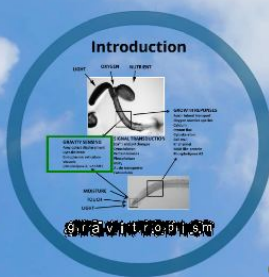




# The Effect of Microgravity on Tomato (*Lycopersicon esculentum*) cv. Arthaloka F1 and Mung Bean (*Vigna radiata*): Structure, Physiology and Molecular Study

**Principal Investigator:  
Dr. Rizkita R. Esyanti**



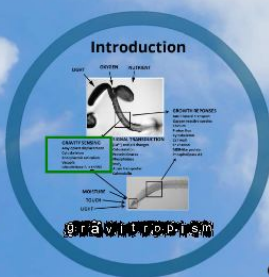
**School of Life Sciences and Technology  
Institut Teknologi Bandung**





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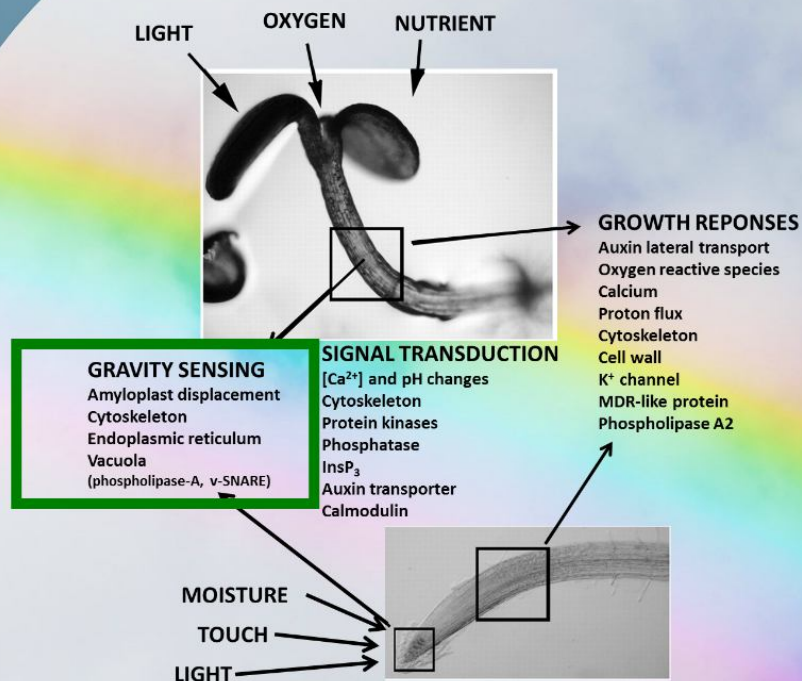
**Principal Investigator:  
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Institut Teknologi Bandung**



# Introduction

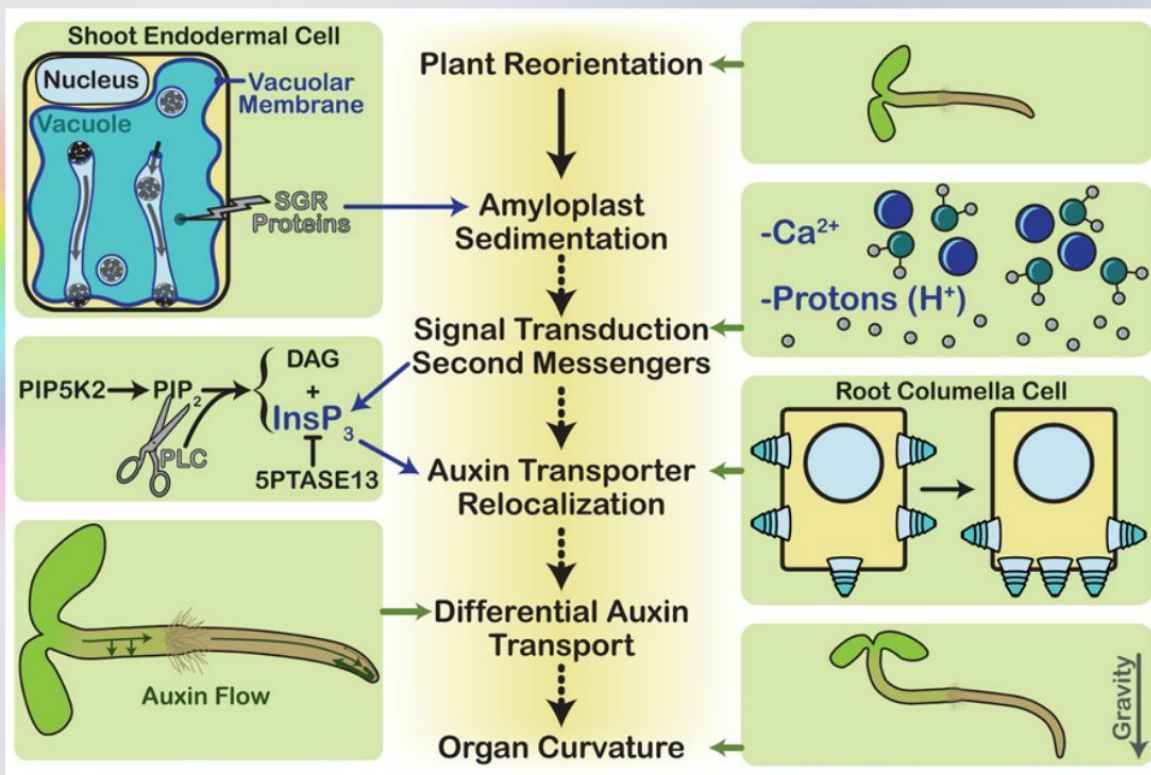


gravitropism

Sch

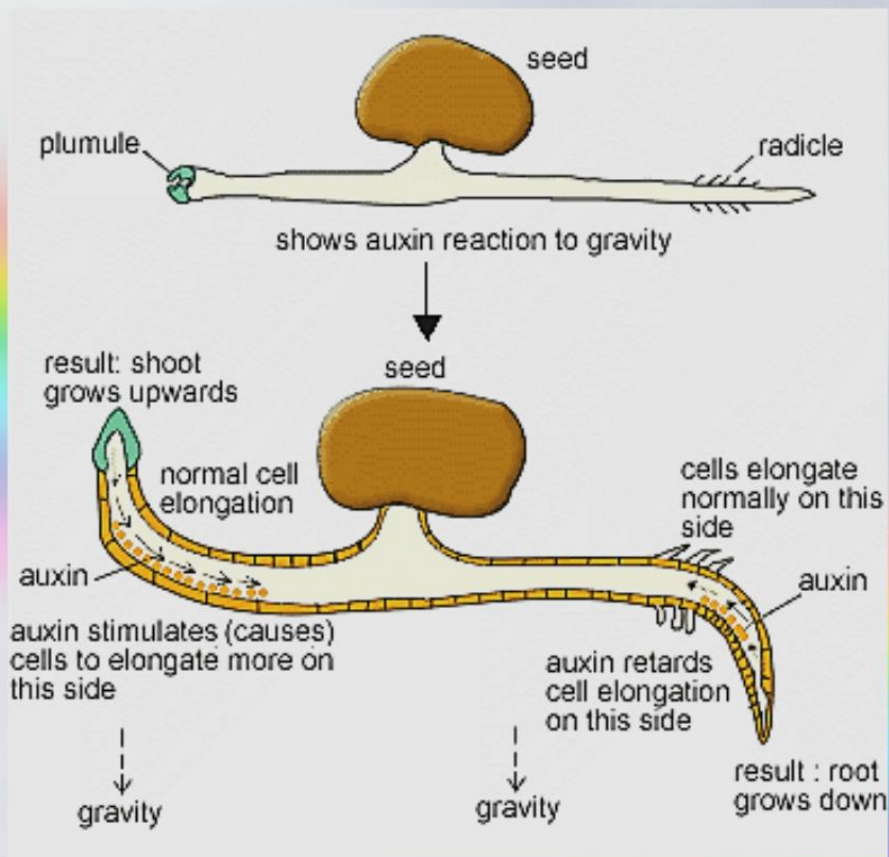


# The Mechanism of Gravitropism



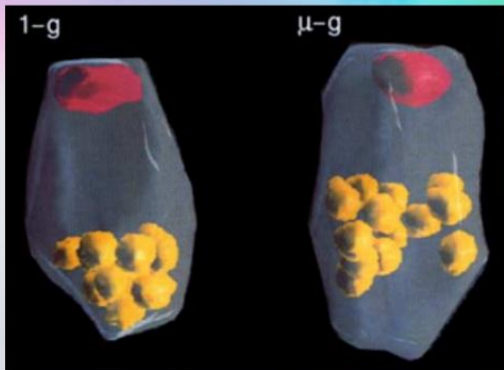
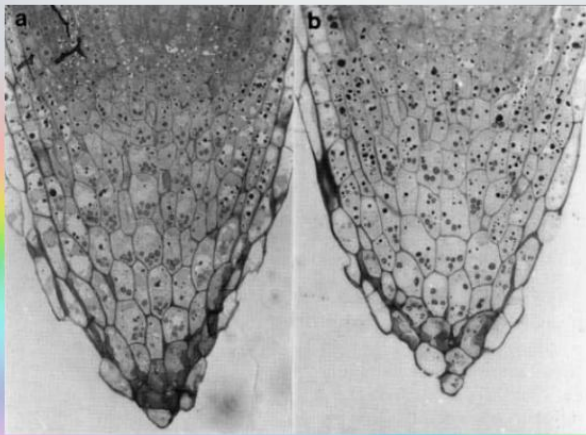
Strohm et al., 2012

