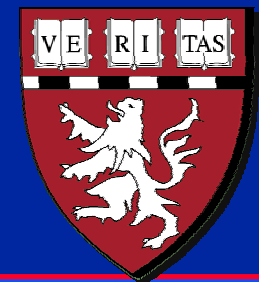




**Massachusetts Institute of Technology  
Harvard Medical School  
Brigham and Women's/Massachusetts General Hosp.  
VA Boston Healthcare System**

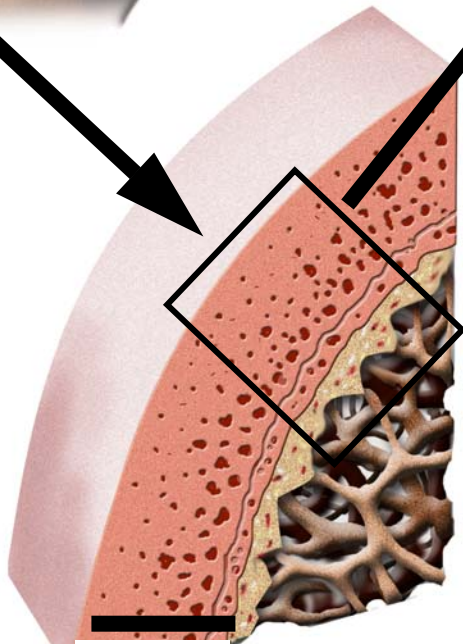
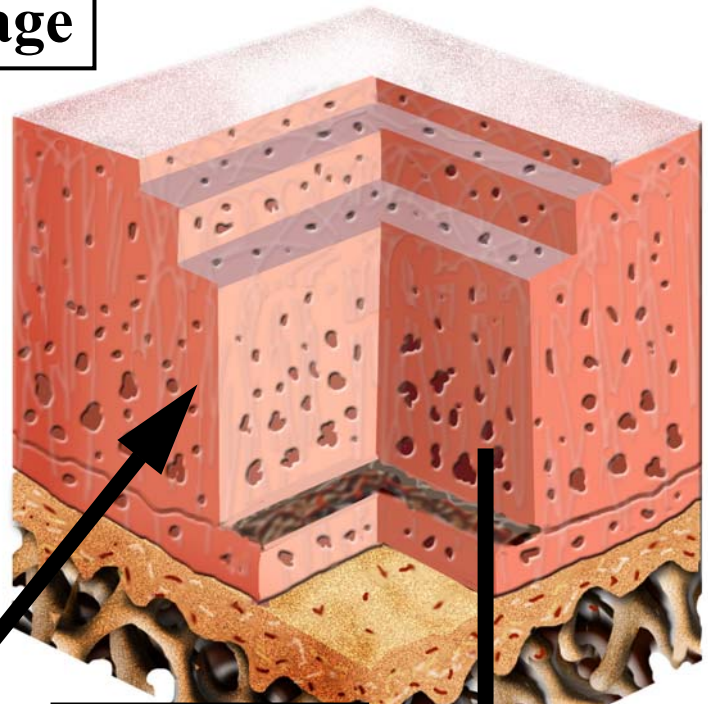
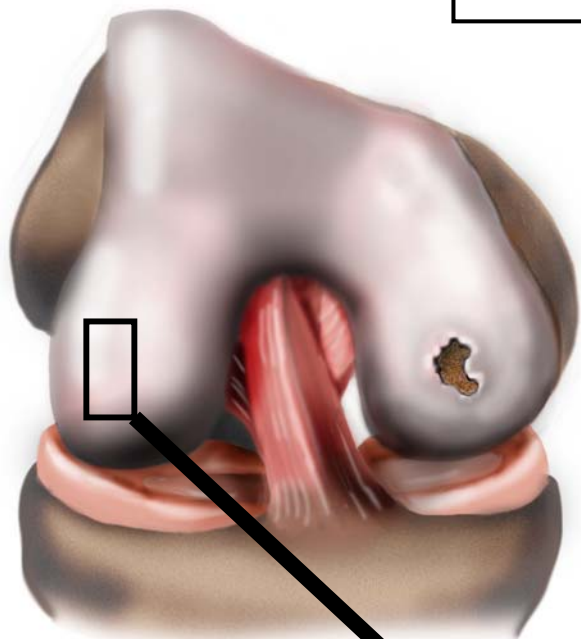


