



# DNA Folding in Interphase

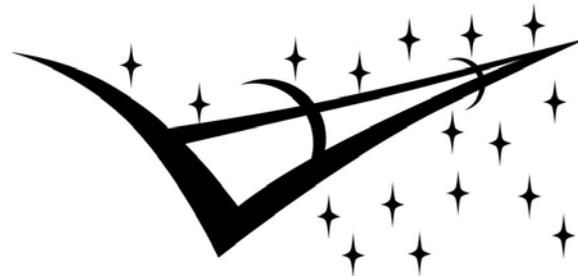
Jimmy Uhlemeyer

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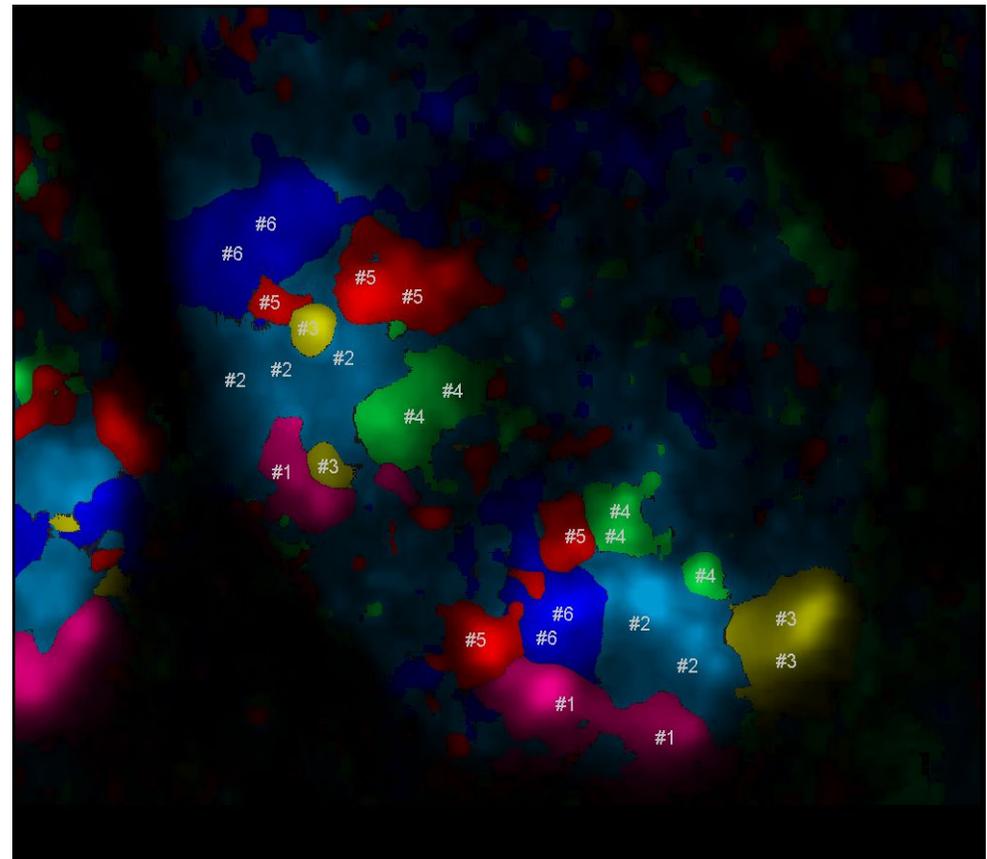
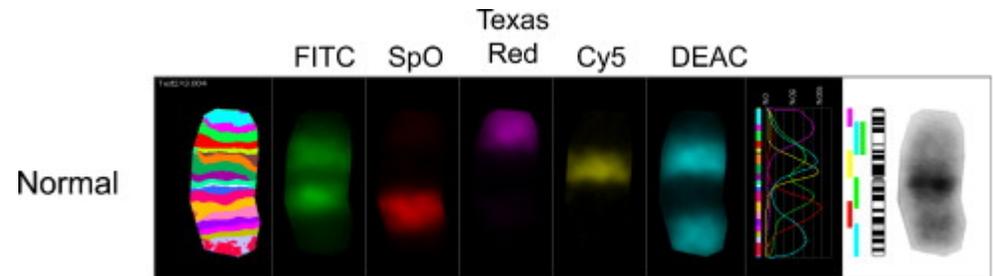
Space Radiation

