

Effects of Microplastics on Telomere Elongation in Regenerated Tissue of the Gray Sand Star

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Objective: Discover potential negative impacts of varying microplastic concentrations on telomere length, found on chromosomes in the tissue of sea star *Luidia clathrata*, after uptake of microplastics and regeneration.

INTRODUCTION

Microplastics

- Small plastic fragments < 5mm
- Primary microplastics: created small
- Secondary microplastics: degraded from UV rays, waves, etc.²
- Over 5 trillion microplastics pollute the ocean surface.³
- Negative impacts on marine organisms:
 - Starvation from gut blockage⁴
 - Translocation into tissue⁵
 - Changes in immune response, liver function, predatory stimuli, mobility⁶
 - Alteration in gene expression, in relation to leaching of chemicals on plastics⁷

Telomeres and *L. Clathrata*



Telomere:
In this picture, the telomeres are the 4 glowing ends of the chromosome. This gives the "tail"-like function.

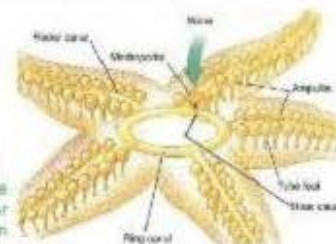
Telomeres:

- Series of sacrificial telomeric repeats at the end of chromosomes
- Prevent the loss of genetic coding from lagging strand degradation after replication⁸

Telomeres that are too short are at risk of losing important genetic coding (ex: for transcription of proteins), premature aging of cells and the organism, and apoptosis of cells

- L. clathrata* has demonstrated increased length of telomeres after regeneration⁹

Fig 1:
Microplastics will enter the madreporite by the water vascular system



METHODS & MATERIALS

Sea star groups (10 in each)

- Control group
 - Group of untreated and injured
 - Group treated with microplastics at low concentration and injured
 - Group treated with microplastics at high concentration and injured
- Pre-regenerative samples of tube feet taken from all. Stored in 95% alcohol. Then, first amputation occurs, one arm from each sea star, for a baseline reading of telomere length
 - Tube feet on new arm bud are taken and stored
 - Specified doses of fluorescent microplastics injection into water

- Second round of amputation of the same arm will be conducted.
- Arm will follow tissue digestion and microplastic quantification to assess uptake
- Sea stars will be placed under fluorescent microscope to see where microplastics accumulate
- Sea stars will be photographed daily using Image J software to monitor growth
- In genetic analysis, DNA will be extracted, and qPCR will be used to infer telomere length between the 4 groups
- Statistical analyses will be used to compare treatment groups to the control

Fig 2: Tissue prep and DNA extraction



The "Why?"

- Sea stars rely on regeneration to be durable in their environments.
- If microplastic intake can disrupt regeneration/ cause a decrease in telomere length, critical threats are posed to this organism and all linear chromosome species that elongate telomeres in gonads for reproduction
- Reduced telomere length could speed the process of cell aging and cell death



Microplastics

Hypothesis: The presence of microplastics in the regenerated tissue of *L. clathrata*, specifically in those treated with higher concentrations of microplastics, will display a decrease in telomere length