# Encapsulation and Osteogenic Differentiation of Mesenchymal Stem Cells in a Biomimetic, Purine Cross-Linked Chitosan Sponge for Bone Tissue Engineering

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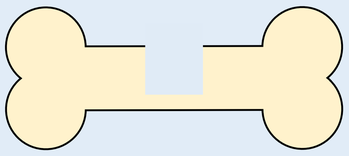
Bone tissue engineering is a promising alternative to autologous bone grafts for treating bone defects



Great interest in employing mesenchymal stem cells (MSCs) in conjunction with biomaterial scaffolds to develop functional bone graft substitutes; however, an optimal scaffold to use with MSCs is still needed

**Injectable, pyrophosphatase (PPtase) loaded, guanosine diphosphate (GDP) cross-linked chitosan sponge**

- Rapid gelation (~1.6 s) upon mixing of the two solutions ensuring efficient encapsulation and localization at site of interest
- Highly biocompatible and biodegradable. Encapsulated MSCs maintained their viability and a homogeneous distribution within the chitosan sponge
- Encapsulated MSCs were successfully committed to the osteogenic lineage. Some osteoinductive effects were observed on encapsulated MSCs that warrant further investigation
- Pyrophosphate as a degradation by-product of the sponge inhibits mineralization, and the co-encapsulation of PPtase proved beneficial in overcoming that inhibitory effect
- Future studies will focus on in vivo testing on rat models of critical bone defects and the possibility of promoting the differentiation of encapsulated MSCs into other lineages in order to move this sponge a step forward towards clinical use as a universal MSC carrier suitable for the regeneration of various tissue types

Scan the code to read our publication in the Journal of Biomedical Materials Research: Part A