# The Effect of Auxin Differential to Cell Growth

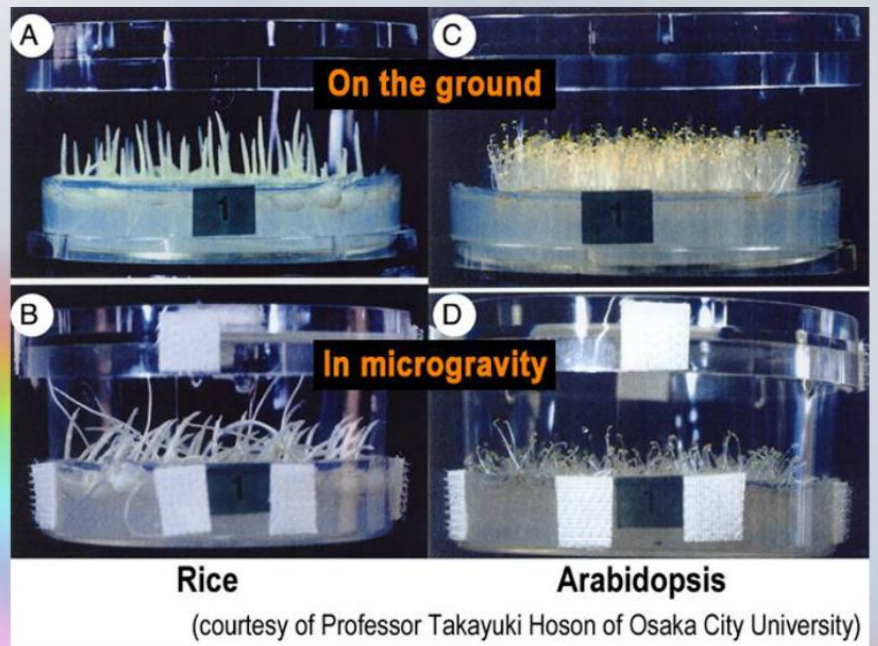


(Based on Hasenstein, 2009)

# The Effect of Microgravity



(Smith et al, 1997)



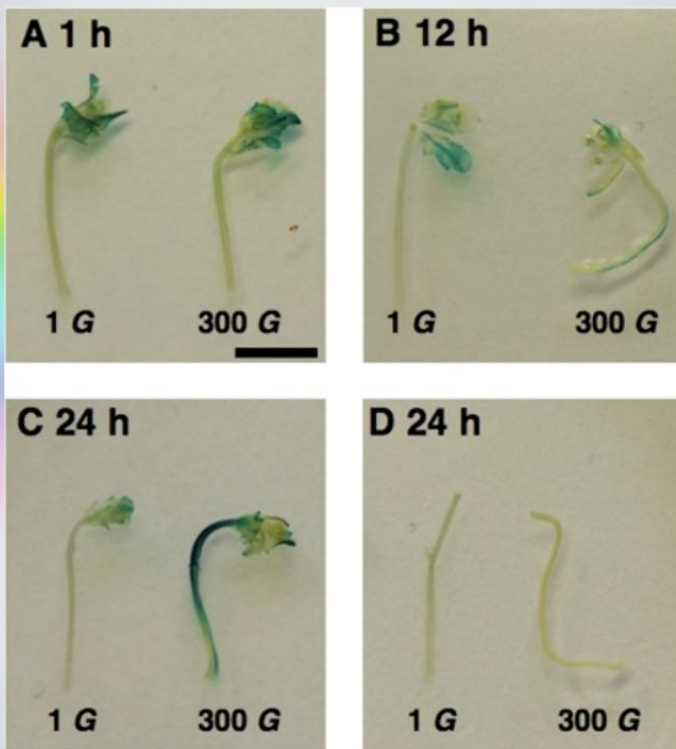
Rice

Arabidopsis

(courtesy of Professor Takayuki Hoson of Osaka City University)

[http://www.jaxa.jp/article/special/kibo/takahashi\\_e.html](http://www.jaxa.jp/article/special/kibo/takahashi_e.html)

## The Effect of Hipergravity



Hipergravity has been proved to inhibit shoot elongation of dicots, such as in hypocotyls of radish and cucumber (Kasahara et al., 1995), cress (Hoson et al., 1996) dan epycotyls of adzuki bean (Soga et al., 1999).

Plant growth inhibited because the changes of xyloglucan structure, thickened the cell wall and reduced its extensibility.

(Tamaoki et al., 2011)



## Purposes

To verify simulation of microgravity by three dimensional clinostat in dark and normal light condition

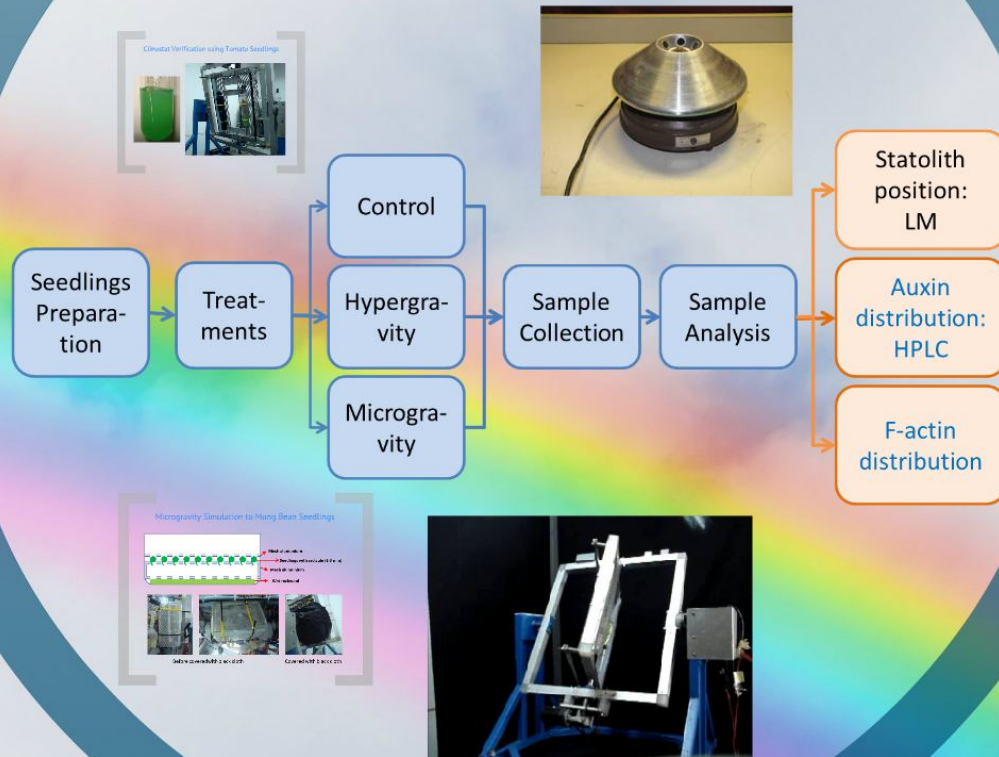


To observe the effect of clinorotation to statolith position in columella and shoot endoderm of *Vigna radiata* seedlings.

To observe auxin distribution, in response to clinorotation and hypergravity simulation.

To observe F-actin distribution due to clinorotation and centrifugation.