SPACE LIFE SCIENCES  
SUMMER INSTITUTE

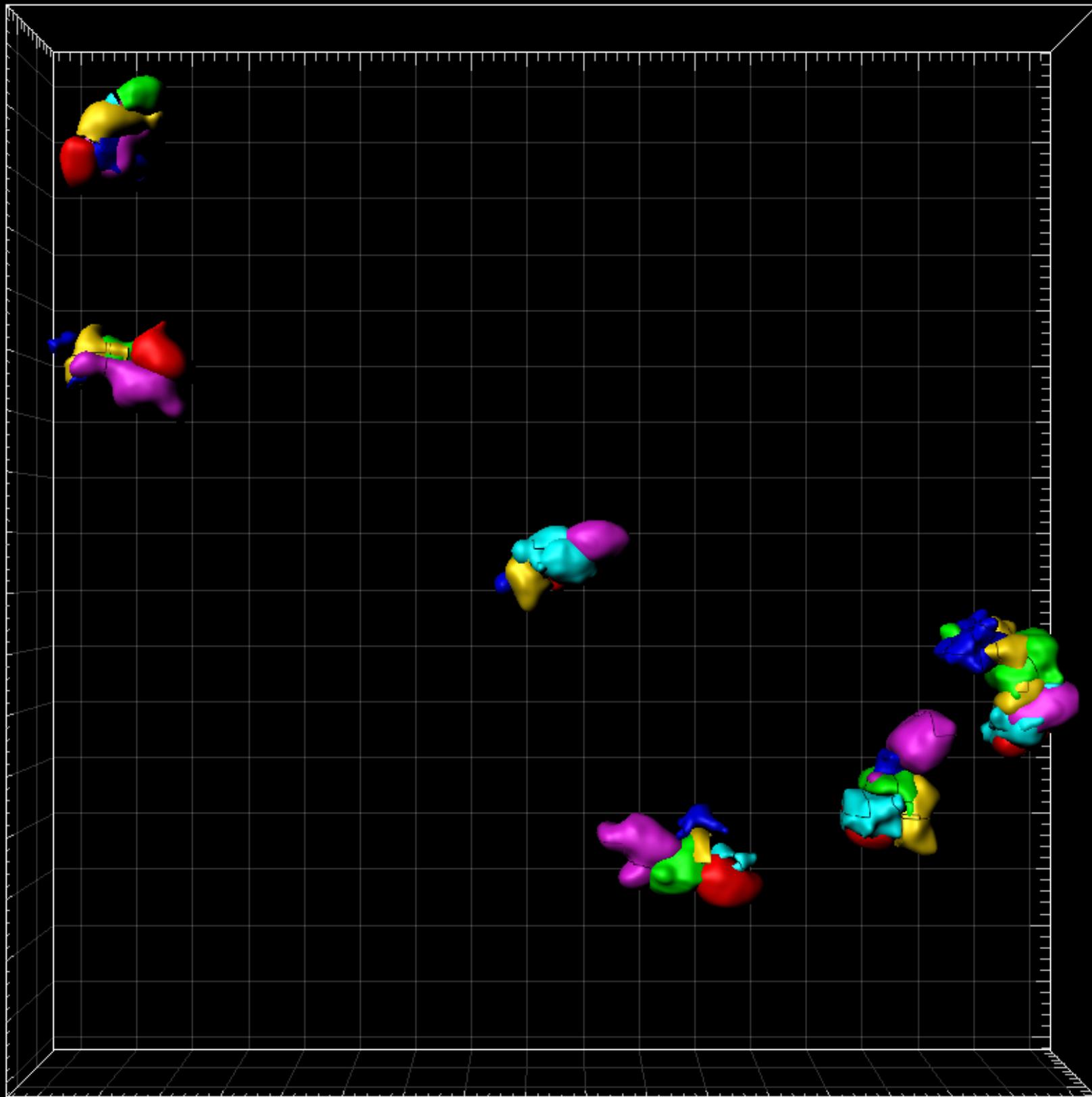


# Background

- Radiation damage is one of the biggest problems in space travel
- Relative frequency of chromosome exchanges is dependent on LET
- MBand / FISH techniques
- Frequency of type of chromosome exchanges may be dependent on location



Hada M, Wu H, Cucinotta FA., mBAND analysis for high- and low-LET radiation-induced chromosome aberrations: A review. *Mutat Res*,2011;711(1-2):187-192.



