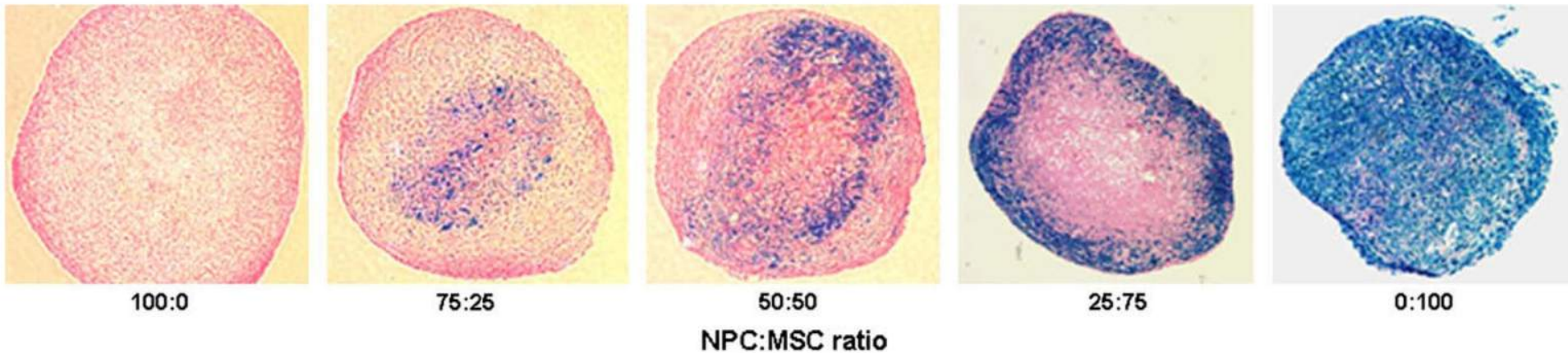


# Methods (General)

- Injection: Cells
- Insertion: Tissues, ECM, Scaffolds
- Transplantation: Whole Disc

# Methodology Research

- Injection/Mixture of MSCs → Improved
- Successful animal transplant

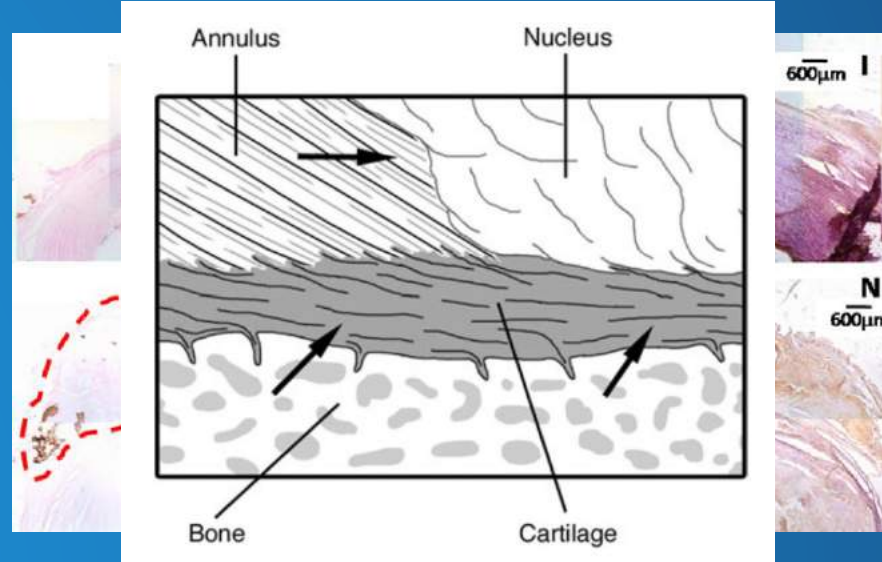


# Challenges - Cells

- What cells?
- Harvest problems (DCs)
- Differentiation problems (SCs)
- Cell culture difficulties

