MATERIALS AND METHODS

Preparation of ^{64}Cu-DOTA-trastuzumab

About 6 mg of trastuzumab (8 mg/mL in 0.1 M $NaHCO_3$, pH 8.5) was reacted with a 180-fold molar excess of 1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid mono N-hydroxysuccinimide ester (DOTA-NHS) for 18 h at 4°C, then purified by ultrafiltration on a VIVASPIN 2 ultrafiltration device [molecular weight cut off = 30 kDa, Sartorius, Bohemia, NY] eluted with phosphate-buffered saline (PBS; pH 7.5). DOTA substitution was determined by labeling a 10 μL sample of the impure reaction mixture with $^{64}CuCl_2$ (Washington University, St Louis, MO, USA) for 3 h at 46°C in 0.1 M ammonium acetate buffer (pH 6.0). The sample was analyzed by instant thin layer silica-gel chromatography (Pall Corp, Ann Arbor, MI) developed in 100 mM sodium citrate buffer (pH 5.0) to separate ^{64}Cu-DOTA-trastuzumab (R_f = 0.0) from ^{64}Cu-DOTA (R_f = 1.0). The proportion of radioactivity at the origin was measured in a γ-counter (Wallac 1480, Perkin Elmer) and multiplied by the molar ratio of DOTA-NHS:trastuzumab (180:1) to calculate the DOTA substitution level. There were 1.5 DOTA per trastuzumab. Purified DOTA-trastuzumab (100 μg) was labeled with 25 MBq of $^{64}CuCl_2$ and the final radiochemical purity was >98%.

Clonogenic Assays

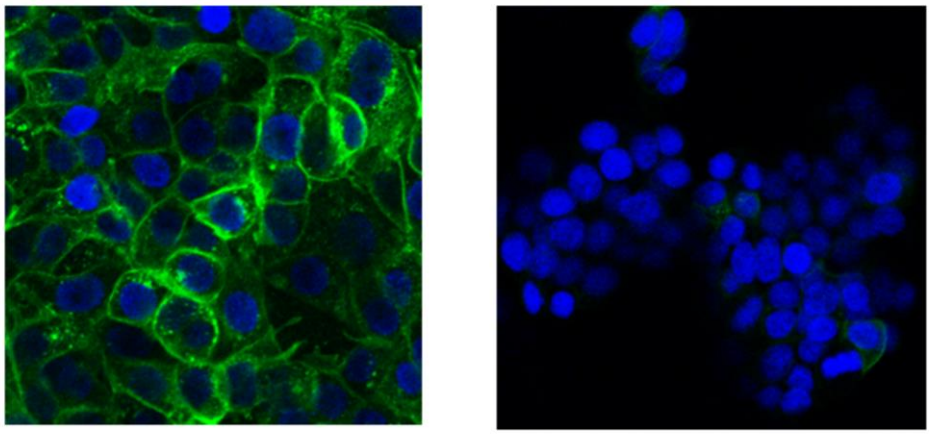
MCF-7/HER2-18 cells exposed to ^{64}Cu-DOTA-trastuzumab as described in the main article were harvested by trypsinization and resuspended in 1 mL of culture medium.

Cell concentration was determined using a Scepter™ Handheld Automated Cell Counter (EMD Millipore). Approximately 150-4,000 MCF-7/HER2-18 untreated cells or cells treated with ^{64}Cu-DOTA-trastuzumab were seeded in triplicate into 6-well plates containing growth medium. Following culturing at 37°C and 5% CO_2 for 10 days, surviving colonies (>50 cells) were stained with methylene blue (1% in a 1:1 mixture of ethanol and water) and scanned using a FluorChem gel documentation system (Alpha Innotech). The number of colonies in each well was counted using ImageJ software (U.S. National Institutes of Health, Bethesda) and customized macros (*1*). The plating efficiency was calculated as the ratio of the number of colonies divided by the number of cells seeded. The SF was calculated by dividing the plating efficiency of treated cells by the plating efficiency of untreated cells.

Cell Fractionation

At each selected time point of incubation of MCF-7/HER2-18 cells with ^{64}Cu-DOTA-trastuzumab as described in the main article, the medium was removed and the cells were washed twice with phosphate-buffered saline (PBS). Then the surface-bound radioactivity was displaced from the cells by incubation with 200 mM sodium acetate/500 mM sodium chloride (pH 2.5) on ice for 5 mins. Cytoplasmic and nuclear fractions were isolated using a nuclei isolation kit (Nuclei EZ Prep Nuclei Isolation Kit, NUC-101; Sigma-Aldrich) following the manufacturer's protocol except that the first Nuclei EZ lysis buffer incubation time on ice was 4.5 h to ensure complete separation of trastuzumab in the cytoplasm from the cell nucleus (Supplemental Fig. 1).