|||||  
Threshold &  
Smoothing 1

|||||  
Surfacing 2

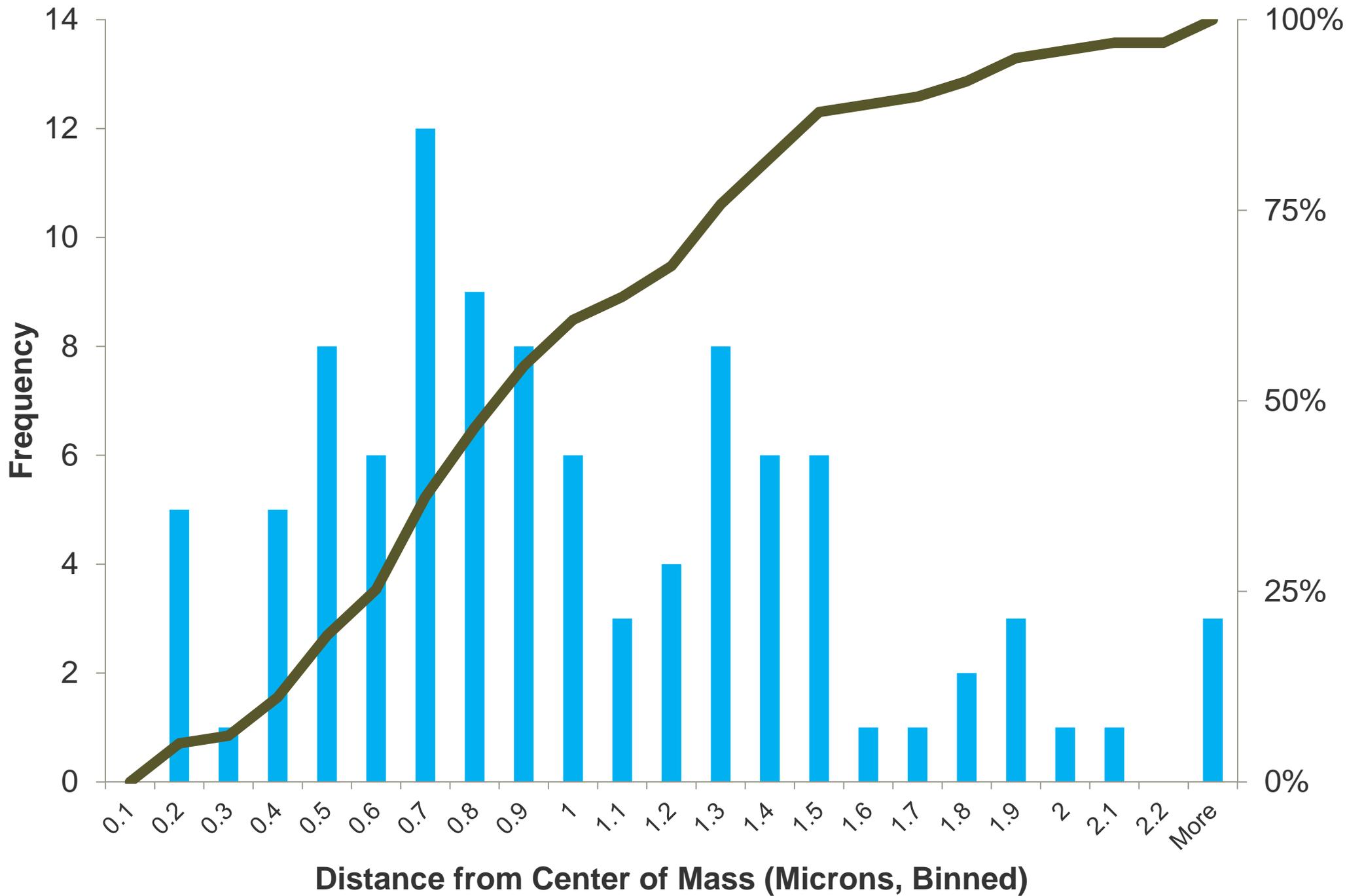
|||||  
Clean-up 3

|||||  
Separating  