# Challenges - Categories

- Leakage problems  
Osteophytes  
Damage
- Interface problems

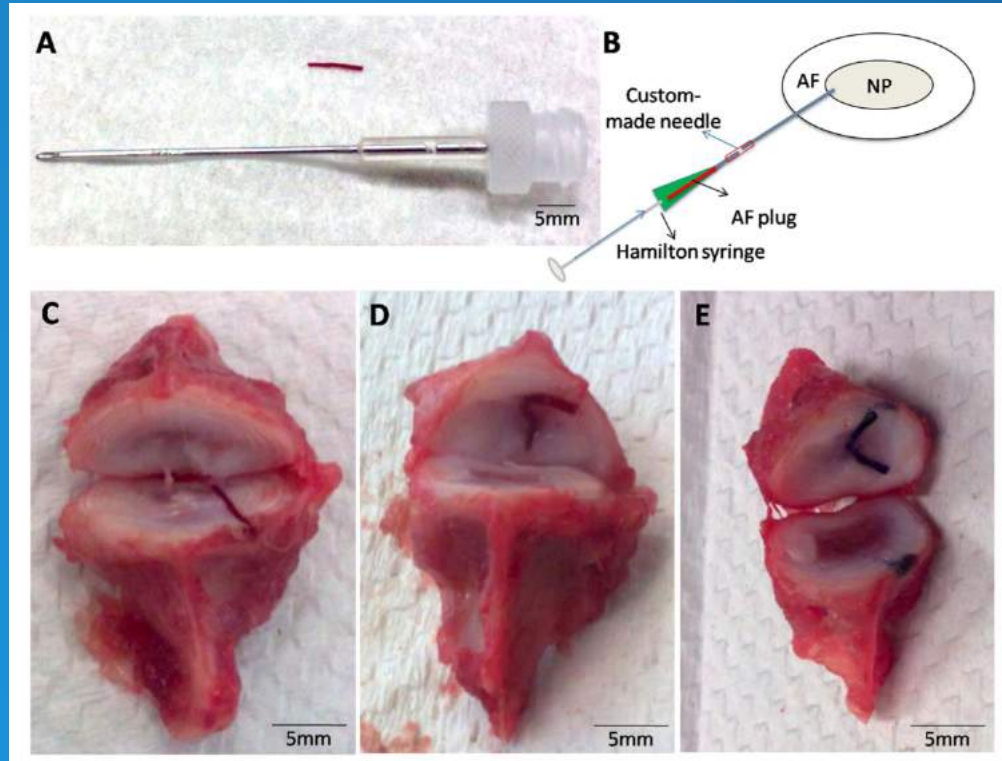


