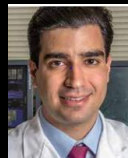
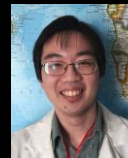


Dosimetry and Treatment Planning at the Cellular and Multicellular Level

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MIRD Pamphlet No. 25

MIRDcell V2.0

- Dosimetry/Radiobiology tool for radiopharmaceuticals
 - Single cell
 - Population of isolated cells (e.g. leukemia)
 - Multicellular cluster

Vaziri et al. J Nucl Med 2014; 55: 1557-1564

<http://mirdcell.njms.rutgers.edu>

Step 1 – Choose your radionuclide

The screenshot shows the MIRDCell v2.0 web application interface. The browser address bar displays <http://mirdcell.njms.rutgers.edu>. The application title is "MIRDCell v2.0 - A Multicellular Dosimetry Tool". The interface has several tabs: "Source Radiation", "Cell Source/Target", "Radiobiological Parameters", "Multicellular Geometry", "Output", "Information", and "Credits".

The "Predefined MIRDCell Radionuclide" section is active, showing two radio buttons: β Full Energy Spectrum and β Average Energy Spectrum. A dropdown menu for "Radionuclide" is open, listing: Xe-131m, Xe-133, Xe-135, Xe-135m, Y-86, Y-87, Y-88, Y-89m, Y-90 (highlighted), Y-91, and Y-91m.

The "Monoenergetic Particle Emitter" section has two radio buttons: Alpha Particle and Electron. Below are input fields for "Yield / Decay" and "Energy (MeV)".

The "User Created Radionuclide" section has two radio buttons: Retrieve (with an "Open" button) and Create. The "Create" section includes a "Name:" field, a "Help" button, a "Choose radiation" dropdown, "Yield / Decay:" and "Energy (MeV):" fields, and buttons for "Add Radiation (Click for each to be added)", "Confirm List of Radiations", and "Save Radionuclide (to your disk)".

The "Input Data for Calculation" section shows a text area with the following output:

```
Output File OutPut\Y-90.RAD for Y-90
Y-90 64.10h 65
T1/2 = 64.10h Decay Mode: B-
Radiations of each type listed in increasing energy
Number of photon radiations: 41
Number of beta radiations: 3
Number of monoenergetic electron radiations: 21
ICODE Y (Int) E(MeV) Mnemonic
START RADIATION RECORDS
2 1.38785E-03 6.52413E-06 X
2 9.74822E-10 2.37008E-05 X
2 1.30841E-13 8.73999E-05 X
```

A "Reset" button is located at the bottom of this section.

Step 2 – Choose cell size & activity distribution

http://mirdcell.njms.rutgers.edu

MIRDcell v2.0 - A Multicellular Dosimetry Tool

Source Radiation | Cell Source/Target | Radiobiological Parameters | Multicellular Geometry | Output | Information | Credits

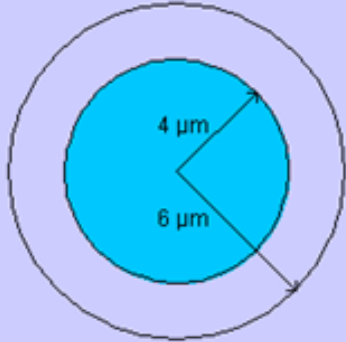
Target ← Source

- Cell←Cell
- Cell←Cell Surface
- Nucleus←Nucleus
- Nucleus←Cytoplasm**
- Nucleus←Cell Surface
- Cytoplasm←Nucleus
- Cytoplasm←Cell Surface
- Cytoplasm←Cytoplasm