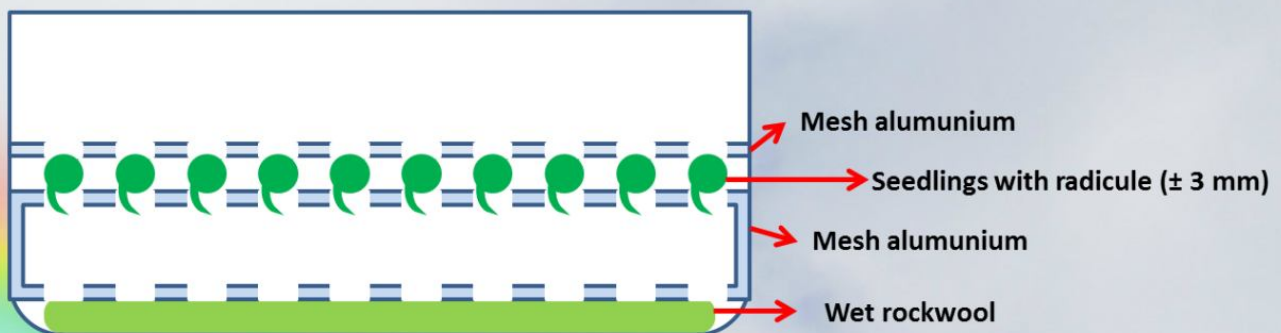
# Research Outline



## Clinostat Verification using Tomato Seedlings



## Microgravity Simulation to Mung Bean Seedlings

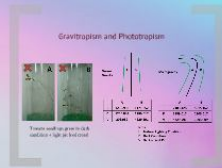
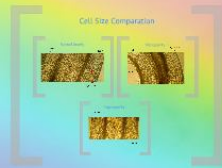
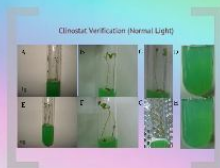
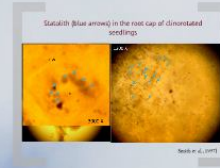
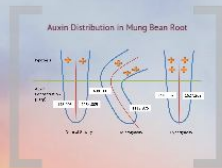
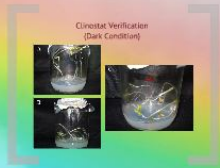
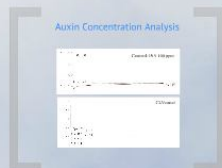


Before covered with black cloth

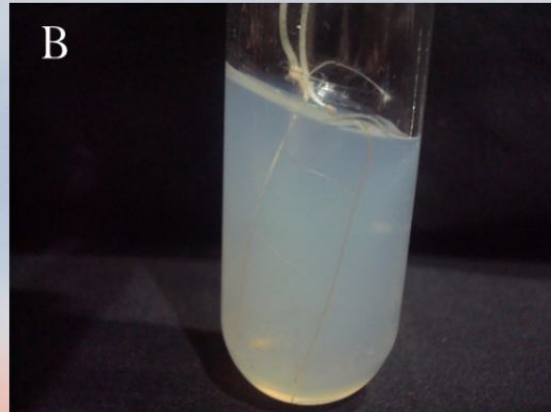


Covered with black cloth

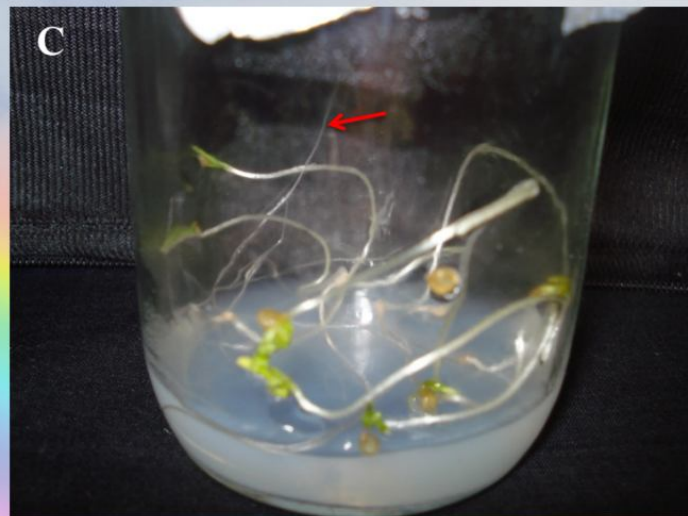
# Results



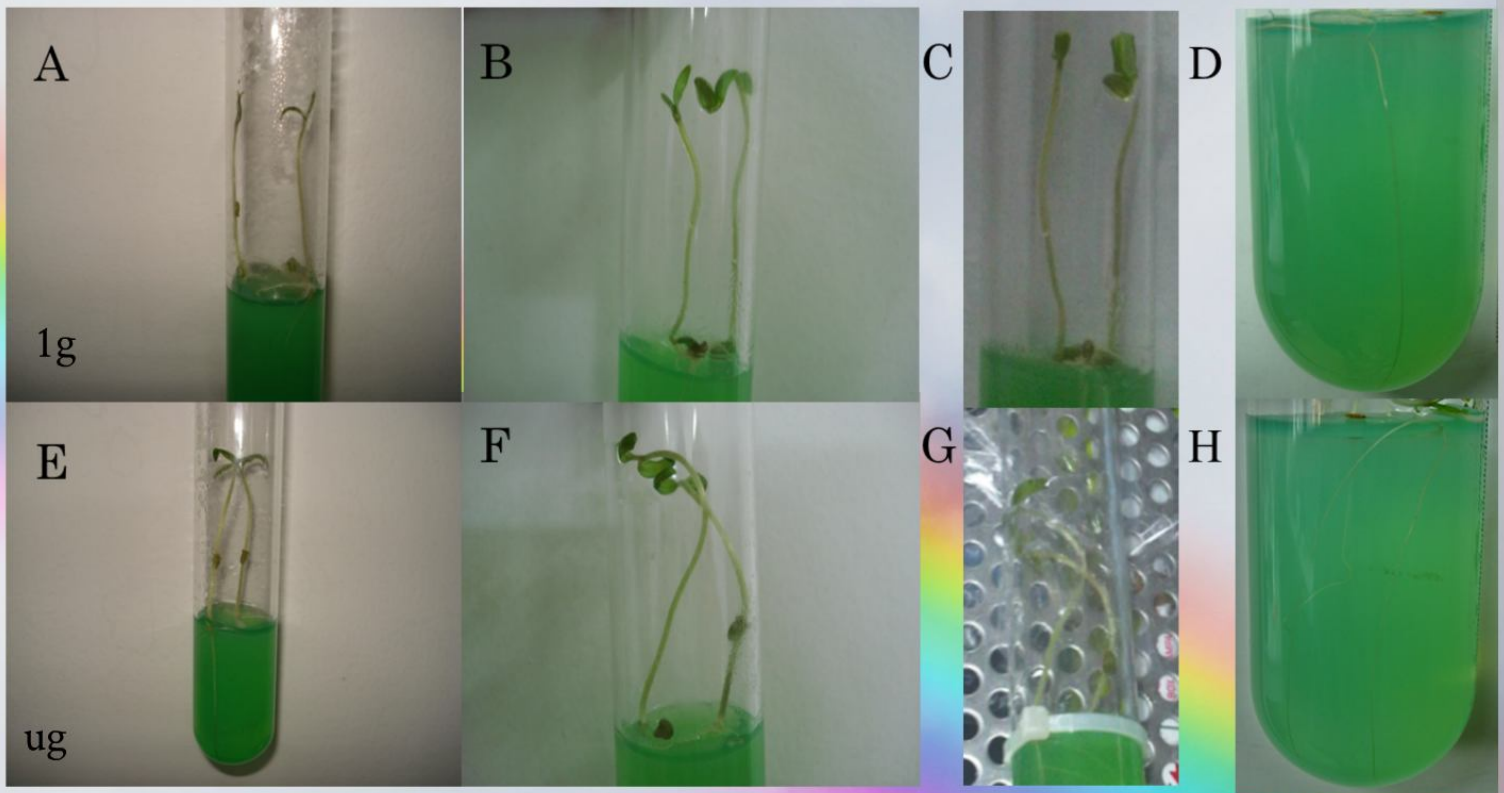
## Clinostat Verification (Dark Condition)