# Challenges - Complex

- Survival
- Nutrition
- Efficacy

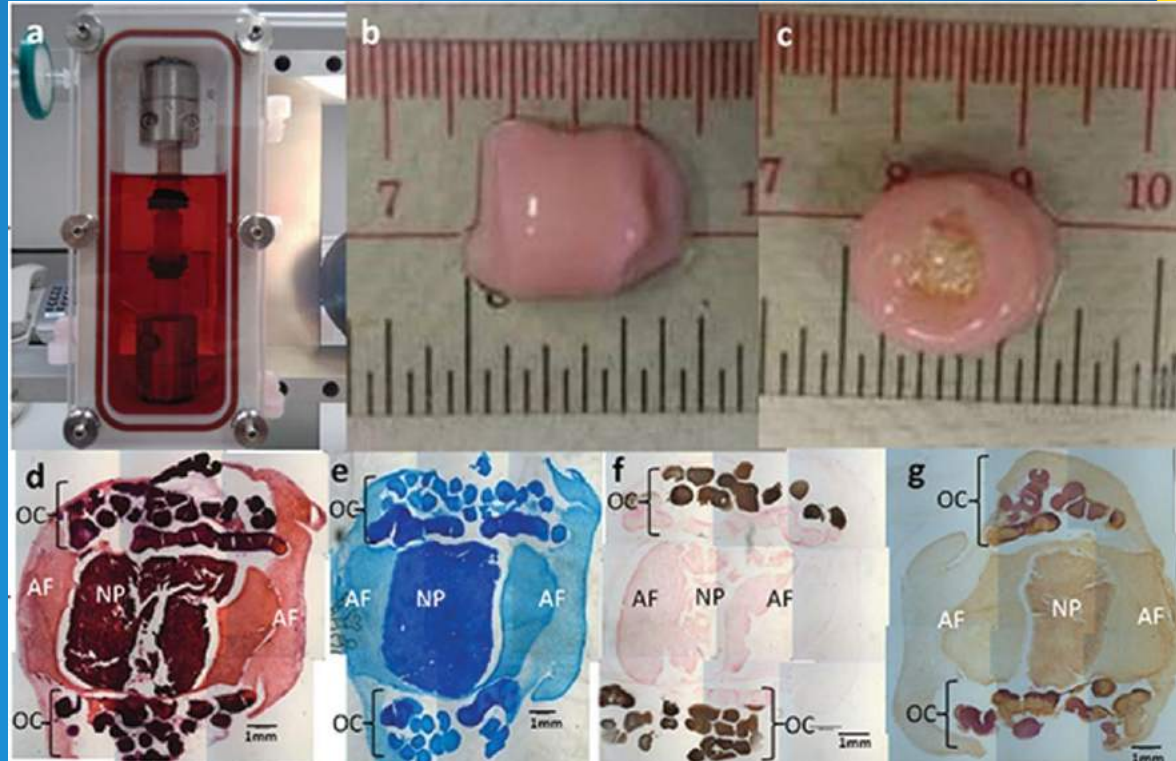
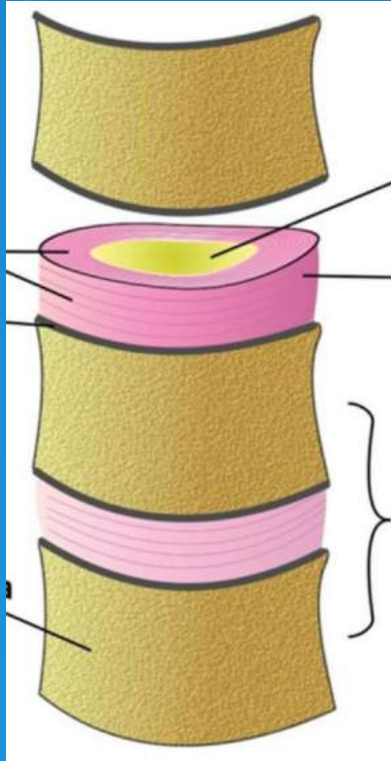