RESULTS



A . Before incubation with lysis buffer

B. After incubation with lysis buffer on ice for 4.5 hours

SUPPLEMENTAL FIGURE 1. Confocal images of MCF-7/HER2-18 cells treated3 overnight with 10 μg/mL Alexa488 labeled trastuzumab (green). Cell nuclei were stained with DAPI (blue). (A). Before incubation with lysis buffer. (B) After incubation with lysis buffer on ice for 4.5 h.

SUPPLEMENTAL TABLE 1

Self-Dose S-Values to the Cell Nucleus for ^{64}Cu in Subcellular Compartments of a Single Cell Model Calculated Using MCNP in Comparison to MIRD Published or MIRDcell Calculated S-Values

		S-value (mBq × Bq^{-1} × s^{-1})							Relative Difference (RD, %)			
		MCNP			*MIRD		†MIRDcell		MIRD		MIRDcell	
‡ R_C	‡ R_N	$S_{N\leftarrow\square}$	$S_{N\leftarrow Cy}$	$S_{N\leftarrow CS}$	$S_{N\leftarrow N}$	$S_{N\leftarrow N}$	$S_{N\leftarrow Cy}$	$S_{N\leftarrow CS}$	$S_{N\leftarrow\square}$	$S_{N\leftarrow\square}$	$S_{N\leftarrow Cy}$	$S_{N\leftarrow CS}$
5	2	9.32	0.356	0.111	9.26	9.34	0.386	0.104	0.7	-0.2	-7.8	6.7
5	3	3.17	0.295	0.115	3.19	3.22	0.32	0.11	-0.7	-1.6	-7.8	4.5
5	4	1.47	0.29	0.133	1.48	1.5	0.317	0.151	-0.7	-2.0	-8.5	-11.9
6	3	3.17	0.197	0.077	3.19	3.22	0.209	0.073	-0.7	-1.6	-5.7	5.5
6	4	1.47	0.176	0.081	1.48	1.5	0.187	0.078	-0.7	-2.0	-5.9	3.8
6	5	0.81	0.179	0.093	0.821	0.83	0.193	0.101	-1.1	-2.4	-7.3	-7.9
7	3	3.17	0.144	0.056	3.19	3.23	0.149	0.053	-0.7	-1.9	-3.4	5.7
7	4	1.47	0.127	0.058	1.48	1.5	0.131	0.055	-0.7	-2.0	-3.1	5.5
7	5	0.81	0.118	0.061	0.821	0.83	0.122	0.058	-1.1	-2.5	-3.3	5.2
7	6	0.5	0.121	0.068	0.507	0.52	0.129	0.073	-1.0	-2.5	-6.2	-6.8
8	4	1.47	0.098	0.043	1.48	1.51	0.099	0.041	-0.7	-2.6	-1.0	4.9
8	5	0.81	0.089	0.045	0.821	0.84	0.09	0.042	-1.1	-2.8	-1.1	7.1
8	6	0.5	0.084	0.047	0.507	0.52	0.086	0.045	-1.0	-2.7	-2.3	4.4
8	7	0.34	0.087	0.053	0.338	0.35	0.092	0.055	-0.9	-2.9	-5.4	-3.6
9	4	1.47	0.078	0.033	-	1.51	*0.079*	*0.032*		-2.6	-1.3	3.1
9	5	0.81	0.071	0.035	0.821	0.84	0.071	0.032	-1.1	-2.9	0.0	9.4
9	6	0.5	0.066	0.036	0.507	0.52	0.066	0.034	-1.0	-2.9	0.0	5.9
9	7	0.34	0.063	0.038	0.338	0.35	0.064	0.036	-0.9	-2.9	-1.6	5.6