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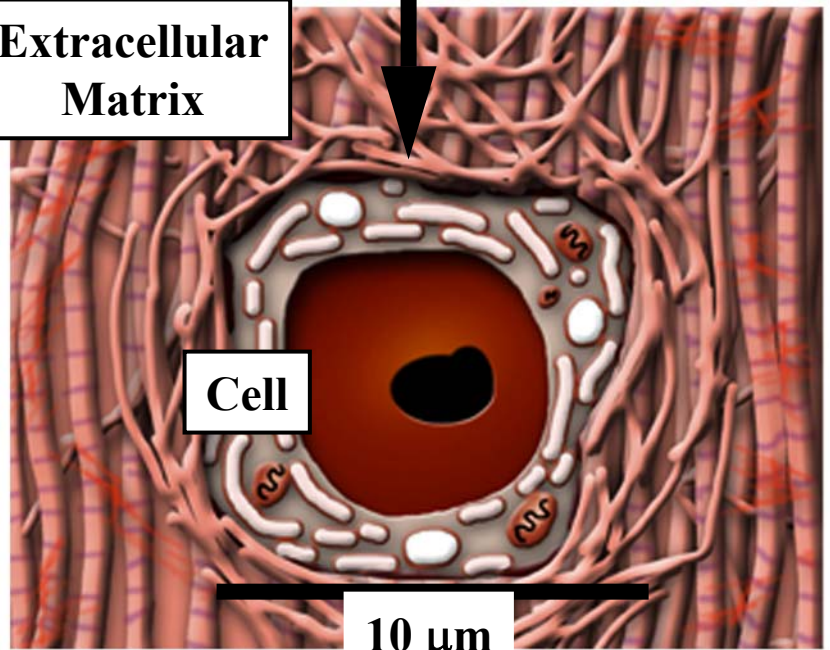
**CELL-MATRIX INTERACTIONS**

**M. Spector, Ph.D.**

# Articular Cartilage



Extracellular Matrix



Cell

4 mm

10 μm

# **Chondrocytes (P2 Canine) in a Type I Collagen-GAG Scaffold**

Image removed due to  
copyright considerations.

**“Control Volume”**

# UNIT CELL PROCESSES

## Concept of a “Control Volume” around a Cell

Soluble  
Regulator

A



“Control Volume”

# COLLAGEN-GAG MATRICES: MODEL BIOMATERIALS (ANALOGS OF EXTRACELLULAR MATRIX)

Investigation of cell interactions (UCPs) *in vitro*

- Type I (bovine and porcine)
- Type II (porcine)
- Chondroitin 6-sulfate

Image removed due to  
copyright considerations.

1mm

Image removed due to  
copyright considerations.

- Freeze-dried
- Dehydrothermally cross-linked
- Additional cross-linking

500 $\mu$ m

# CELL –MATRIX INTERACTIONS WITH COLLAGEN-GAG MATRICES *IN VITRO*

- Cell interactions with the scaffold
  - Mitosis, migration, synthesis, and contraction, and their interrelationships
- Can provide insights into scaffold composition and structure for improved performance in regenerative medicine
- Can provide insights into cell behavior *in vivo*

# **Chondrocytes (Passage 2 Canine) in a Type I Collagen-GAG Matrix**

**Live cell imaging  
for a period of 5  
hours.**

Image removed due to  
copyright considerations.

