DNA Folding in Interphase

Jimmy Uhlemeyer
Texas A&M University
Drs. Honglu Wu and Ye Zhang
Space Radiation
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

DNA Folding in Interphase
Regional Distance from Chromosome Center of Intensity

- Red
- G/B
- Cy5
- Green
- Orange
- Blue

DNA Folding in Interphase
Regional Distance from Chromosome Center of Intensity

Distance (Microns)

Colored Region

Texas Red, Red/G-B, Green-Blue, G-B/Cy5, Cy5, Cy5/Green, Green, Green/Orange, Orange, Orange/Blue, Blue

DNA Folding in Interphase
Distribution of Angles Between Regions

Angle (Degrees)

Percentage

G-B
Cy5
Green
Orange
Distributions of Distance Between Regions B, 12, and 20

- **B to 12**
- **B to 20**
- **12 to 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

This work is partially funded by National Space Biomedical Research Institute via NASA Cooperative Agreement NCC 9-58.
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