Red / Orange 4

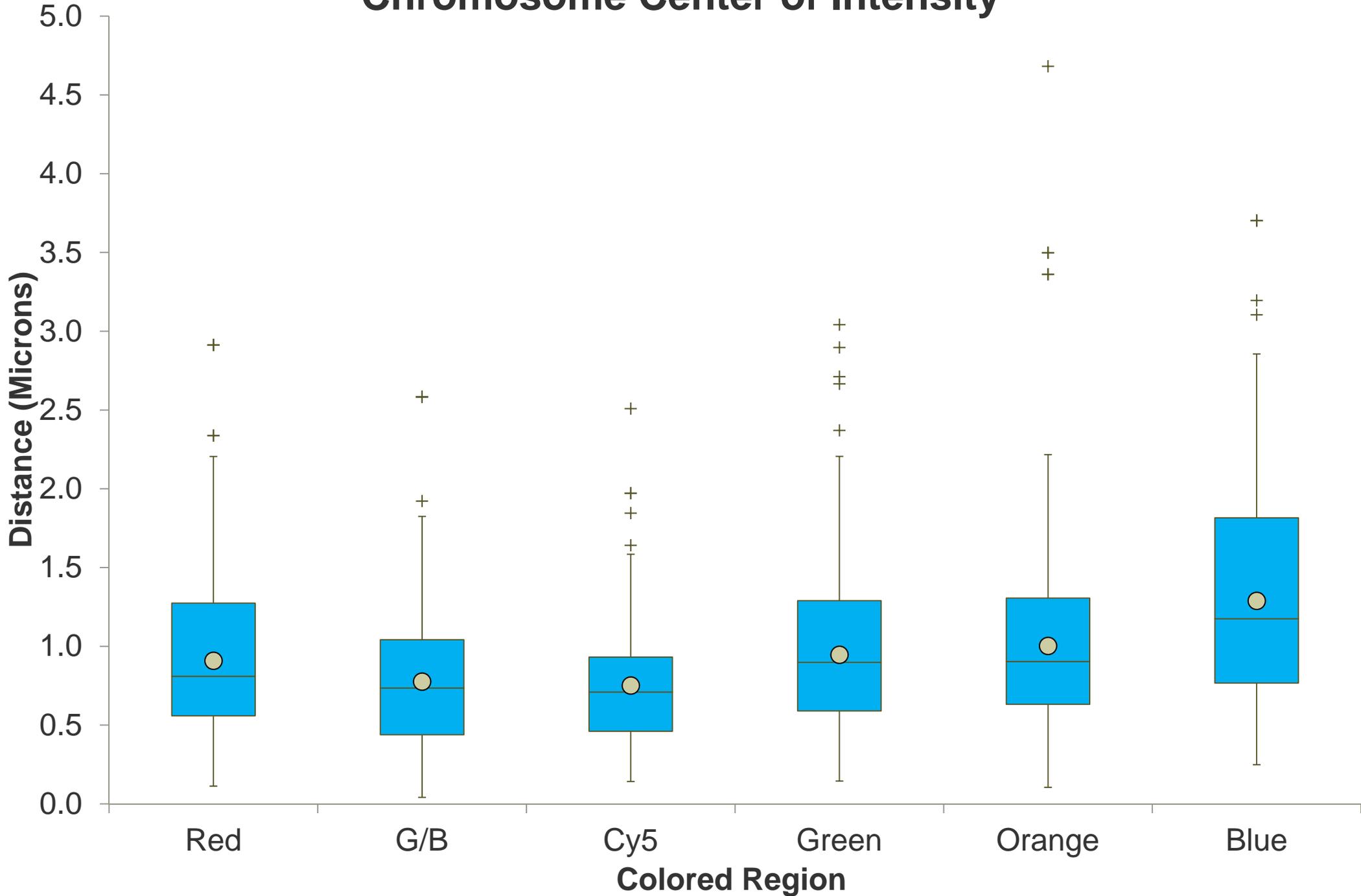
|||||  
Separating  
Green / Blue 5

|||||  
Copying Data 6

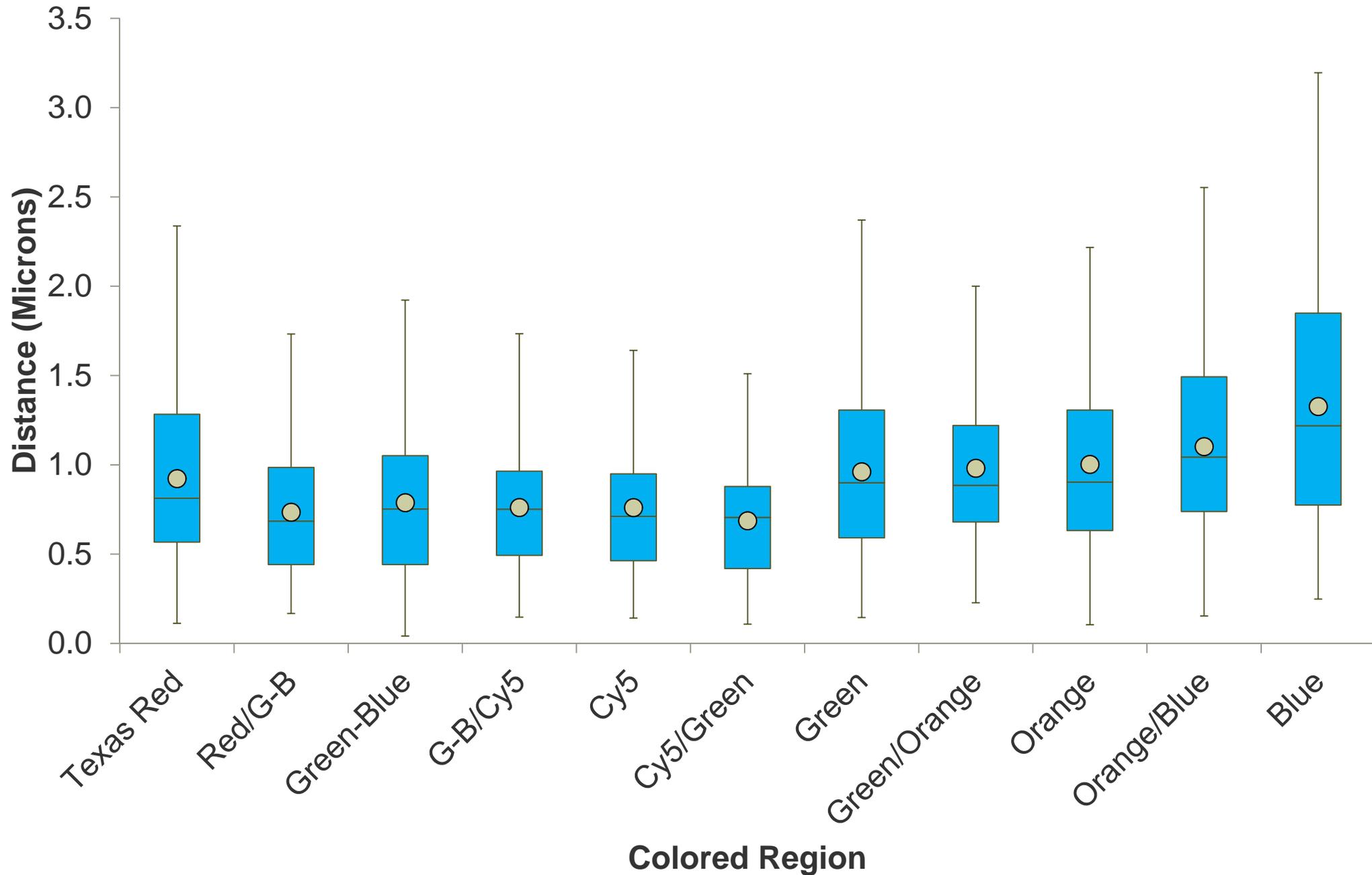
