

# **Alcohol Affects Osteoinductive Capacity**

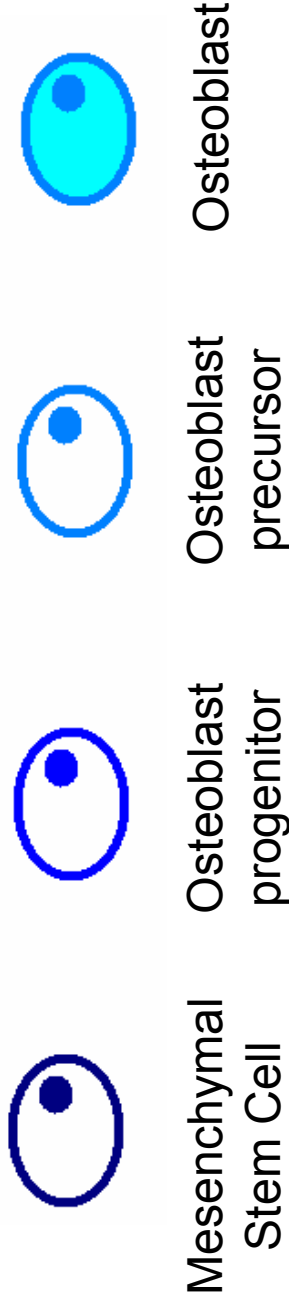
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# Alcohol and Bone

- Chronic Alcohol Consumption:
  - 35% of caloric intake derived from alcohol
  - 5-6 beers or 7-8 glasses of wine/day
- This pattern of alcohol consumption can result in:
  - Increased risk for osteoporosis
  - Stunted bone growth
  - Delayed or abnormal fracture healing

