Oral Communication
OC-186

Growth in Simulated Microgravity Modifies 3D Genome Organization in Differentiating Human Motor Neurons

Topic: Molecular and Cellular Biology

Hong Chen[1], Hongmei Luo[1], Fei Yang[2], Ying-jun Tan[3], Xiaojian Cao[1], Chun-yan Wang[3], Qiu-zhi Zhou[1], Liujia Shi[3], Tao-wan Gong[1], Yun-qiang Chen[1], Song Zhang[1], Jia Xu[1], Gang Cao[2], Ya-jie Li[1], Ying-hui Li[3], Dan-xia Huang[1]

[1]*Rehabilitation Medicine, Tongji Hospital, Tongji Medical College, HUST, Wuhan, China*
[2]*College of Veterinary Medicine, Huazhong Agriculture University, Wuhan, China*
[3]*State Key Laboratory of Space Medicine, China Astronaut Research and Training Center, Beijing, China*

BACKGROUND

The influence of mechanical stimuli, such as gravity, on cellular behavior has been recognized, yet its impact on motor neuron (MN) differentiation and the role of three-dimensional (3D) genome architecture in this process remain underexplored. This study aimed to investigate how simulated microgravity (SMG) affects MN differentiation and to explore the role of chromosomal structural changes in this process.

METHODS

Motor neuron differentiation was induced in vitro, and the cells were exposed to SMG conditions. Immunofluorescence was used to detect markers related to proliferation and differentiation. High-resolution chromosome conformation capture (Hi-C) technology was used to analyze the alterations in chromosomal architecture.

RESULTS

Our results demonstrated that SMG inhibited the proliferation of MNPs while promoting their maturation at the biological level. Additionally, SMG exposure led to significant alterations in compartments, TADs and chromatin loops in MNs. Structural changes were observed in key genes, such as FOXP1, NRP1, and PIEZO2. These genes are involved in processes related to proliferation, differentiation, and mechanosensitive ion channel activity.

CONCLUSION

Gravity significantly influences the 3D chromosomal architecture and directs motor neuron differentiation. Structural alterations in chromatin, particularly in genes involved in differentiation and mechanosensitive signaling, emphasize the role of mechanical forces in cellular development. These insights into MN maturation could impact regenerative medicine and space exploration.

Statement of Disclosures

None

Doi: 10.5606/archisprm.2026.OC-186

Corresponding Author:
Hong Chen
Rehabilitation Medicine, Tongji Hospital, Tongji Medical College, HUST, Wuhan, China
Email: chenhong1129@hust.edu.cn