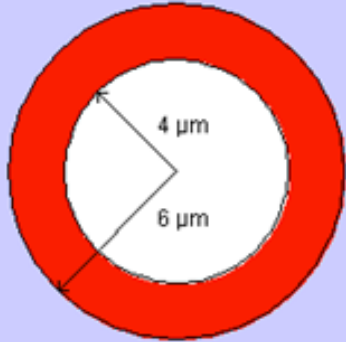
Radius of Cell (RC) μm

Radius of Nucleus (RN) μm

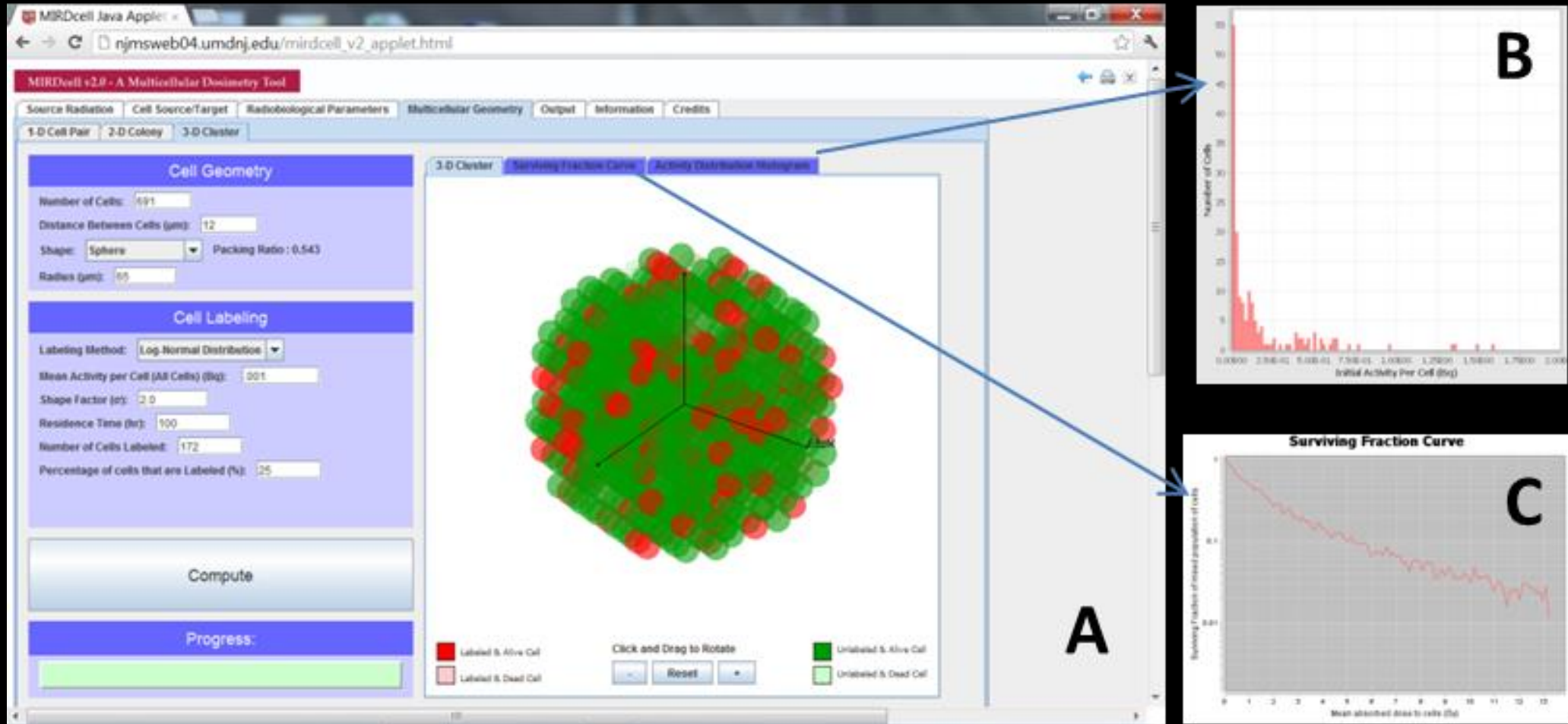
Target Volume



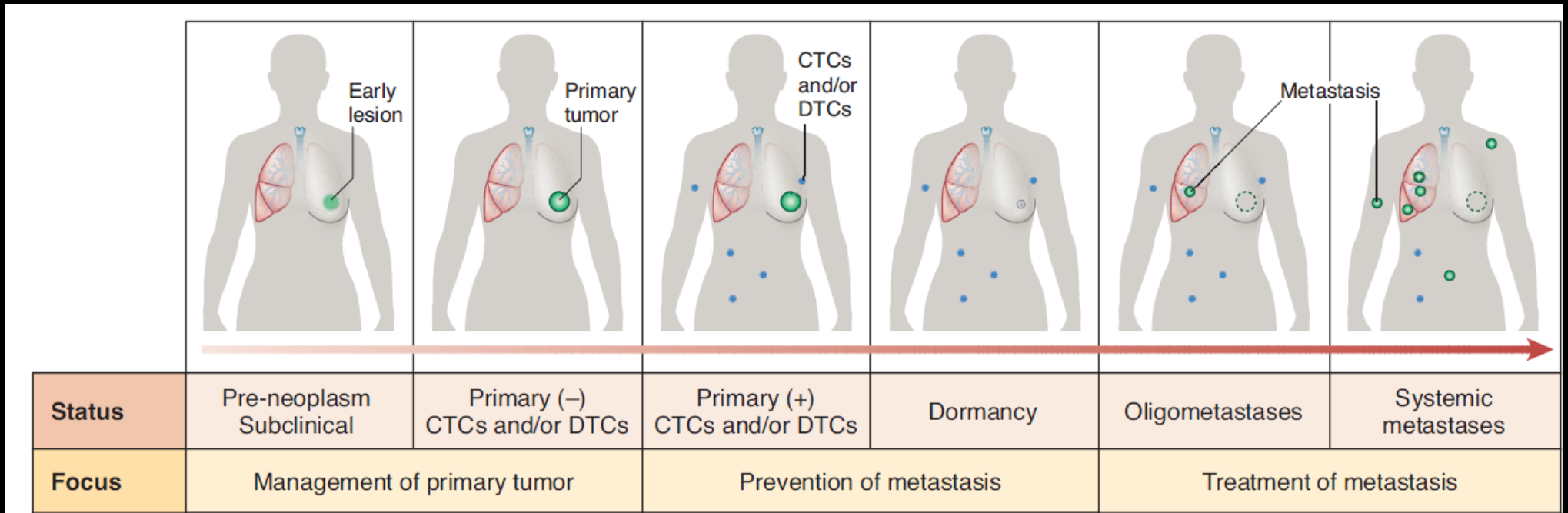