9	8	0.24	0.066	0.042	0.239	0.24	0.069	0.043	-0.8	-2.9	-4.3	-2.3
10	5	0.81	0.058	0.027	0.821	0.84	0.058	0.026	-1.1	-3.0	0.0	3.8
10	6	0.5	0.054	0.028	0.507	0.52	0.054	0.026	-1.0	-3.1	0.0	7.7
10	7	0.34	0.051	0.029	0.338	0.35	0.051	0.028	-0.9	-3.2	0.0	3.6
10	8	0.24	0.049	0.031	0.239	0.25	0.049	0.029	-0.8	-3.3	0.0	6.9
10	9	0.18	0.051	0.034	0.176	0.18	0.053	0.035	-0.6	-3.3	-3.8	-2.9
11	5	0.81	0.049	0.022		0.84	0.048	0.021		-3.2	2.1	4.8
11	6	0.5	0.045	0.023		0.52	0.045	0.021		-3.3	0.0	9.5
11	7	0.34	0.042	0.024		0.35	0.042	0.022		-3.5	0.0	9.1
11	8	0.24	0.04	0.024		0.25	0.04	0.023		-3.3	0.0	4.3
11	9	0.18	0.039	0.026		0.18	0.039	0.024		-3.3	0.0	8.3
11	10	0.13	0.041	0.028		0.14	0.042	0.028		-2.9	-2.4	0.0
12	6	0.5	0.039	0.019		0.52	0.038	0.018		-3.5	2.6	5.6
12	7	0.34	0.036	0.019		0.35	0.036	0.018		-3.7	0.0	5.6
12	8	0.24	0.034	0.02		0.25	0.034	0.019		-3.7	0.0	5.3
12	9	0.18	0.033	0.021		0.18	0.032	0.019		-3.3	3.1	10.5
12	10	0.13	0.032	0.022		0.14	0.032	0.02		-2.9	0.0	10.0
12	11	0.11	0.034	0.024		0.11	0.034	0.024		-3.7	0.0	0.0

* Goddu SM, Howell RW, Bouchet LG, Bolch WE, Rao DV,. MIRD Cellular S-Values: Self-absorbed dose per unit cumulated activity for selected radionuclides and monoenergetic electron and alpha particle emitters incorporated into different cell compartments. Reston, VA: The Society of Nuclear Medicine; 1997. $S_{N\leftarrow Cy}$ and $S_{N\leftarrow CS}$ from MIRD were the same as those from MIRDcell, thus omitted here.

† Vaziri B, Wu H, Dhawan AP, Du P, Howell RW, Committee SM. MIRD pamphlet No. 25: MIRDcell V2.0 software tool for dosimetric analysis of biologic response of multicellular populations. *J Nucl Med*. 2014;55:1557-1564.

‡ Radius of the cell or cell nucleus (μm).

SUPPLEMENTAL TABLE 2

* Cross-dose S-values to the cell nucleus ($mGy \cdot Bq^{-1} \cdot s^{-1}$) for ^{64}Cu distributed homogeneously in different cell compartment of cells cubically closely packed in circular monolayer with a radius of 0.1 mm calculated by MCNP5 and MIRDCell

		MCNP5				MIRDCell				
†R_C	†R_N	N ← N (min-max)	N ← Cy (min-max)	N ← CS (min-max)	Mean	N ← N	N ← Cy	N ← CS	‡Mean	RD %
5	2	0.283-0.391	0.334-0.439	0.314-0.399	0.408	0.299	0.317	0.321	0.312	31
5	3	0.315-0.425	0.331-0.439	0.316-0.403		0.308	0.319	0.326	0.318	
5	4	0.326-0.432	0.333-0.444	0.321-0.401		0.317	0.327	0.330	0.325	
6	3	0.139-0.261	0.162-0.284	0.152-0.264	0.258	0.197	0.208	0.210	0.205	26
6	4	0.155-0.277	0.161-0.283	0.158-0.264		0.206	0.210	0.214	0.210	
6	5	0.161-0.280	0.166-0.288	0.163-0.273		0.207	0.213	0.216	0.212	
7	3	0.108-0.177	0.128-0.196	0.118-0.173	0.175	0.131	0.137	0.140	0.136	28
7	4	0.118-0.184	0.1280.195	0.117-0.173		0.136	0.139	0.142	0.139	
7	5	0.125-0.191	0.130-0.198	0.119-0.174		0.136	0.141	0.143	0.140	
7	6	0.129-0.196	0.132-0.199	0.122-0.176		0.141	0.143	0.145	0.143	
8	4	0.074-0.132	0.084-0.142	0.075-0.127	0.124	0.096	0.097	0.099	0.097	27
8	5	0.081-0.137	0.085-0.143	0.076-0.126		0.096	0.099	0.101	0.098	
8	6	0.085-0.139	0.088-0.142	0.078-0.127		0.098	0.100	0.101	0.100	
8	7	0.088-0.142	0.090-0.145	0.082-0.128		0.099	0.102	0.103	0.101	
9	4	0.057-0.099	0.064-0.106	0.056-0.097	0.091	0.068	0.071	0.073	0.071	28
9	5	0.058-0.100	0.063-0.107	0.056-0.099		0.070	0.072	0.073	0.071	
9	6	0.060-0.102	0.063-0.107	0.058-0.100		0.069	0.073	0.074	0.072	