**J. Cheng**

# CELL –MATRIX INTERACTIONS

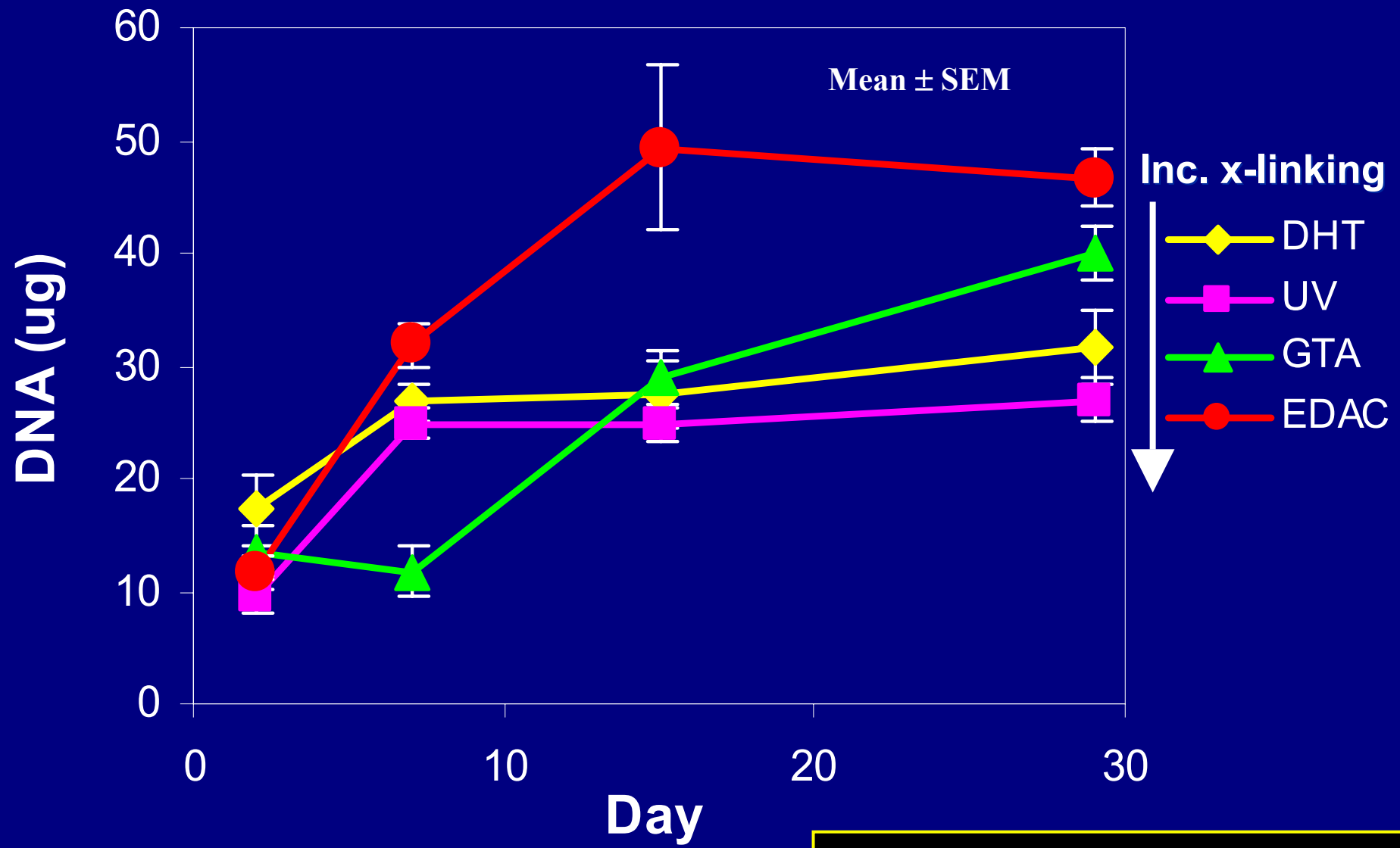
- **Mitosis**
- **Migration**
- **Synthesis**
- **Contraction**



# **Chondrocyte (P2 Canine) in a Type I Collagen-GAG Matrix: Mitosis**

Image removed due to  
copyright considerations.