# Red Region Distance to Center



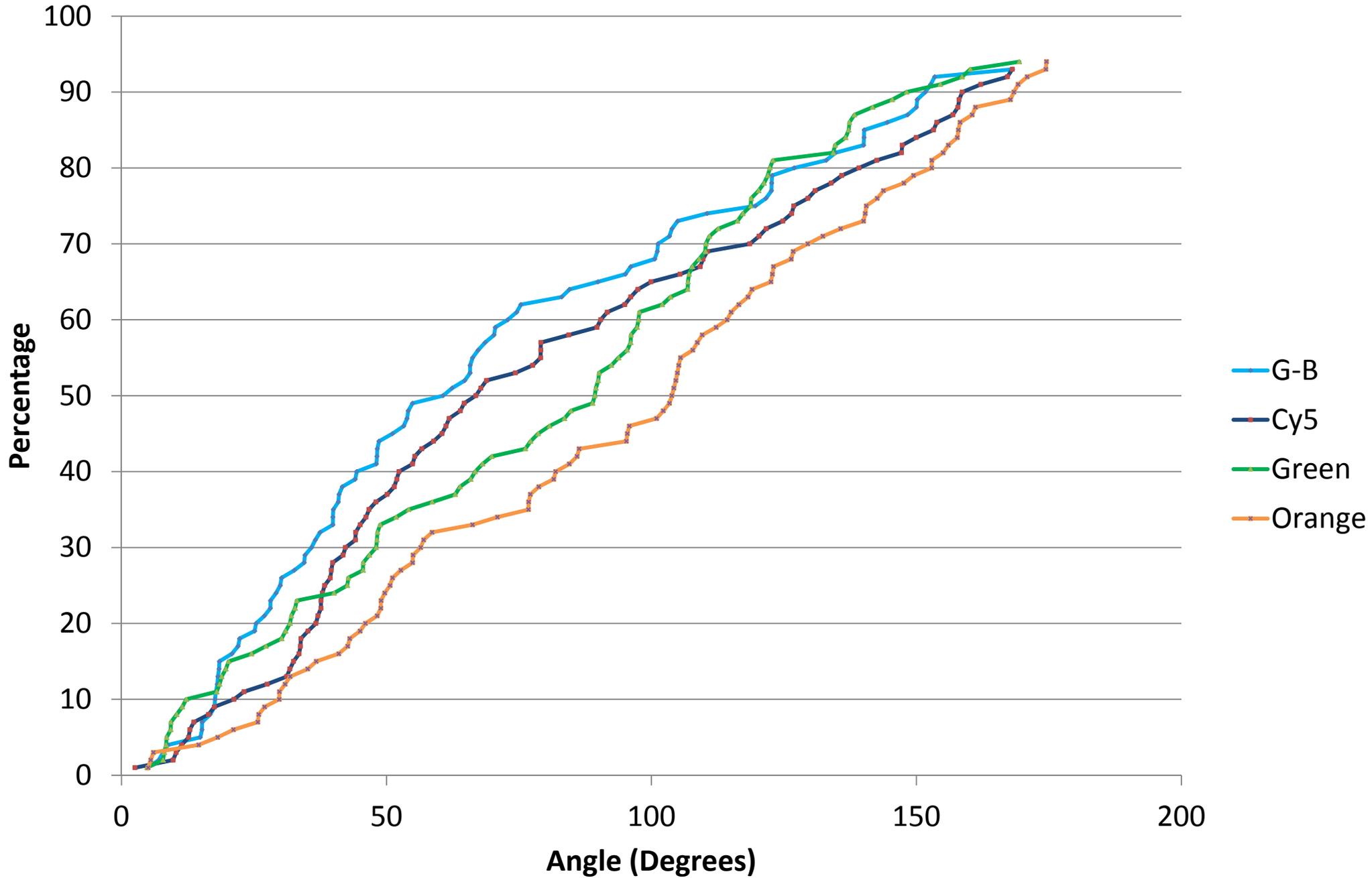
# Regional Distance from Chromosome Center of Intensity