## Clinostat Verification (Dark Condition)

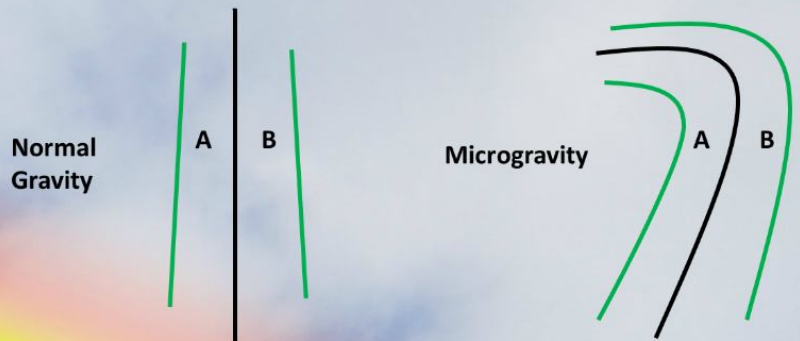
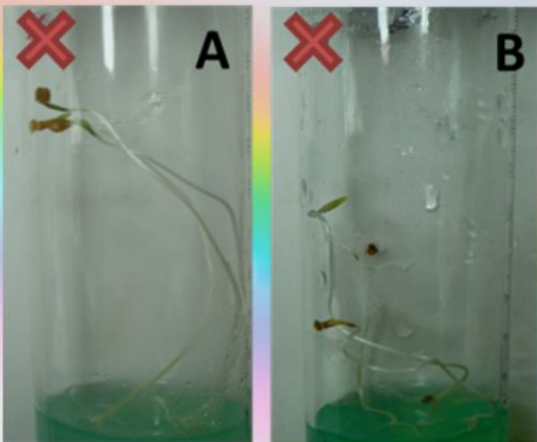


## Clinostat Verification (Normal Light)





# Gravitropism and Phototropism



	A	B
L	1236.998	1171.852
D	1250.834	1289.017
V	208.989	4229.591

	A	B
L	2183.428	5915.162
D	1289.017	1905.017
V	4229.591	10934.09

Tomato seedlings grew in dark condition + light pit (red cross)