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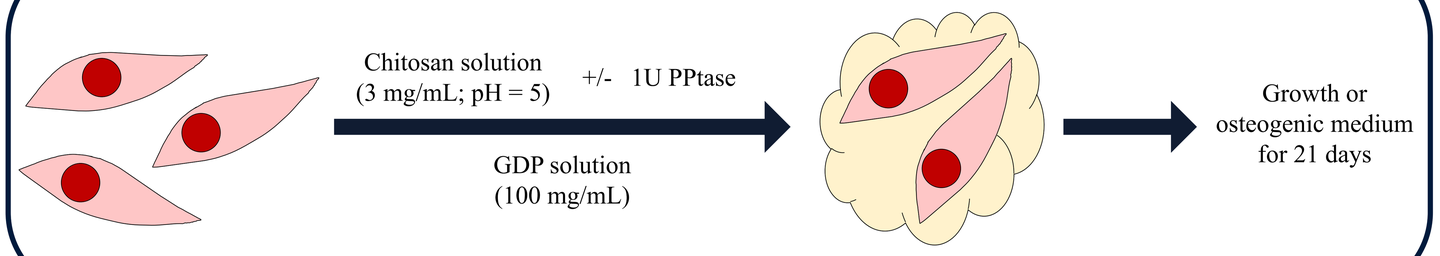
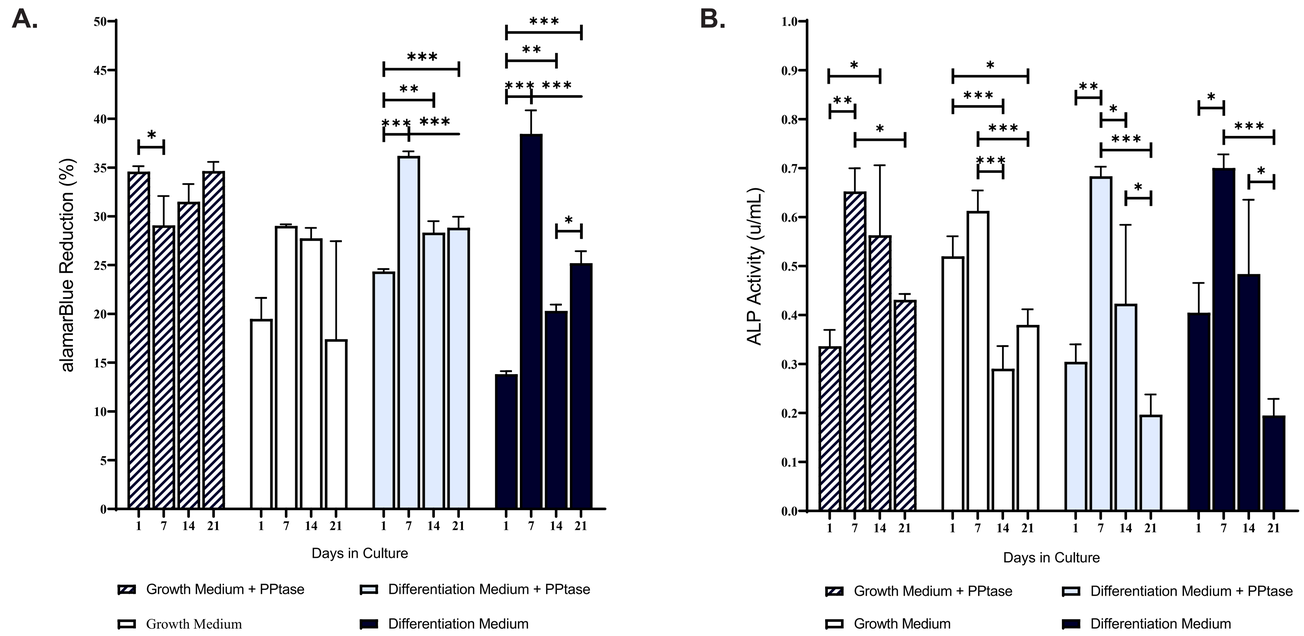
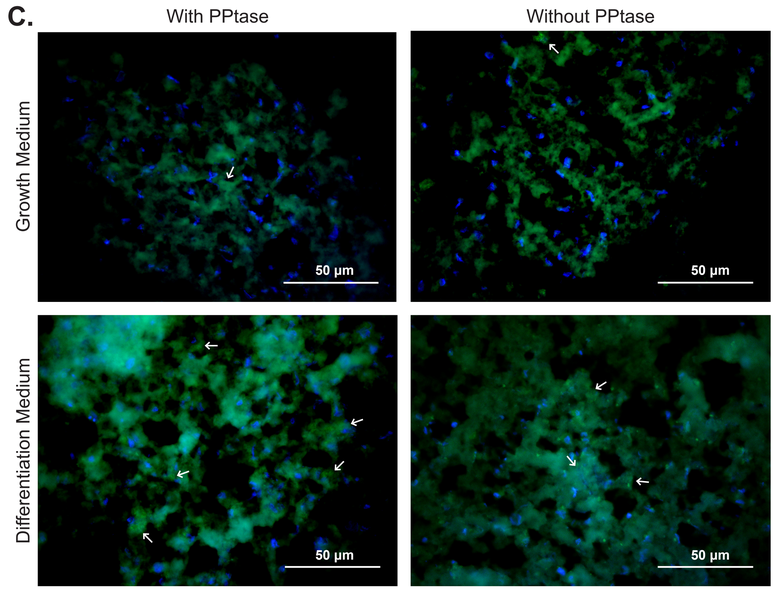
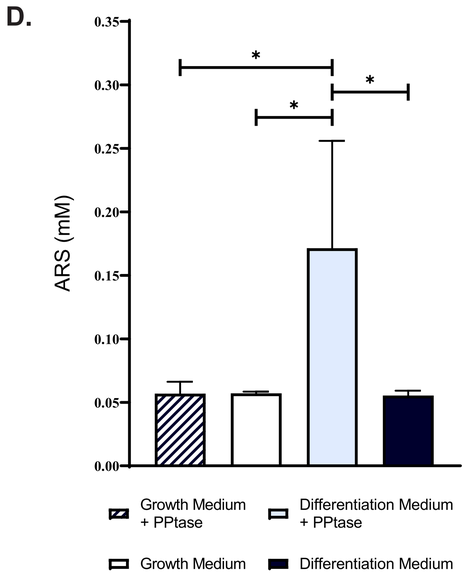
## METHODOLOGY




## RESULTS




**Assessment of cell survival and differentiation.** (A) almarBlue reagent reduction over 21 days (n=3), (B) ALP activity over 21 days (n=3), (C) fluorescent staining for DAPI (blue) and AlexaFluor® 555-osteocalcin (green) after 21 days, and (D) quantification of mineralization in indirect cultures by Alizarin Red S staining (n=3); (*: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$)

## AKNOWLEDGEMENTS

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