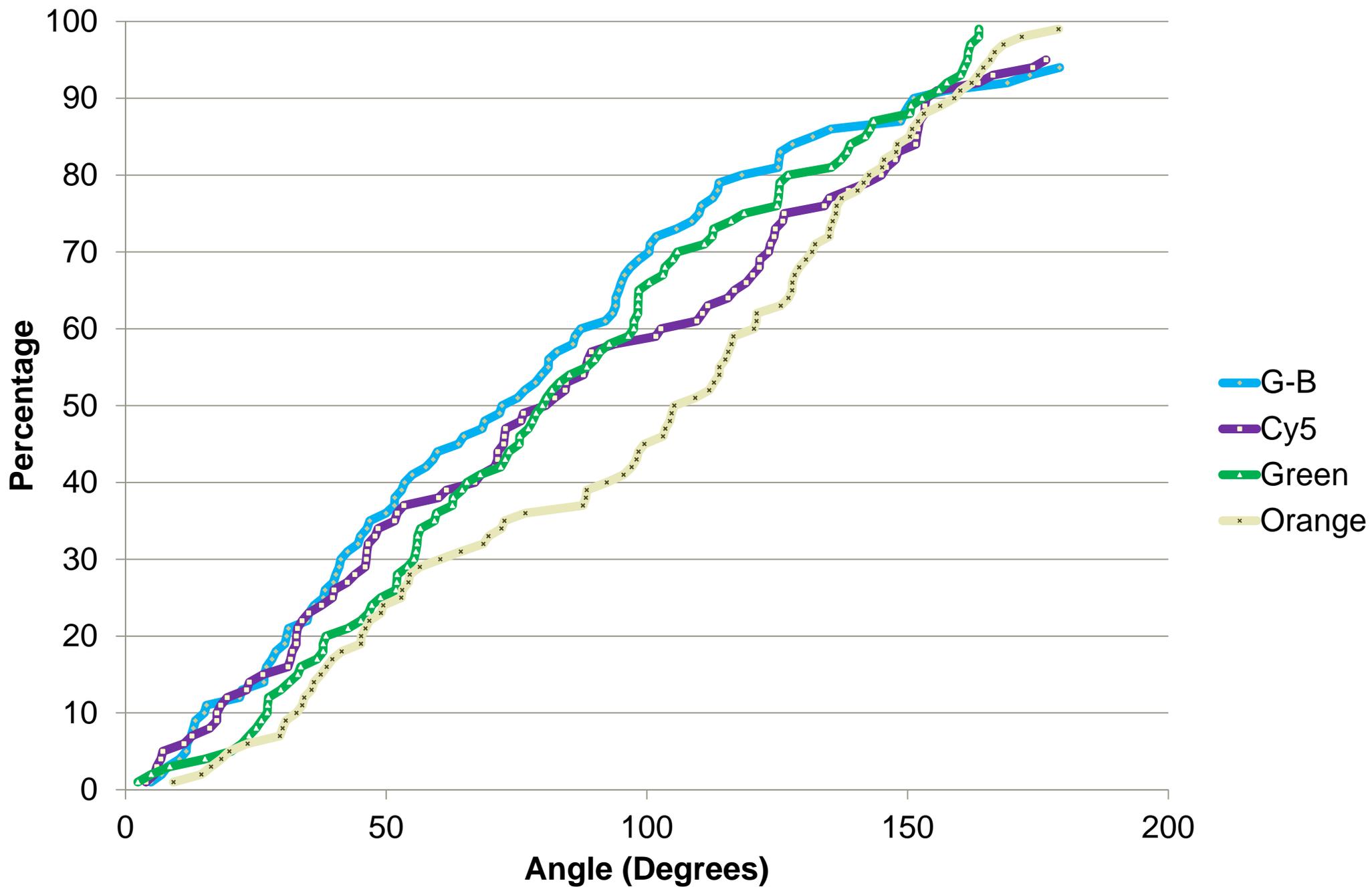
# Regional Distance from Chromosome Center of Intensity



