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Mechanical chondrocyte damage thresholds

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1. Questions
- How much deformation can a chondrocyte endure, and for how long, before it damages
- How does the PCM affect chondrocyte deformations and damage

2. Methods
Bovine chondrocytes are cultured in 3-D agarose constructs for 1, 3, 5, 7, and 10 days. After staining with CTG and PI to stain living cells green and dead cells red [1], they are subjected to nonuniform compression [2] at a confocal microscope, and imaged every hour for 24 hours. Histology is used to assess PCM development over culture time, and to measure cell deformation at 25 % strain.

3. Results

4. Conclusions
- Cell death increases with increasing cell deformation, and with increasing strain duration
- Cell deformation and cell death decrease as the amount of PCM increases
- In our experiments we find that (not shown):
  \[ \text{cell death } [\%] = c(t) \cdot (\text{aspect ratio } - 1) \]
  with \( c(t) \) a function of culture time \( t \)
- These data strongly indicate that the PCM shields the cells from deformations and (therefore) from damage due to compression

References

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