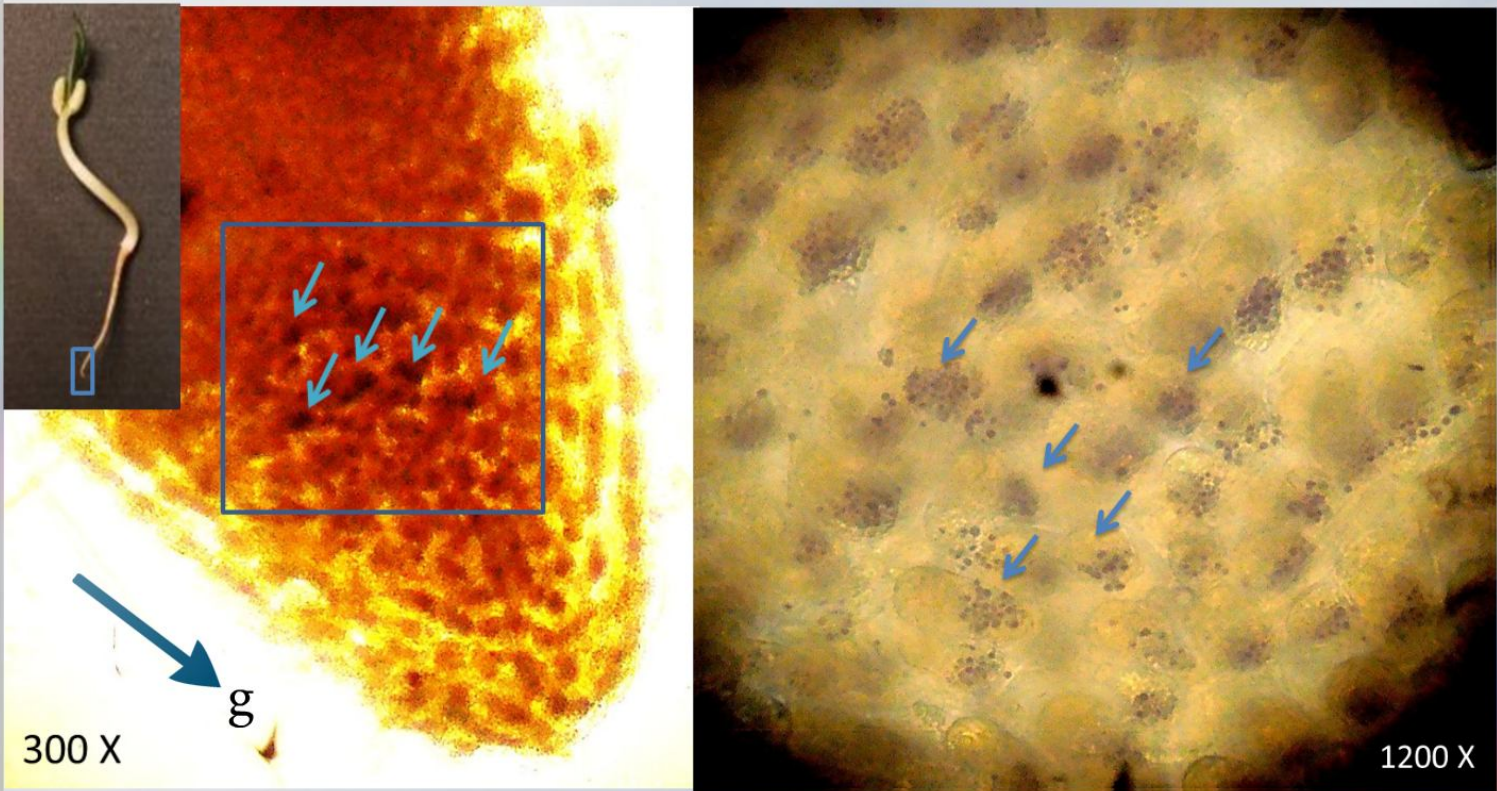
**Note:**

L : Natural Lighting Condition

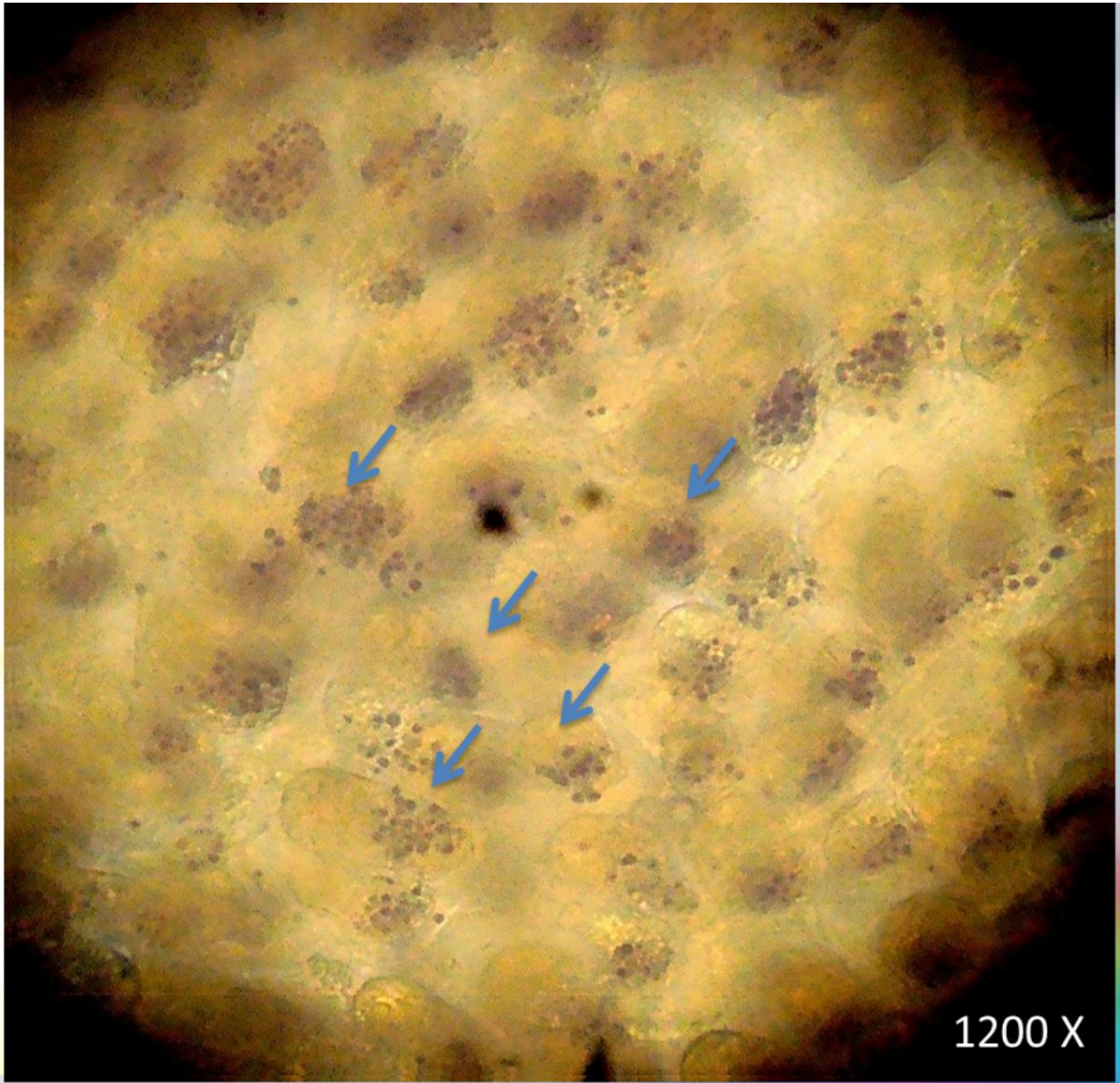
D : Dark Condition

V : Dark + Light Pit

Statolith (blue arrows) in the root cap of control seedlings

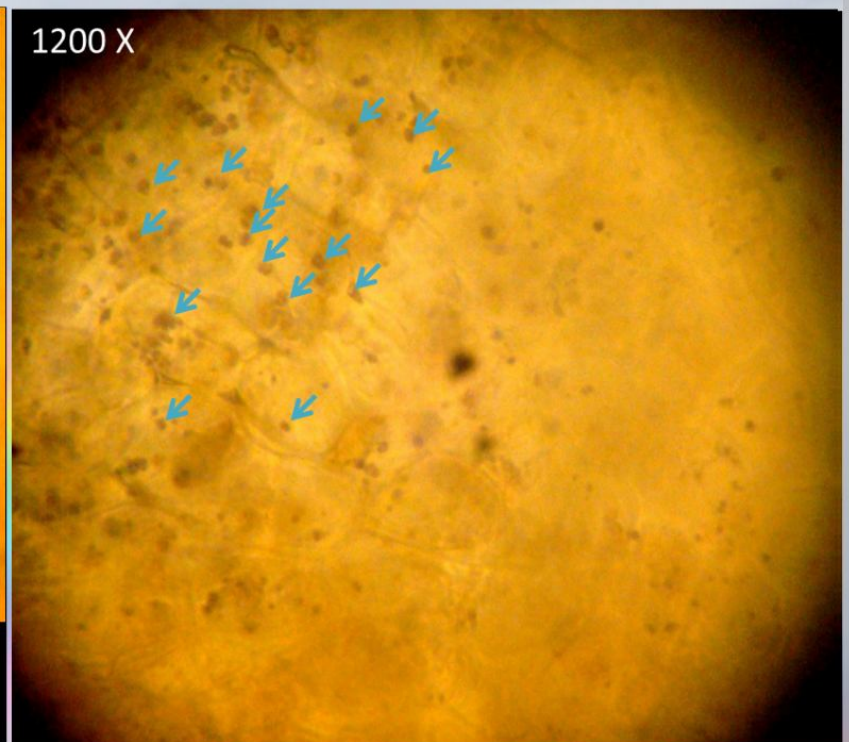
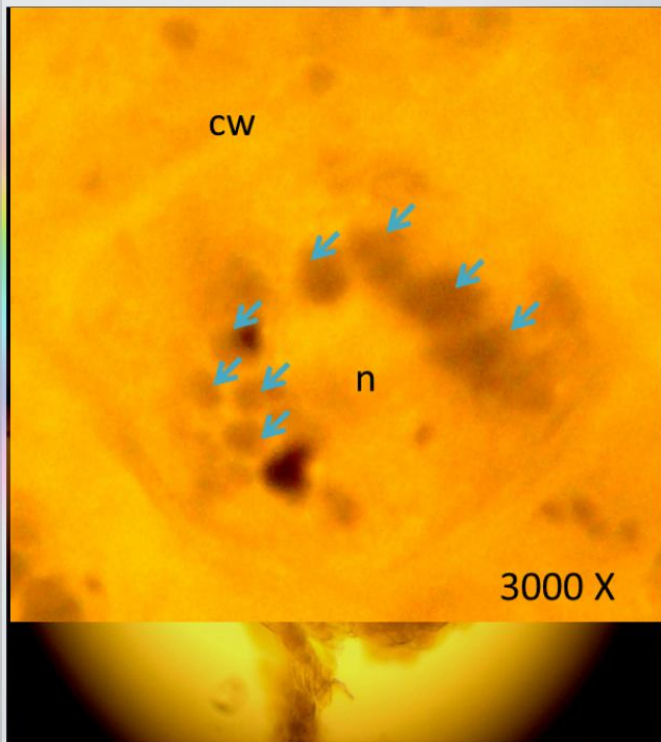


(Smith et al., 1997)



1200 X

## Statolith (blue arrows) in the root cap of clinorotated seedlings



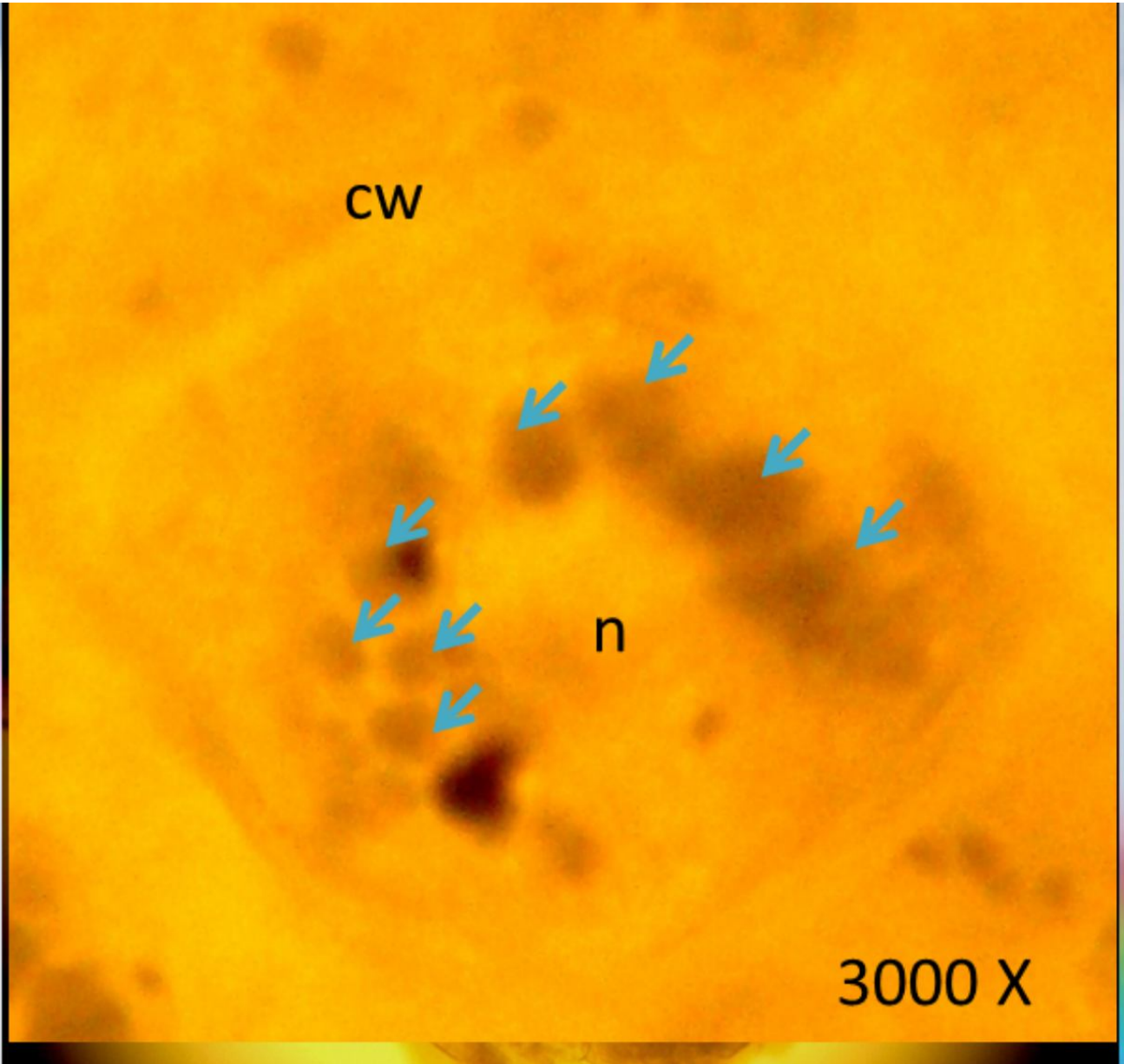
Smith et al., 1997)