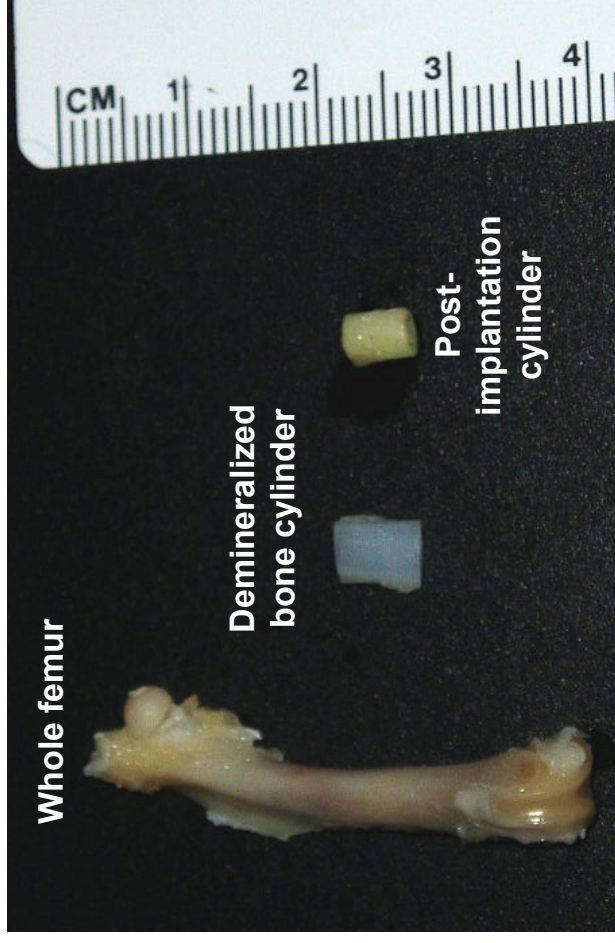
# Background: Osteoinduction



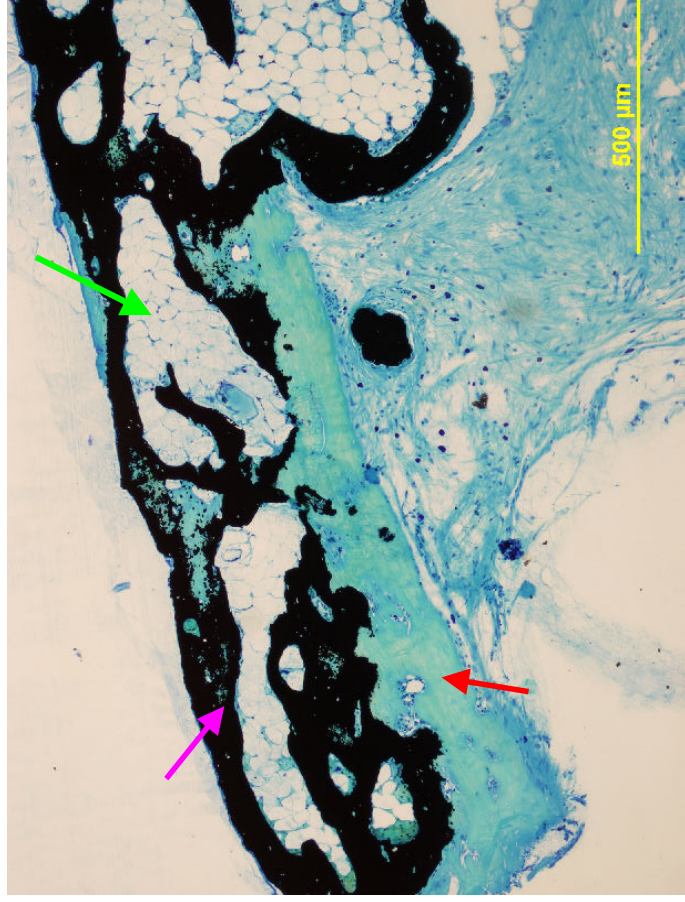
- Osteoblasts deposit osteoid, the organic material which is mineralized to bone
- Osteoinduction occurs during fracture healing and ectopic bone formation

# DeminerIALIZED Bone Matrix (DBM) Cylinder Method

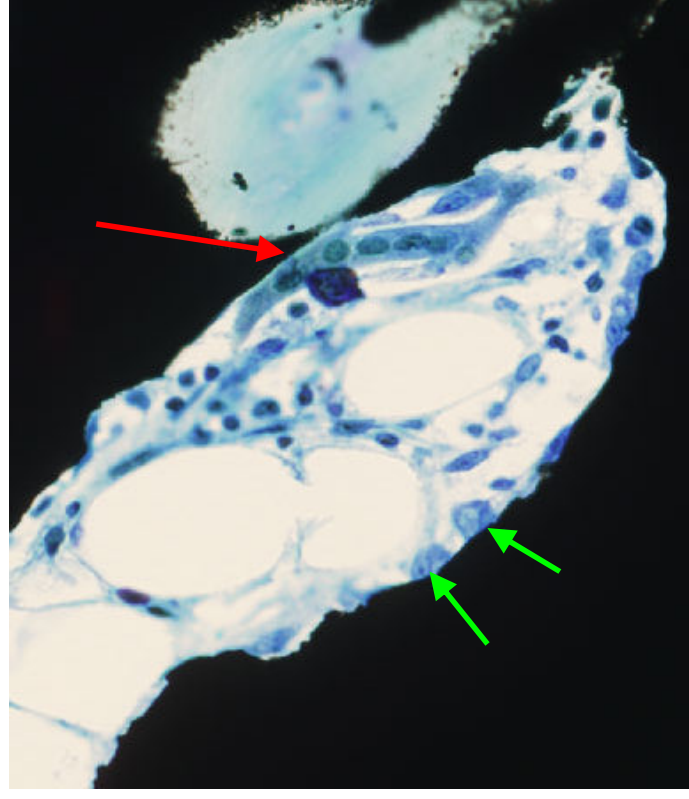
- Ectopic bone formation occurs via osteoinduction
- Matrix contains growth factors and cytokines
- DBM cylinders implanted subcutaneously
- After 6 weeks, DBM cylinders display characteristics of mature bone