# Cutting-edge Research - Plug





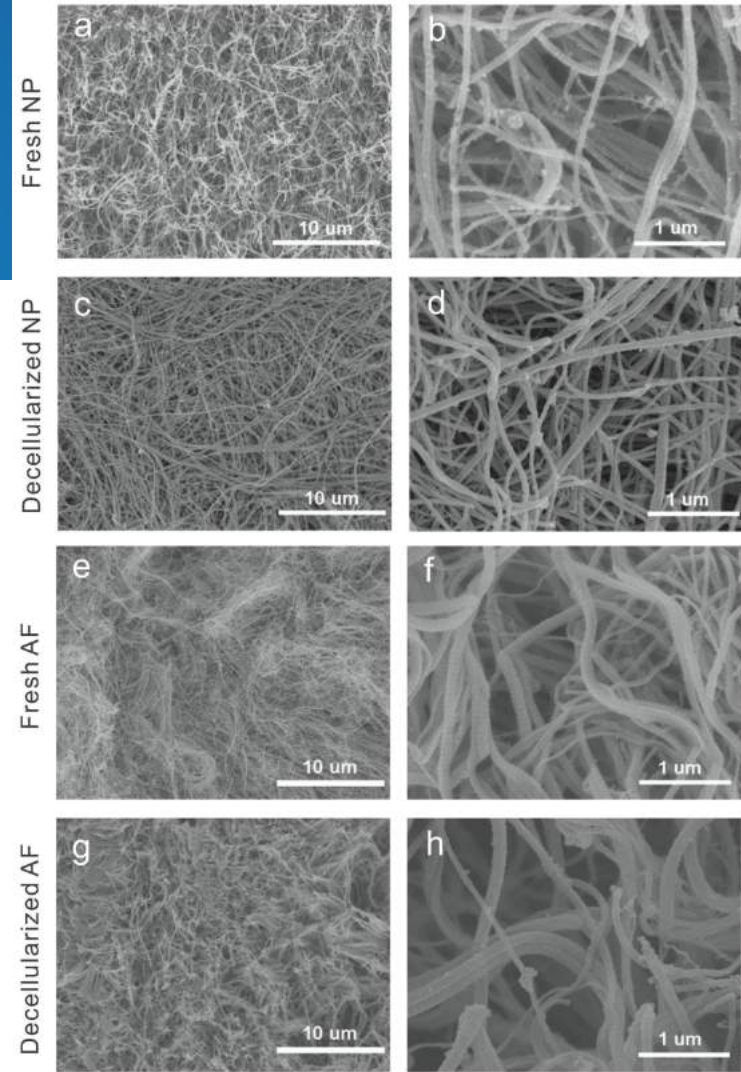
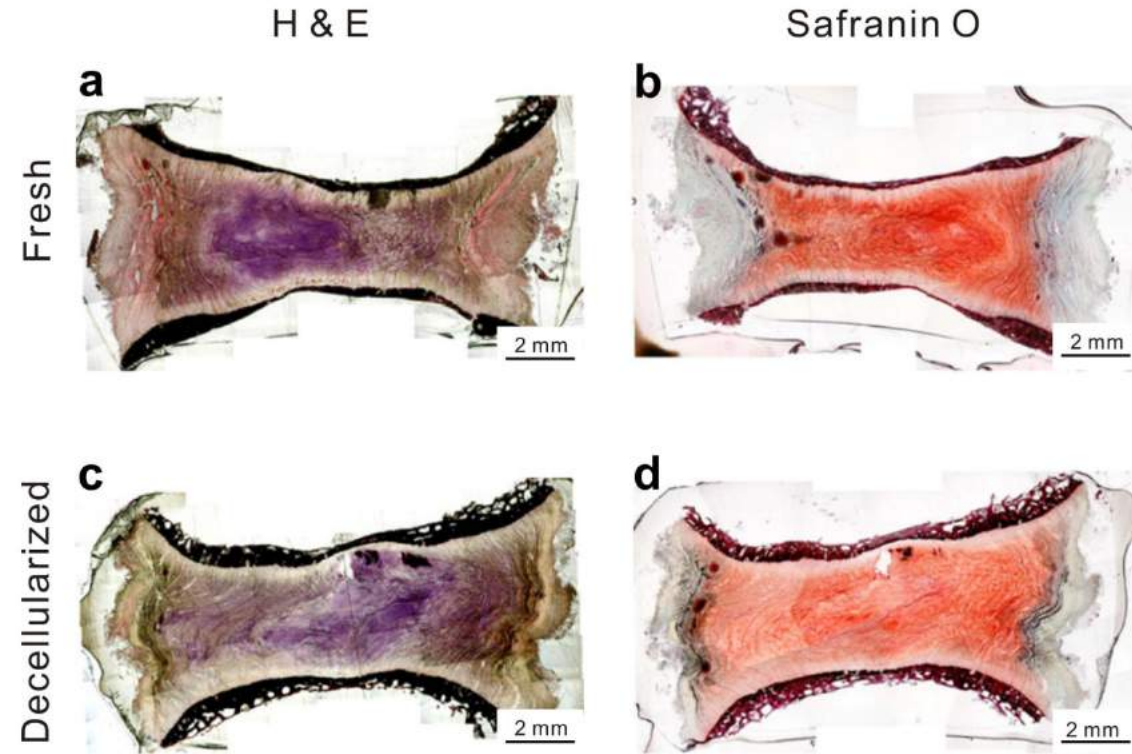
# Cutting-edge Research - SMS