# Effects of Cross-Linking on Chondrocyte Proliferation in Type I Collagen-GAG Matrices



# CELL –MATRIX INTERACTIONS

- Mitosis
- **Migration**
- Synthesis
- Contraction

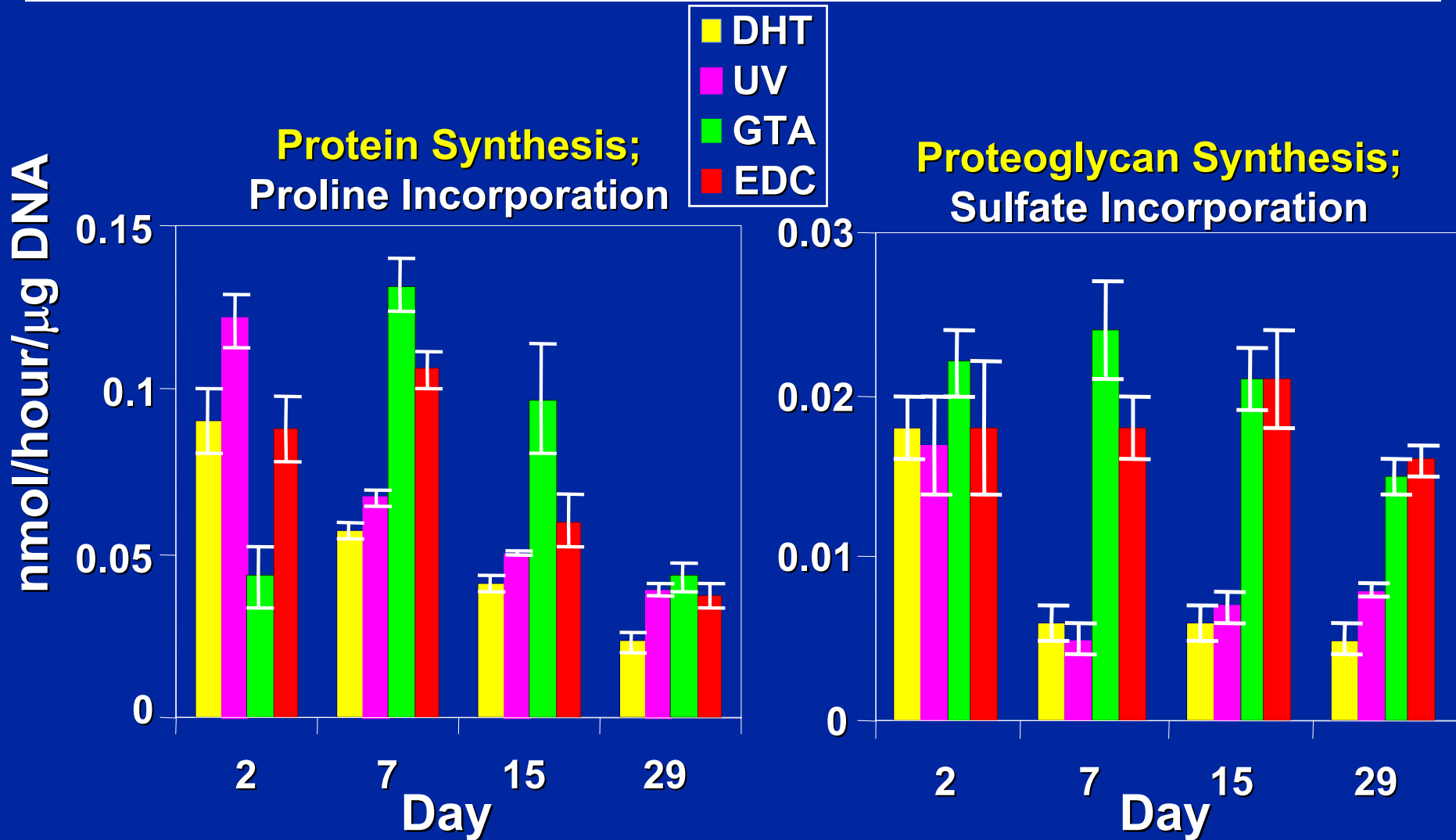
# **Chondrocytes (P2 Canine) in a Type I Collagen-GAG Matrix: Migration and Contraction**

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copyright considerations.