# DBM Cylinder Histology



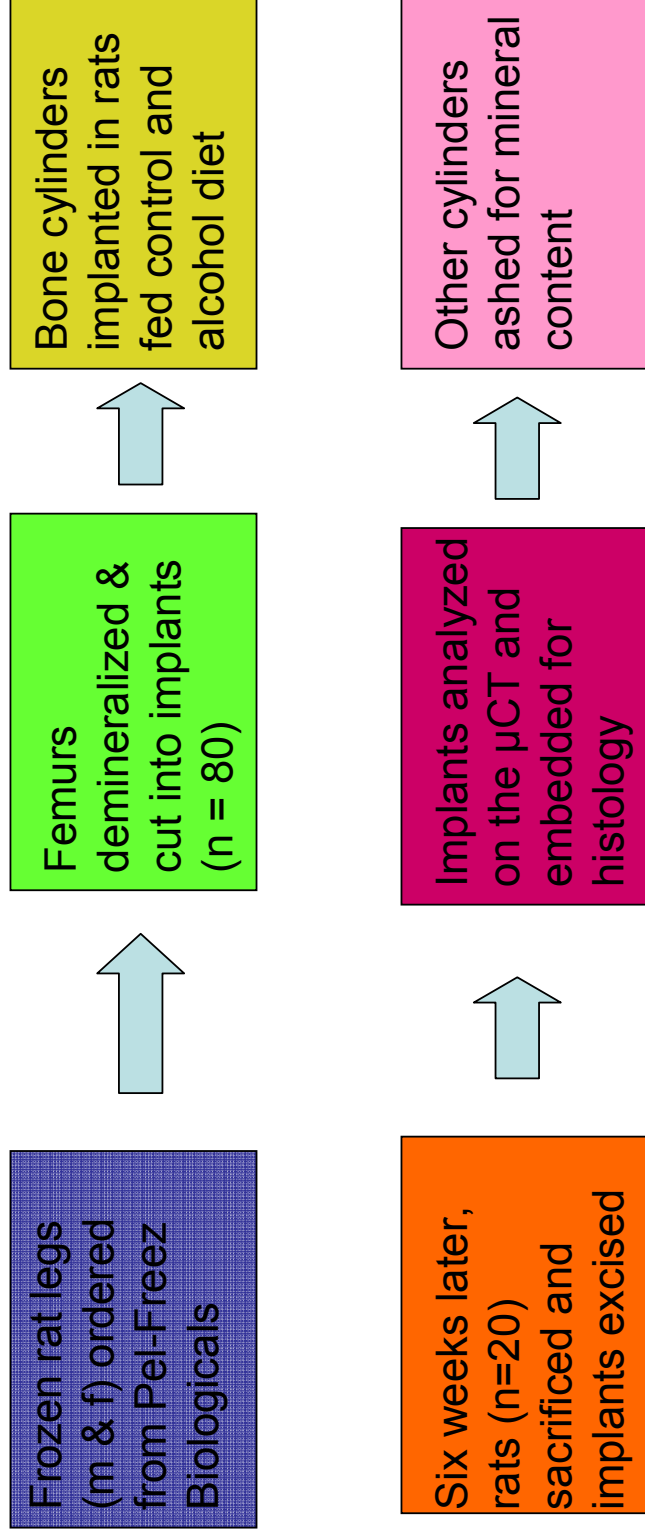
**Stained section showing mineralized bone, fatty marrow and osteoid**