1200 X

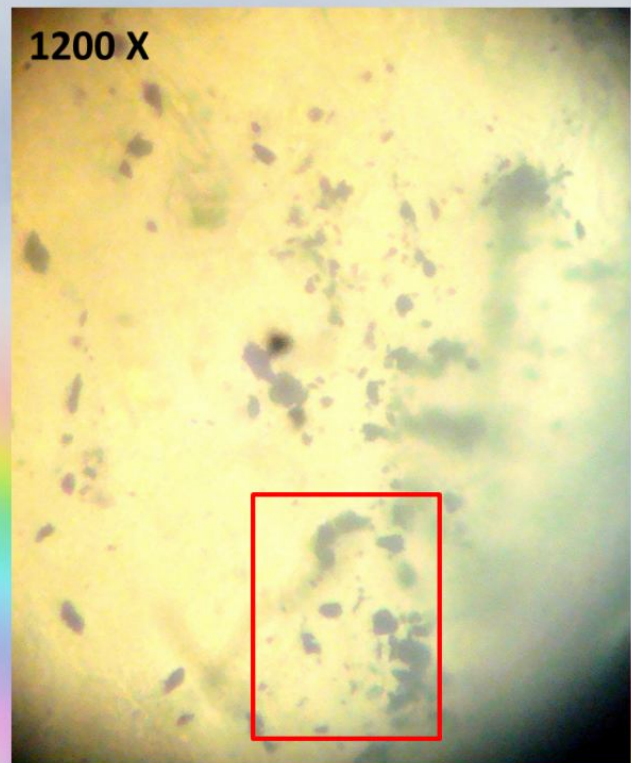
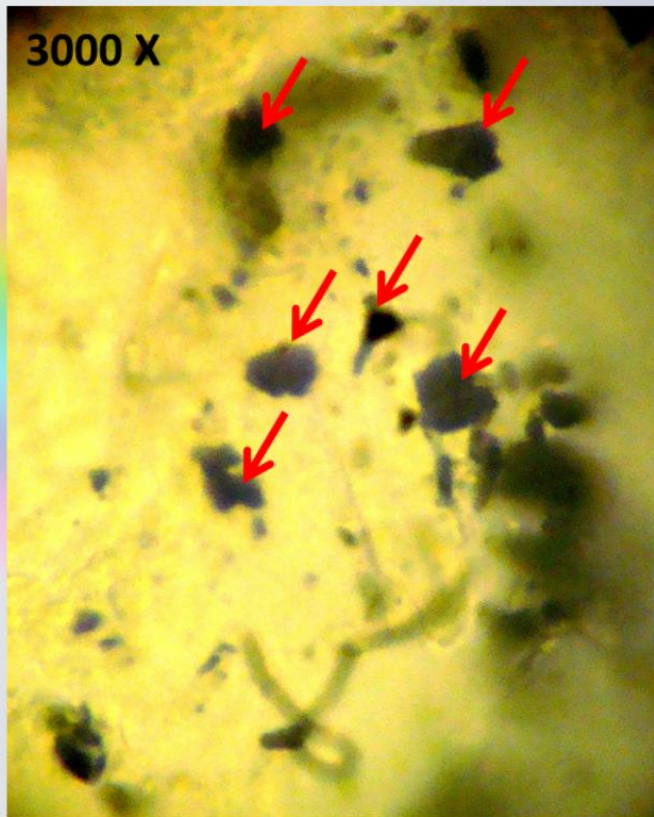


X

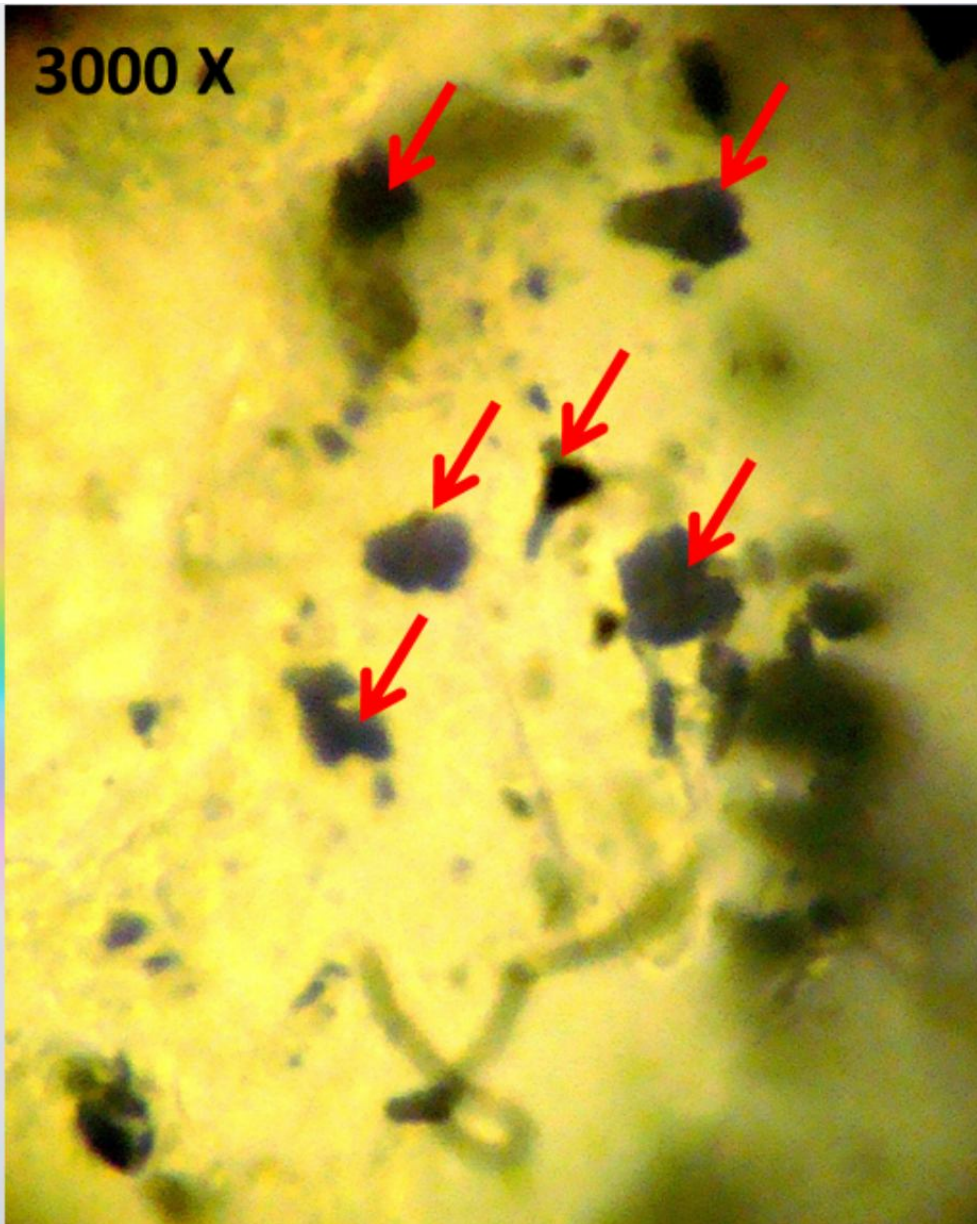
1200



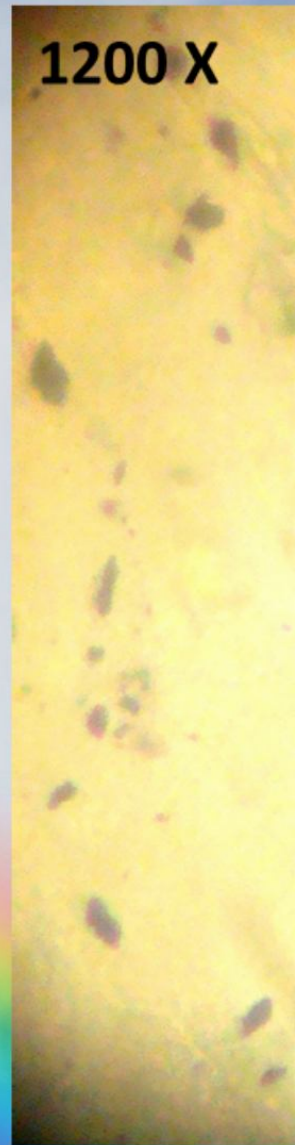
## Statolith (red arrows) in the root cap of centrifugated seedlings