# CELL –MATRIX INTERACTIONS

- Mitosis
- Migration
- **Synthesis**
- Contraction

# Effects of Cross-Linking on Chondrocyte Biosynthesis in Collagen-GAG Matrices



# CELL –MATRIX INTERACTIONS

- Mitosis
- Migration
- Synthesis
- **Contraction**

# **Chondrocytes (P2 Canine) in a Type I Collagen-GAG Matrix: Contraction**

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**40 min**

**B Kinner**



**Non-Seeded: 8 days**

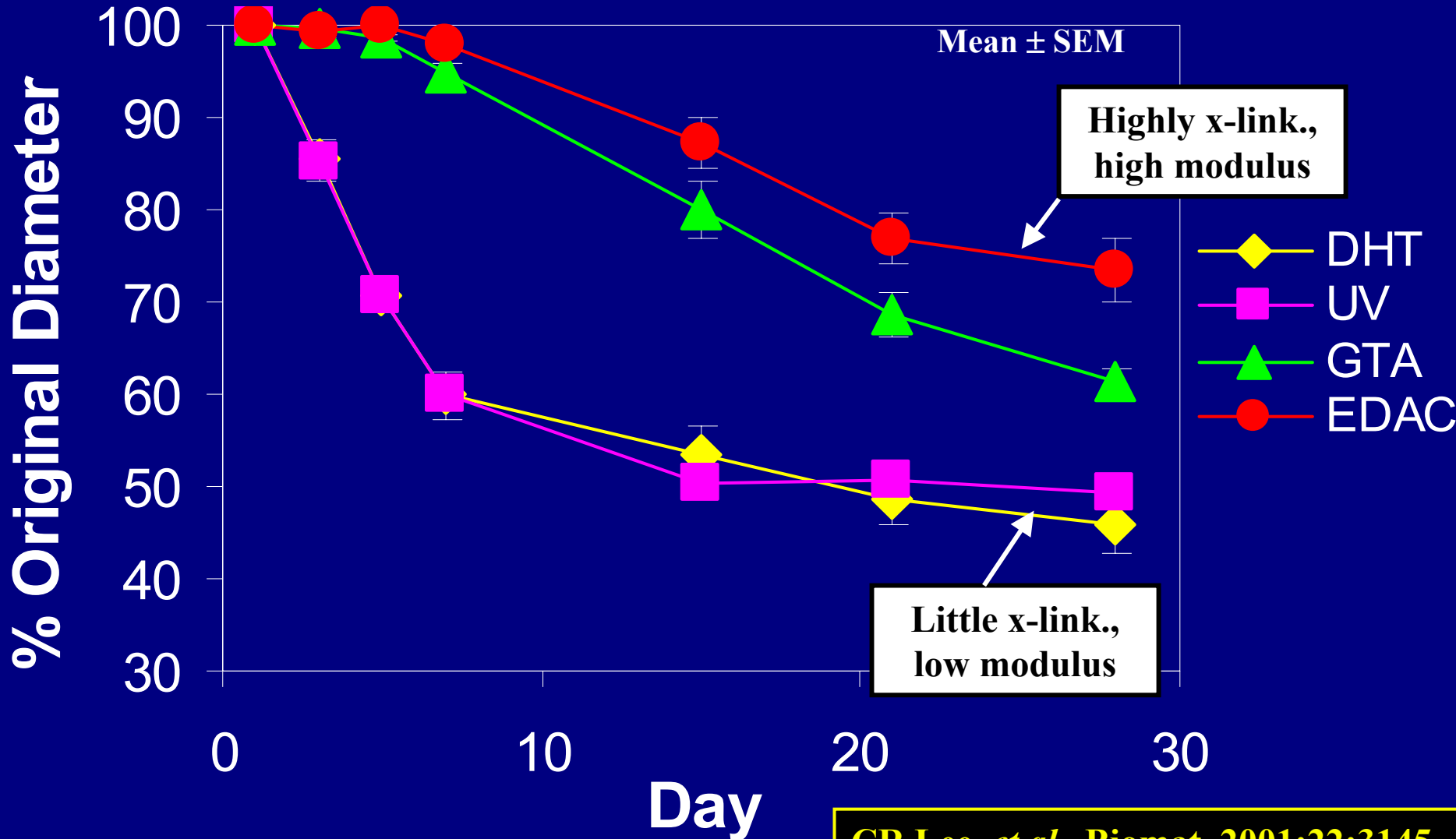
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copyright considerations.