9	7	0.063-0.103	0.065-0.108	0.060-0.102		0.072	0.074	0.074	0.073	
9	8	0.065-0.107	0.066-0.109	0.063-0.104		0.073	0.075	0.076	0.074	
10	5	0.043-0.074	0.048-0.081	0.042-0.071	0.069	0.052	0.054	0.055	0.054	29
10	6	0.045-0.077	0.048-0.081	0.042-0.071		0.051	0.054	0.056	0.054	
10	7	0.047-0.079	0.049-0.082	0.043-0.073		0.054	0.055	0.056	0.055	
10	8	0.048-0.080	0.049-0.082	0.043-0.073		0.055	0.056	0.056	0.056	
10	9	0.049-0.081	0.051-0.084	0.045-0.074		0.055	0.056	0.057	0.056	
11	5	0.037-0.059	0.041-0.065	0.035-0.057	0.053	0.042	0.042	0.043	0.042	27
11	6	0.038-0.060	0.040-0.064	0.035-0.058		0.042	0.043	0.044	0.043	
11	7	0.039-0.062	0.041-0.065	0.036-0.059		0.042	0.043	0.044	0.043	
11	8	0.040-0.063	0.042-0.065	0.036-0.059		0.041	0.044	0.044	0.043	
11	9	0.040-0.063	0.041-0.066	0.037-0.060		0.043	0.044	0.045	0.044	
11	10	0.040-0.065	0.042-0.066	0.037-0.061		0.043	0.045	0.045	0.044	
12	6	0.028-0.048	0.031-0.052	0.026-0.047	0.043	0.033	0.034	0.034	0.034	26
12	7	0.029-0.049	0.032-0.052	0.026-0.047		0.033	0.034	0.035	0.034	
12	8	0.030-0.050	0.032-0.052	0.026-0.047		0.035	0.035	0.035	0.035	
12	9	0.031-0.051	0.032-0.052	0.027-0.048		0.034	0.035	0.035	0.035	
12	10	0.032-0.051	0.033-0.053	0.028-0.049		0.034	0.035	0.036	0.035	
12	11	0.032-0.051	0.033-0.054	0.029-0.050		0.035	0.036	0.036	0.036	

[*] The ranges of cross-dose S-values were calculated by subtracting the self-dose S-value from the respective maximum or minimum spherical cell S-values

[†] Radius of the cell or cell nucleus (□Radi

[‡] The mean of cross-dose values. The maximum SD was 0.022.

SUPPLEMENTAL TABLE 3

* Cross-dose S-values to the cell nucleus ($mGy \cdot Bq^{-1} \cdot s^{-1}$) for ^{64}Cu distributed homogeneously in different cell compartment of cells cubically closely packed in a sphere with a radius of 0.25 mm calculated by MCNP5 and MIRDCell