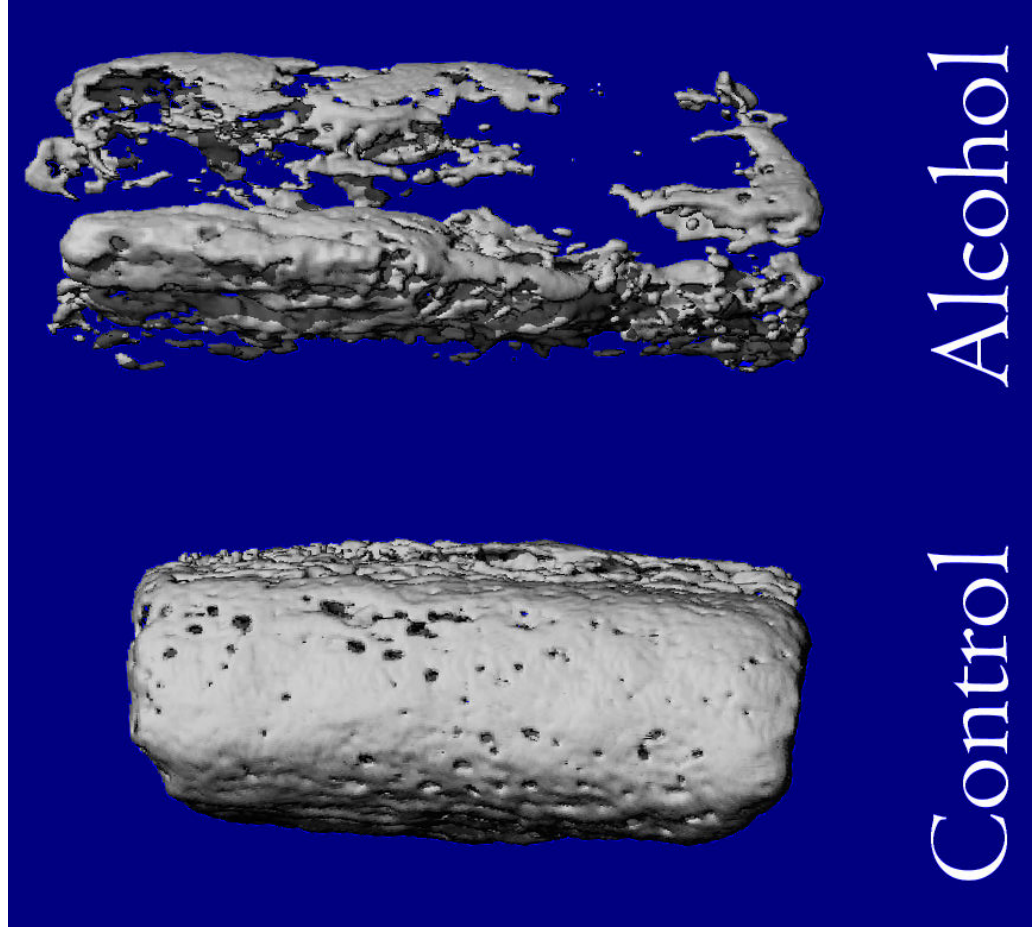
**Bone cells depositing and resorbing bone matrix**

