
A still image from a 3D rotation movie showing the distribution of nanocomposite aggregates (NC 1-5), presented in green, inside the zinc rich cell nucleus, shown in gold.

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## The Bionanoprobe Penetrates More Deeply

The theoretical possibility of focusing synchrotron X-rays to a beam spot as small as 50 nanometers has been made a reality with the construction of the Bionanoprobe, an instrument funded by the American Recovery and Reinvestment Act. Awarded to Gayle Woloschak, radiation oncology, and her team, the Bionanoprobe grant was used to design and develop this unique instrument in a collaborative effort involving Northwestern University, the Advanced Photon Source at Argonne National Laboratory, and the X-Radia Company (now Zeiss-Xray Imaging).

After a three-year-long process from the first schematic drawing of the instrument on a whiteboard to its construction, assembly, and implementation, the Bionanoprobe was used to image the elemental distribution in a human cancer cell, an object several hundred times larger than the beam spot size. Because of X-rays' great penetration depth, this cell sample—treated for 30 minutes with nanoparticles designed to destroy it—could be imaged as it rotated. Image reconstruction in three dimensions allowed visualization of each elemental component of the cell and the nanoparticles that migrated into the cell nucleus. This image provided irrefutable proof that the nanoparticles constructed to selectively attack cancer cells' nuclear DNA reached their destination successfully.

Developing nanoconstructs for cancer treatment and using them in combination with ionizing radiation is Woloschak's primary research focus. Her other research interests include theoretical and experimental studies in radiation biology and maximizing the use of radiobiological animal tissue archives. Her laboratory currently houses North America's largest radiobiological database and animal tissue archive, a collection that brings together samples from every historic radiobiological research site, including several national laboratories and institutes.