		MCNP5				MIRDCell				
†R_C	†R_N	N ← N (min-max)	N ← Cy (min-max)	N ← CS (min-max)	Mean	N ← N	N ← Cy	N ← CS	‡Mean	RD %
5	2	3.23-6.79	3.45-6.88	3.43-6.87	5.05	3.85	3.86	3.90	3.87	30
5	3	3.10-6.82	3.39-6.85	3.42-6.80		3.86	3.87	3.89	3.88	
5	4	3.15-6.82	3.37-6.85	3.40-6.79		3.89	3.91	3.90	3.90	
6	3	1.98-3.93	2.03-3.95	2.01-3.93	2.90	2.22	2.24	2.25	2.24	30
6	4	1.99-3.93	2.02-3.94	2.01-3.93		2.25	2.25	2.26	2.25	
6	5	1.96-3.93	2.00-3.95	2.01-3.93		2.25	2.26	2.27	2.26	
7	3	1.25-2.45	1.28-2.48	1.27-2.47	1.82	1.38	1.39	1.39	1.39	31
7	4	1.26-2.45	1.26-2.47	1.26-2.46		1.39	1.39	1.40	1.39	
7	5	1.25-2.46	1.28-2.48	1.27-2.45		1.38	1.39	1.40	1.39	
7	6	1.25-2.47	1.27-2.48	1.27-2.46		1.39	1.40	1.40	1.40	
8	4	0.83-1.65	0.83-1.65	0.83-1.64	1.21	0.91	0.92	0.93	0.92	31
8	5	0.80-1.64	0.84-1.66	0.83-1.64		0.92	0.92	0.93	0.92	
8	6	0.80-1.64	0.83-1.65	0.83-1.63		0.92	0.92	0.93	0.92	
8	7	0.79-1.65	0.83-1.66	0.83-1.64		0.92	0.93	0.93	0.93	
9	4	0.58-1.14	0.59-1.14	0.59-1.14	0.84	0.63	0.64	0.64	0.63	34
9	5	0.58-1.14	0.60-1.15	0.59-1.15		0.63	0.63	0.64	0.63	
9	6	0.58-1.14	0.59-1.15	0.59-1.15		0.63	0.64	0.64	0.64	

9	7	0.58-1.15	0.59-1.16	0.59-1.15		0.63	0.64	0.64	0.64	
9	8	0.58-1.15	0.59-1.16	0.59-1.15		0.64	0.64	0.64	0.64	
10	5	0.44-0.83	0.45-0.84	0.45-0.83	0.61	0.46	0.46	0.47	0.46	33
10	6	0.44-0.83	0.45-0.84	0.44-0.83		0.46	0.45	0.47	0.46	
10	7	0.44-0.83	0.45-0.84	0.44-0.83		0.46	0.46	0.47	0.46	
10	8	0.44-0.83	0.45-0.84	0.45-0.83		0.46	0.46	0.47	0.46	
10	9	0.45-0.84	0.44-0.84	0.45-0.83		0.46	0.47	0.47	0.47	
11	5	0.29-0.62	0.34-0.62	0.31-0.62	0.46	0.34	0.34	0.34	0.34	34
11	6	0.28-0.62	0.32-0.62	0.30-0.62		0.34	0.34	0.35	0.34	
11	7	0.28-0.62	0.30-0.63	0.31-0.62		0.34	0.34	0.34	0.34	
11	8	0.28-0.62	0.31-0.63	0.31-0.62		0.34	0.34	0.35	0.34	
11	9	0.29-0.62	0.31-0.63	0.31-0.62		0.34	0.34	0.35	0.34	
11	10	0.29-0.62	0.31-0.63	0.39-0.62		0.34	0.35	0.35	0.35	
12	6	0.25-0.48	0.27-0.48	0.25-0.47	0.35	0.26	0.26	0.26	0.26	34
12	7	0.25-0.47	0.26-0.48	0.25-0.48		0.26	0.26	0.27	0.26	
12	8	0.25-0.48	0.25-0.48	0.260.47		0.26	0.26	0.26	0.26	
12	9	0.25-0.48	0.25-0.48	0.26-0.48		0.26	0.27	0.27	0.26	
12	10	0.25-0.48	0.26-0.48	0.26-0.48		0.26	0.27	0.27	0.26	
12	11	0.25-0.48	0.26-0.48	0.26-0.48		0.26	0.27	0.27	0.26	

* The ranges of cross-dose S-values were calculated by subtracting the self-dose S-values from the respective maximum or minimum spherical cell S-values.

† Radius of the cell or cell nucleus (μ□□□□

‡ The mean of cross-dose $S_{N\leftarrow N}$, $S_{N\leftarrow Cy}$, $S_{N\leftarrow CS}$ values. The maximum SD was 0.05.

SUPPLEMENTAL TABLE 4

[*] Mean cross-dose S-values to a cell nucleus ($mGy \cdot Bq^{-1} \cdot s^{-1}$) for ^{64}Cu in cells in a monolayer in a tissue culture plate as a functions of the well size and cell dimension

		[†] R_C							
plate	[‡] *R*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
6-well	1.74	0.738	0.486	0.341	0.252	0.192	0.151	0.121	0.099
12-well	1.10	0.736	0.484	0.340	0.251	0.191	0.150	0.120	0.098
24-well	0.77	0.733	0.482	0.339	0.249	0.190	0.149	0.120	0.098
48-well	0.55	0.730	0.480	0.337	0.248	0.189	0.148	0.119	0.097
96-well	0.32	0.721	0.474	0.332	0.245	0.187	0.146	0.117	0.096

[*] Mean S_{cross} values are independent of the radius of cell nucleus and subcellular location of ^{64}Cu.