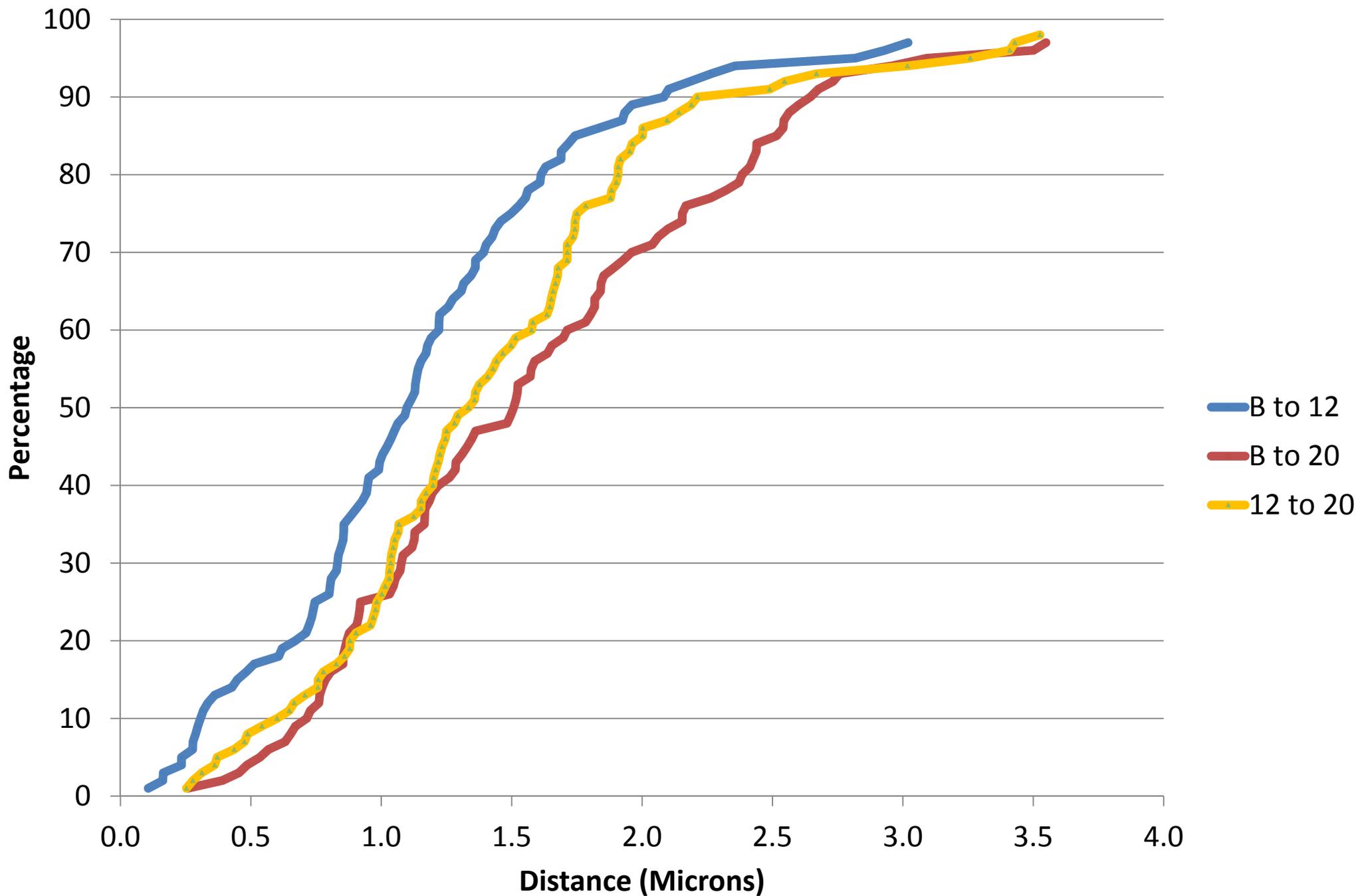
# Distribution of Angles Between Regions