3000 X

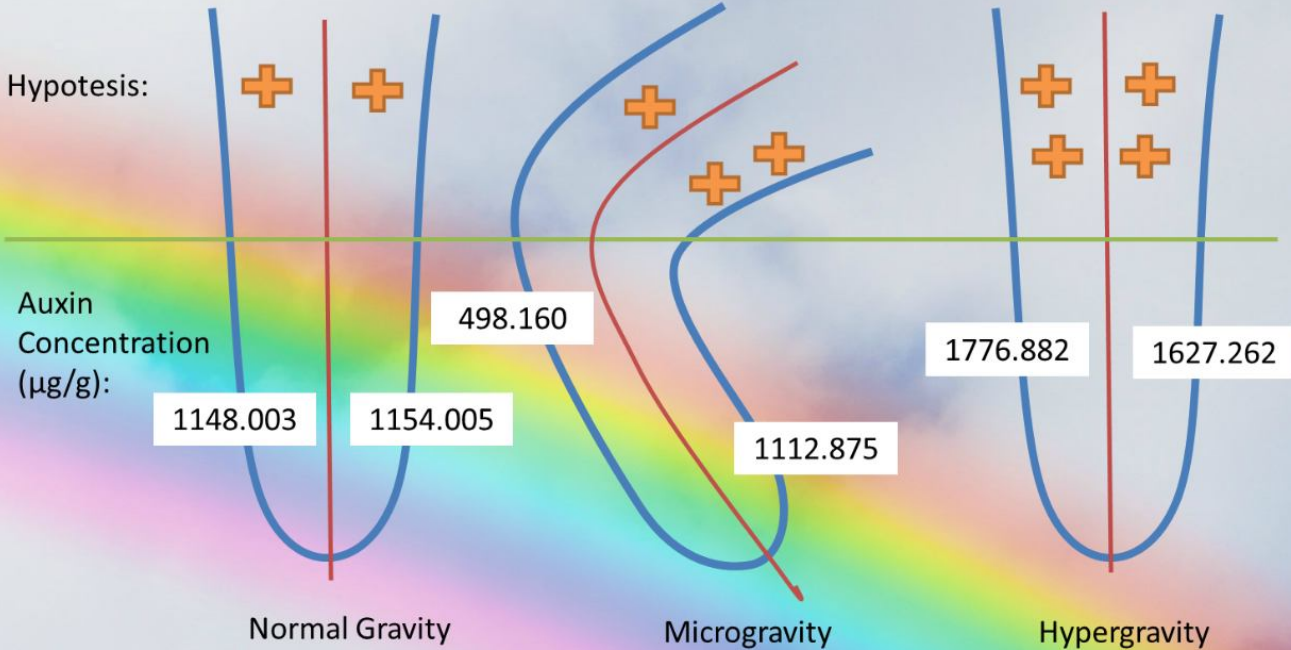


1200 X



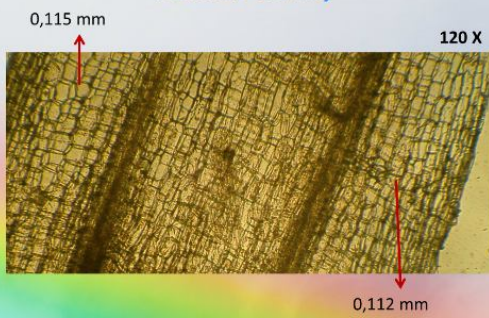


# Auxin Distribution in Mung Bean Root

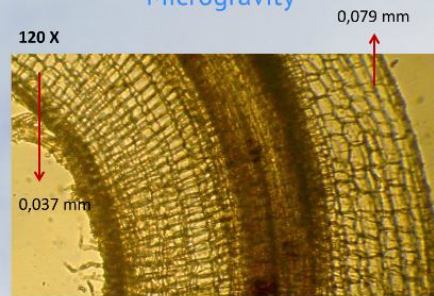


# Cell Size Comparison

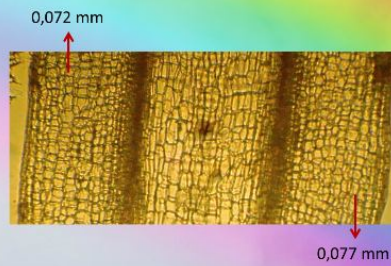
Normal Gravity



Microgravity



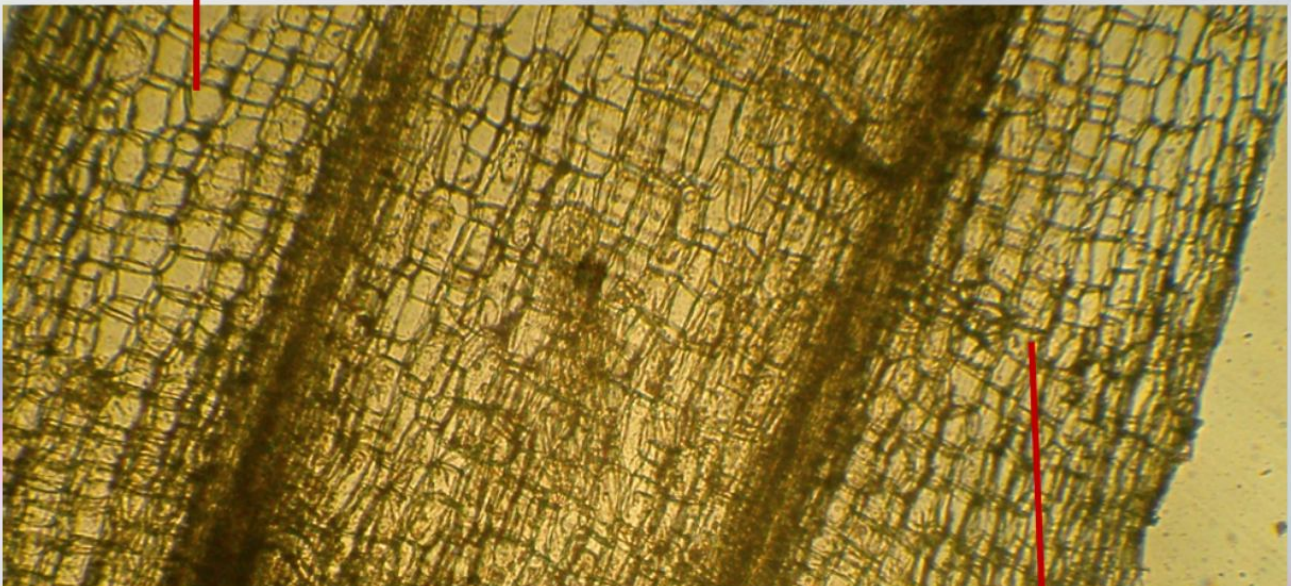
Hypergravity



# Normal Gravity

0,115 mm

120 X

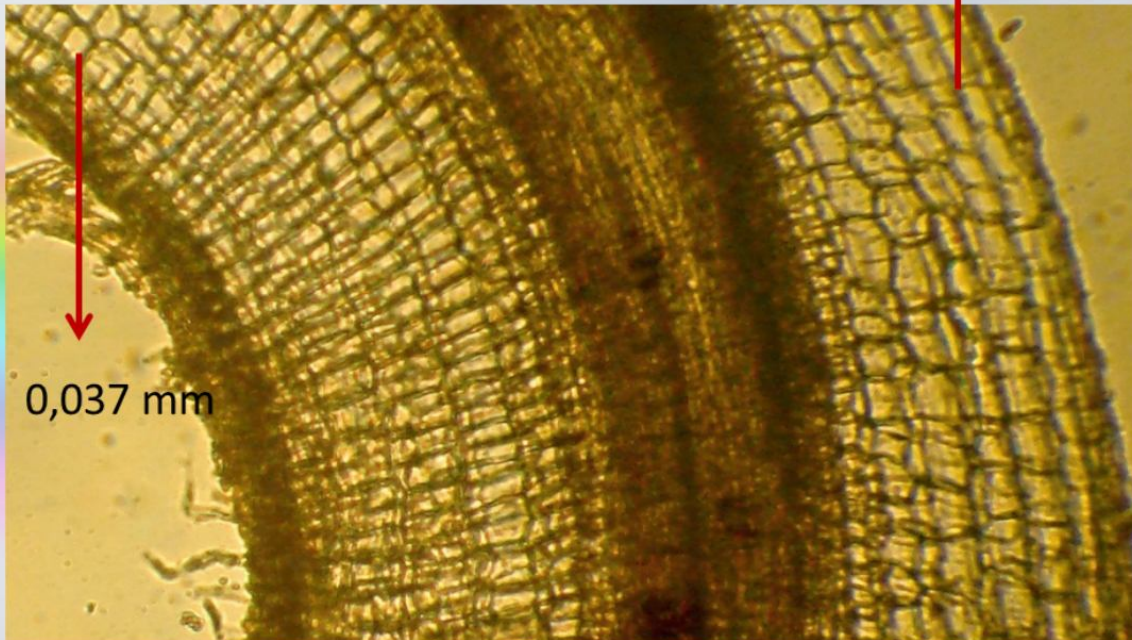


0,112 mm

# Microgravity

120 X

0,079 mm

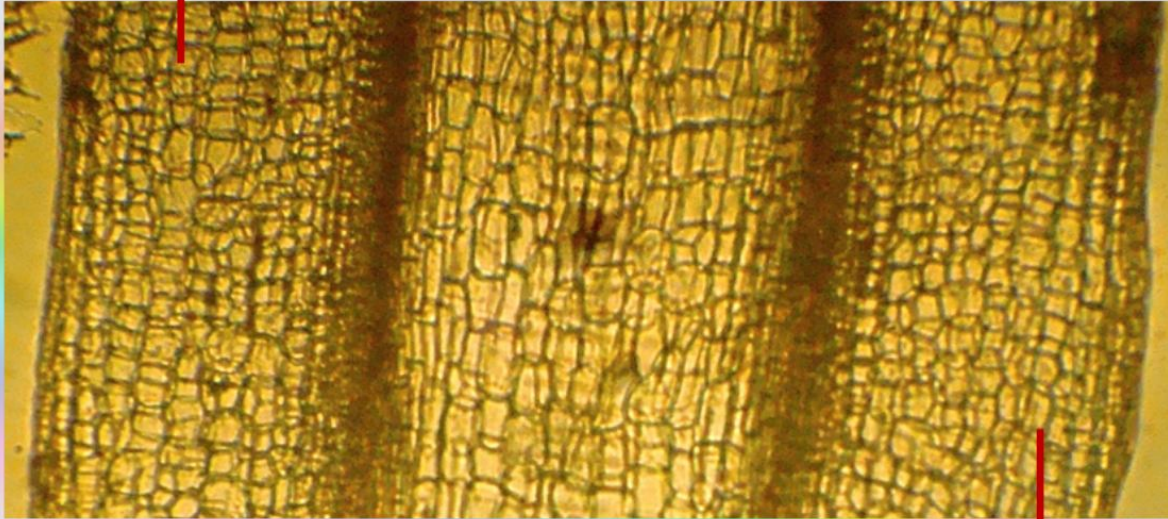


0,037 mm



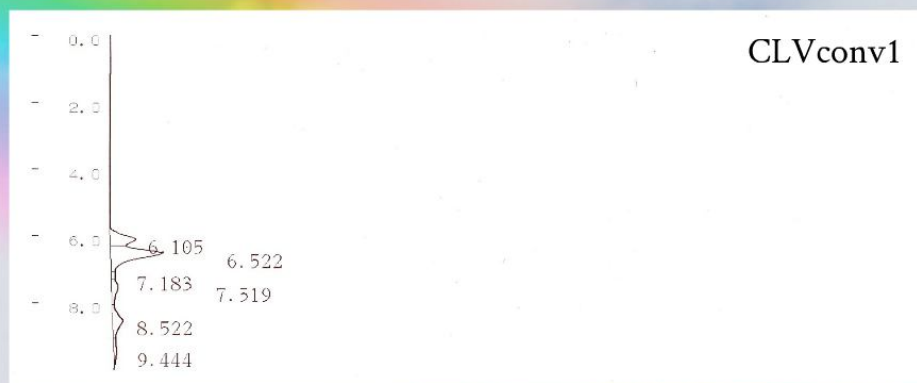
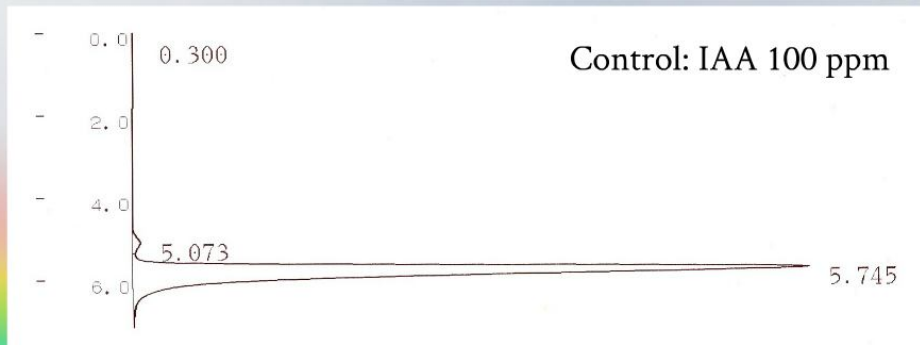
# Hypergravity

0,072 mm



0,077 mm