# Effect of Alcohol on Osteoinduction

Hypothesis: Alcohol will reduce osteoinductive response



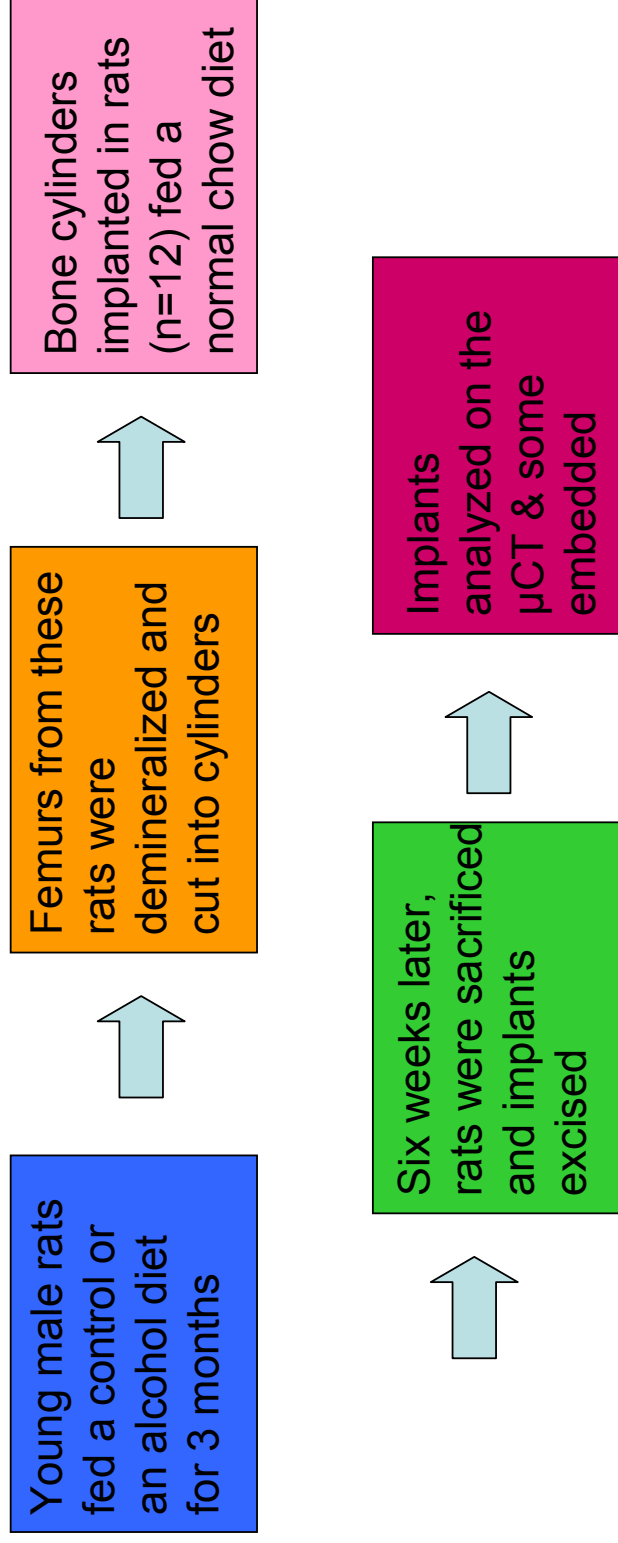
# Study Results



- Lower bone volume in implants from alcohol rats
- No significant difference in relative mineral components (ICP-AES)
- Amount of bone formed is reduced in alcohol-consuming animals
- No difference in bone quality between the two groups

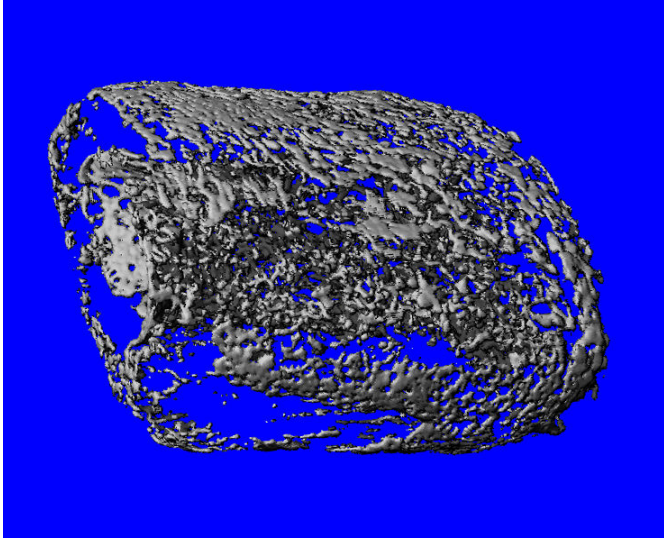
# Biological Memory in Bone

Hypothesis: Bone matrix deposited in the presence of alcohol will show a similar decrease in osteoinduction