# Our Suggestion

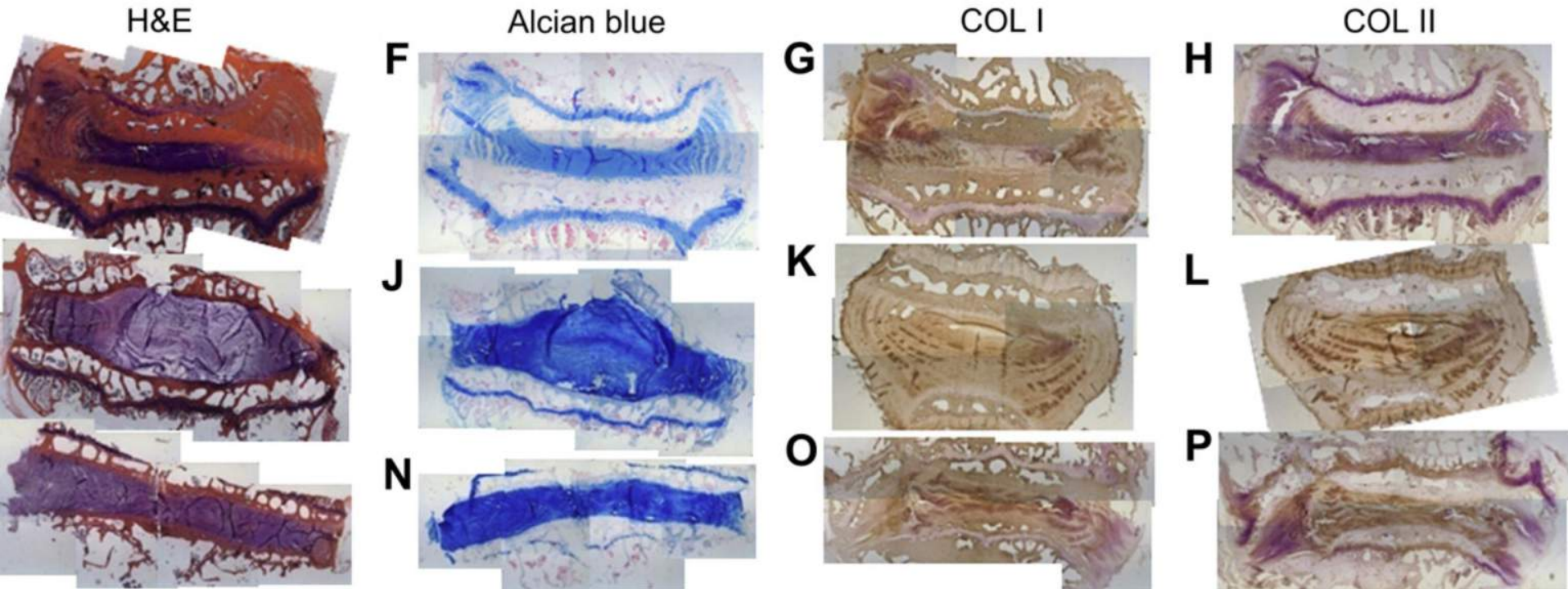
- Decellularization - Xenogenic Disc
- Recellularization - Human MSCs
- Dr. Doris Taylor

# Research Support





# Research Support (Continued)



# Problems

- Washed away?
- Thoroughness
- Survival
- Differentiation

# Conclusion

- Widespread + Significant Burden
- IVD Degeneration
- Treatments differ
- Tissue Engineering & Challenges
- Our Proposal: Recell-Decell
- Future: Pathogenesis (vital!)

# Acknowledgements

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- Cheston Cheng (3035179317)



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**Thank You!**