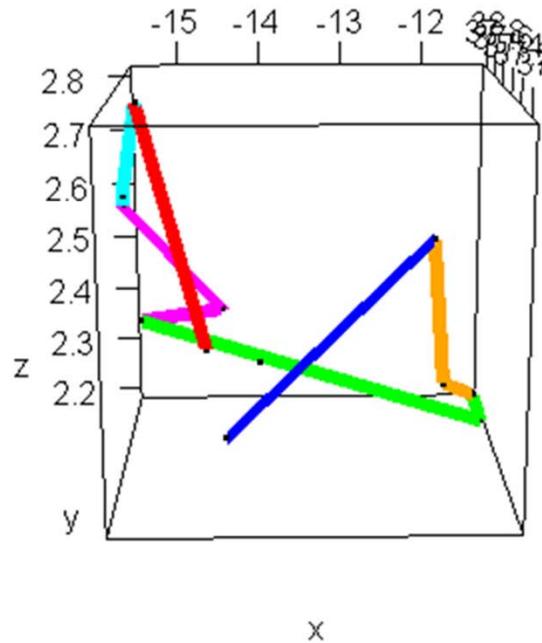
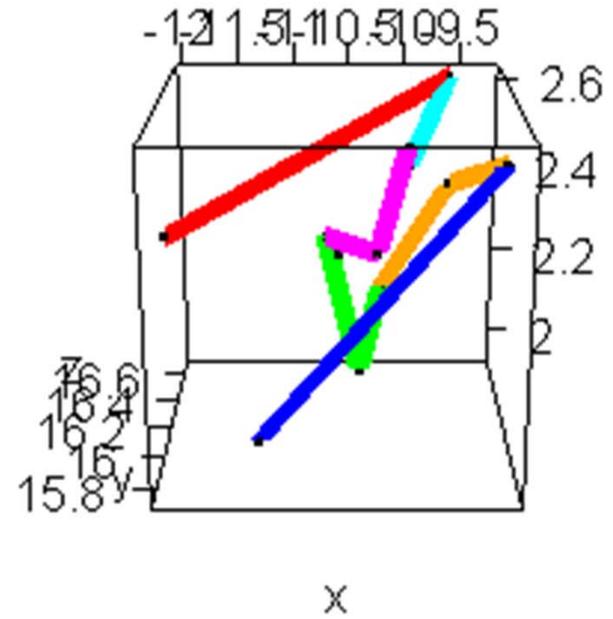
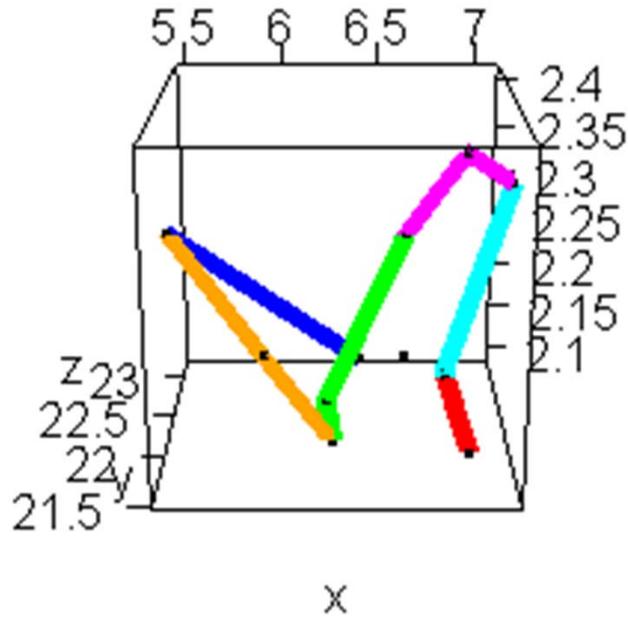
# Distribution of Angles Within Regions



# Distributions of Distance Between Regions B, 12, and 20

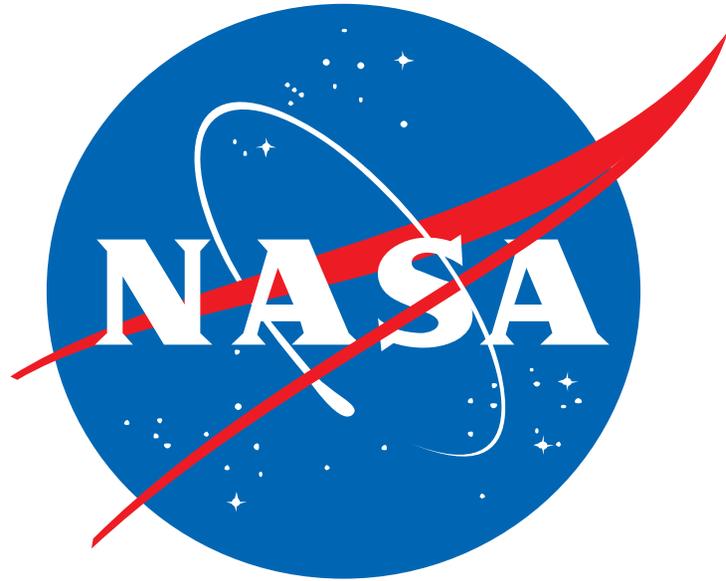


# Representative Cells (all units in microns)



# Discussion

- Physical location of genes contributes to the inter- versus intra-chromosome aberration ratio.
- Folding structure in interphase affects breakpoint distribution.
- The q arm on chromosome 3 has much less severe bends than the p arm in interphase.
- Gene density and transcription activity are additional factors that affect final damage distribution.
- mBAND techniques along with confocal microscopy can produce three-dimensional models of chromosomes at many stages of the cell cycle.
- A protocol for imaging and measurement of cells contributes to precise results.



Thank You!

Drs. Honglu Wu and Ye Zhang  
Dr. Dipta Bandyopadhyay  
Drs. Lauren Merkle and Jacqueline Reeves  
Everyone in the Radiation Laboratory  
Bitplane, makers of Imaris  
NASA JSC and NSBRI

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# Introduction

- Doctoral candidate - Dr. Ford
- Researching techniques for mouse irradiation
- Looking to make space a safer place for people
- Interested in NASA for possible space living areas and travel to other planets



# Objectives of Internship

- Learn about micronuclei induction
- Obtain and analyze data on depth vs. biological damage curves – ongoing...
- Learn more about various types of microscopy and MBAND
- Determine positions of various locations within interphase chromosomes using Imaris software
- Refine said into distances and angles between and within regions and their centers of mass