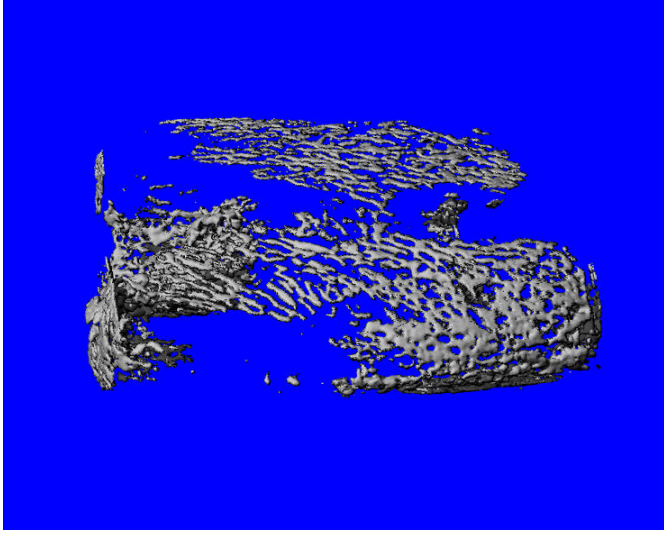




# Study Results



Bone formed on DBM  
from an animal  
consuming control diet



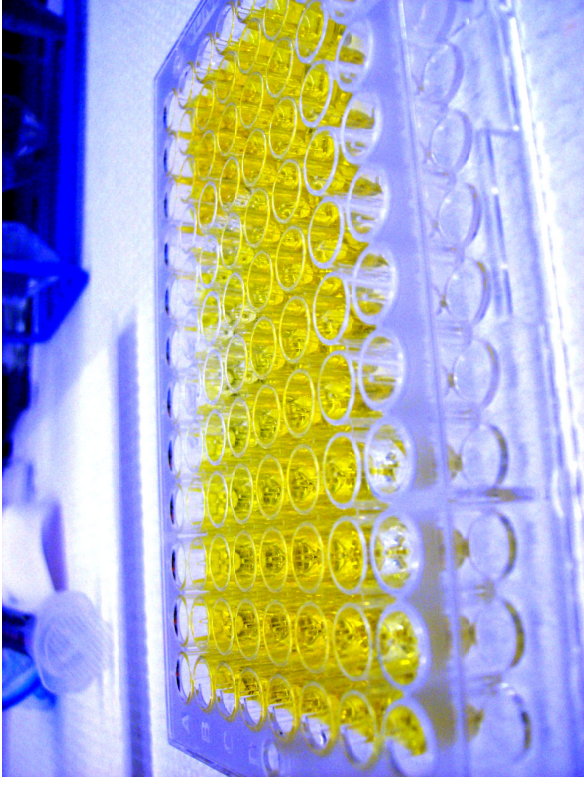
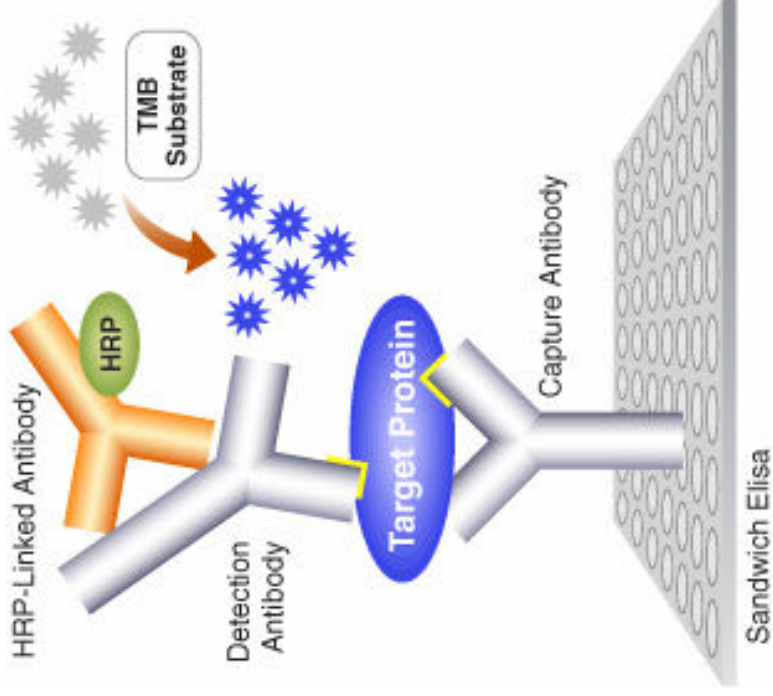
Bone formed on DBM  
from an animal  
consuming alcohol diet

## Insulin-like Growth Factor 1 (IGF-1)

- Growth hormone stimulates production of IGF-1
- Alcohol decreases serum GH and therefore serum IGF-1
- Microarray data from a previous study showed IGF-1 to be downregulated in an animal model for chronic alcohol abuse
- Alcohol disrupts IGF-1 signaling in skeletal muscle

# ELISA

- Enzyme-Linked Immunosorbent Assay



# ELISA Results

- No significant difference in normalized IGF-1 concentration
- Need to do further analysis of experimental setup to determine sources of inter-assay variability
- Need to improve data analysis techniques

## Future direction

- Continue work on IGF-1
- Test for DBM compositional differences of other osteoinductive factors
- BMP-2
- TGF-Beta

# Take Home Message

- Impaired fracture healing in alcohol abusers could be explained in part by impaired osteoinduction
- Impaired osteoinduction may persist long after dietary conditions return to normal
- Other dietary interventions may cause similar changes in bone matrix composition

**Questions?**