**21 days**

Image removed due to  
copyright considerations.

**Non-Seeded and Cell-Seeded  
Collagen-GAG Scaffolds**

# Adult canine articular chondrocytes (passage 3) contract a type I collagen-GAG matrix, reflected in the decrease in diameter



# CELL –MATRIX INTERACTIONS

- **What are the interrelationships among UCPs: mitosis, synthesis and contraction?**

# **BIOMATERIALS-TISSUE INTERACTIONS**

**Cell + Matrix**

**Connective  
Tissue**

**Epithelia**

**Muscle**

**Nerve**

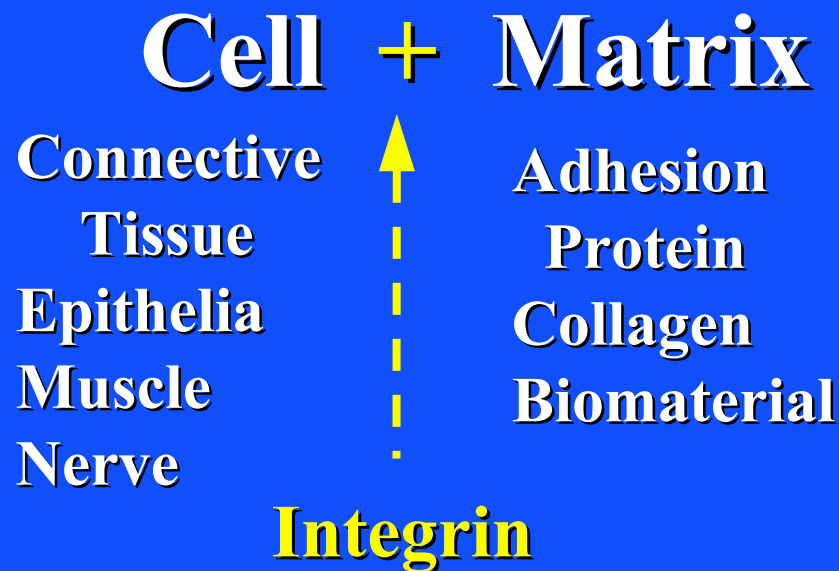
# **BIOMATERIALS-TISSUE INTERACTIONS**

## **Cell + Matrix**

**Connective  
Tissue  
Epithelia  
Muscle  
Nerve**

**Adhesion  
Protein  
Collagen  
Biomaterial**

# BIOMATERIALS-TISSUE INTERACTIONS



# “UNIT CELL PROCESSES”

**Cell + Matrix** <sup>UCP</sup> 

**Connective  
Tissue  
Epithelia  
Muscle  
Nerve**

**Mitosis  
Synthesis  
Migration  
Contraction  
Endocytosis  
Exocytosis**