# Auxin Concentration Analysis



# Conclusions

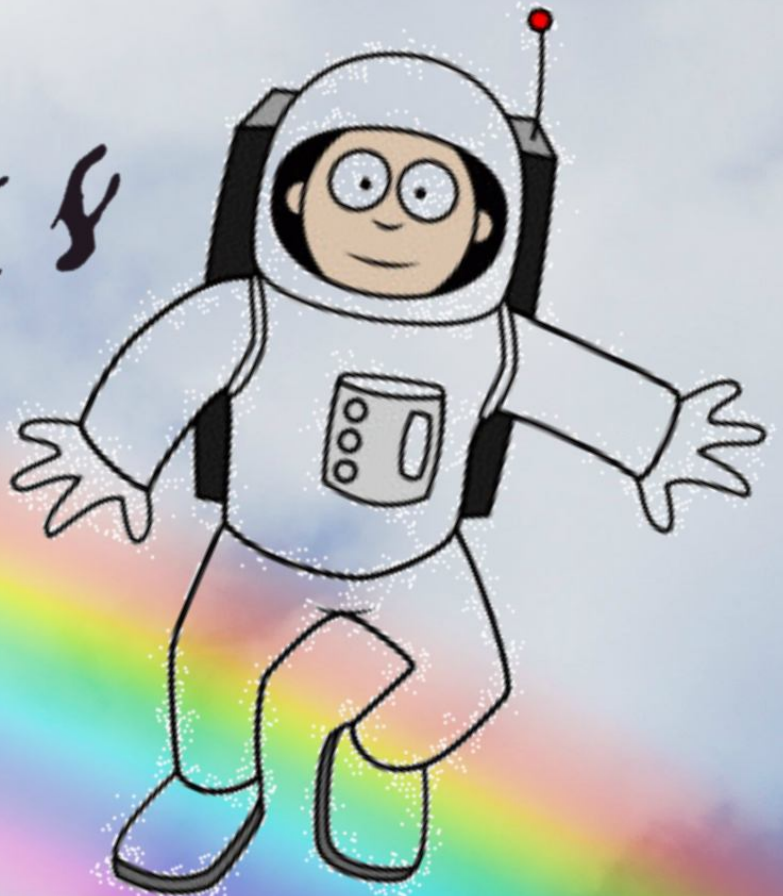
Three dimensional clinostat built for this experiment was able to simulate microgravity condition.

The position of the statolith in mung bean seedling treated on clinostat was dispersed in the cytoplasm. In several cells, the statolith positioned around the nucleus, at the proximal part of the cells. Hypergravity broke the statolith structure.

The analysis of auxin confirmed that bending response was caused by auxin asymmetry distribution.



Thanks

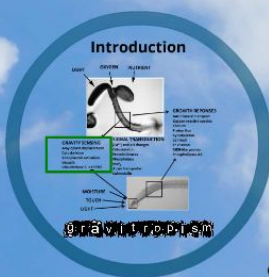






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