Source Volume



Step 4 – Choose your cell geometry: 3D multicellular cluster

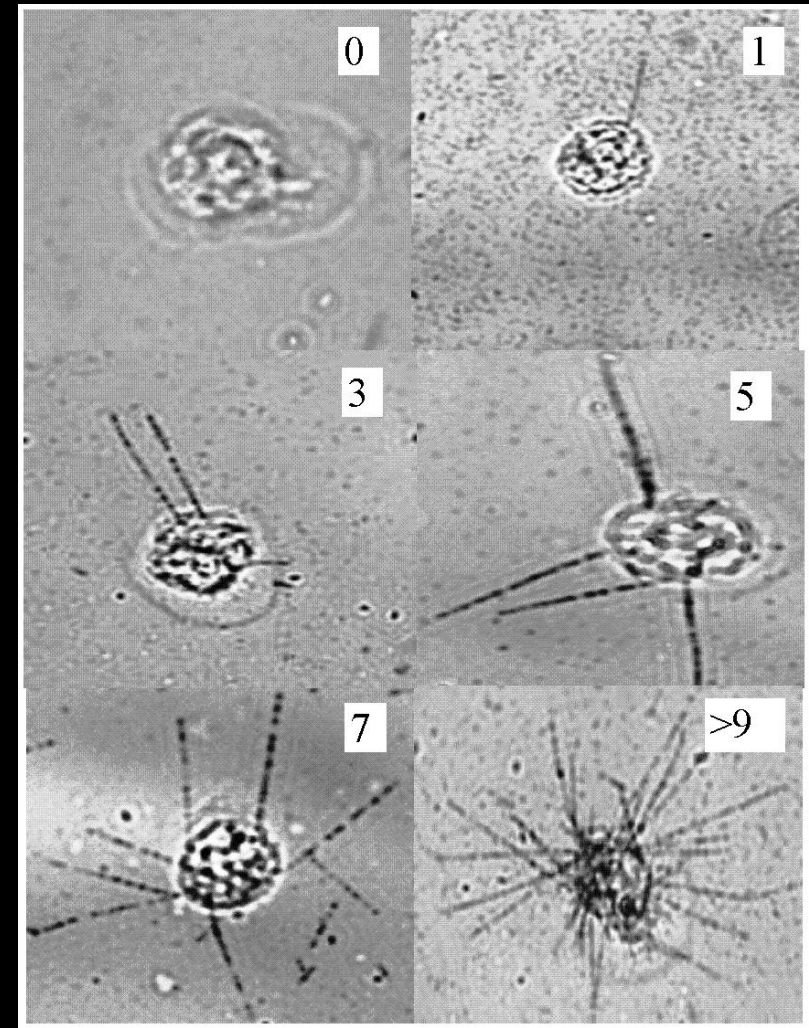
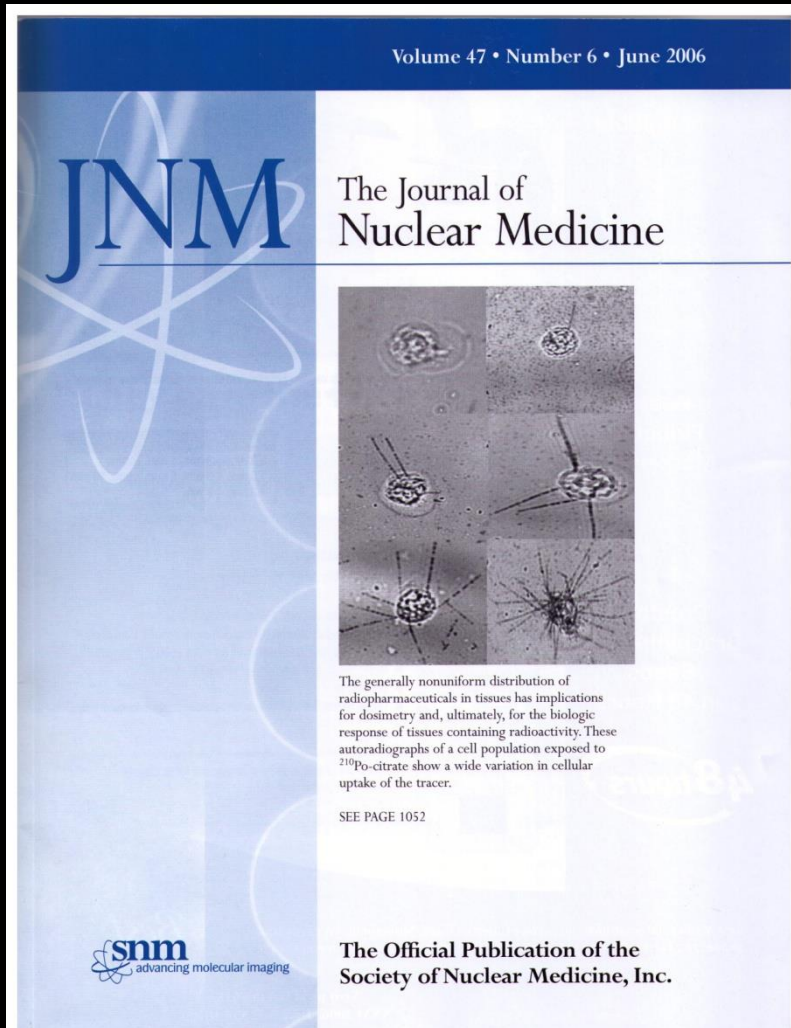


Circulating Tumor Cells (CTC) Disseminated Tumor Cells (DTC) Metastases



Wan et al. VOLUME 19 | NUMBER 11 | NOVEMBER 2013 NATURE MEDICINE

Nonuniform Labeling of Target Cells



Personalized Medicine Must Fully Address Heterogeneity of DTC