[†] Radius of the cell (μm)

[‡] R: radius of a well in a tissue culture plates with 6, 12, 24, 48 or 96 wells in cm.

SUPPLEMENTAL TABLE 5

* Mean cross-dose S-values to a cell nucleus ($mGy \cdot Bq^{-1} \cdot s^{-1}$) for ^{64}Cu [in] a spherical cluster of cells as functions of the radius of the sphere and cell radius

‡R_C	†R_{sphere}					
	0.05	0.1	0.25	0.5	1.5	6
5	1.040	2.128	5.048	8.829	15.091	18.609
6	0.583	1.212	2.902	5.090	8.714	10.749
7	0.353	0.751	1.816	3.193	5.476	6.758
8	0.228	0.495	1.209	2.132	3.661	4.519
9	0.154	0.343	0.844	1.492	2.566	3.169
10	0.109	0.246	0.611	1.084	1.867	2.306
11	0.080	0.182	0.456	0.811	1.400	1.730
12	0.057	0.138	0.349	0.623	1.076	1.330

* Mean S_{cross} values are independent of the radius of cell nucleus.

† Radius of the sphere (mm)

‡ Radius of the cell (μm)

SUPPLEMENTAL TABLE 6

Number of cells [in] a spherical cluster as functions of the radius of the sphere and cell radius

†R_C	*R_{sphere}					
	0.05	0.1	0.25	0.5	1.5	6
5	5.23E+02	4.19E+03	6.54E+04	5.24E+05	1.41E+07	9.05E+08
6	3.03E+02	2.42E+03	3.79E+04	3.03E+05	8.18E+06	5.24E+08
7	1.90E+02	1.53E+03	2.39E+04	1.91E+05	5.15E+06	3.30E+08
8	1.27E+02	1.02E+03	1.60E+04	1.28E+05	3.45E+06	2.21E+08
9	8.90E+01	7.18E+02	1.12E+04	8.98E+04	2.42E+06	1.55E+08
10	6.50E+01	5.23E+02	8.18E+03	6.54E+04	1.77E+06	1.13E+08
11	4.90E+01	3.93E+02	6.15E+03	4.92E+04	1.33E+06	8.50E+07
12	3.70E+01	3.03E+02	4.73E+03	3.79E+04	1.02E+06	6.54E+07

* Radius of the sphere (mm)

† Radius of the cell (μ□□

SUPPLEMENTAL TABLE 7

S-values to monolayer cells in a well in a tissue culture plate ($pGy \cdot Bq^{-1} \cdot s^{-1}$) from ^{64}Cu in the surrounding water (medium) calculated as a function of the well size and cell dimension

plate	*R*	R_C							
		5	*6*	*7*	*8*	*9*	*10*	*11*	*12*
6-well	1.74	4.31	4.25	4.17	4.14	4.16	4.07	4.09	3.97
12-well	1.10	12.4	12.2	12.0	11.8	11.9	11.7	11.7	11.5
24-well	0.77	24.3	23.9	23.4	23.2	23.3	22.8	22.9	22.6
48-well	0.55	47.9	47.0	46.0	45.7	45.9	44.9	45.0	44.4
96-well	0.32	135	131	129	128	128	126	125	124

* R: radius of the well (cm)

† R_C: radius of the cell (μ□ □

SUPPLEMENTAL TABLE 8

Contribution of Radiation Emissions of ^{64}Cu to the S_{self} Values

Radiation	**Contribution to S_{self} (%)**		
	N→N	Cy→N	CS→N
Photons *	0.1-0.3	0.4-0.7	0.7-0.8
Positron (β^+) †	3.3-10.3	13.0-21.0	21.0-24.0
Beta-minus particle (β^-) ‡	13.0-36.0	45.0-70.0	73.0-77.0
Auger and IC Electrons §	53.0-84.0	8.5-42.0	0-5.4

* Photons: Eγ=0.0145 keV (2.24/decay); 511 keV (0.35/decay).

† Positrons: $E_{max}\beta^+$=0.65 MeV (0.174/decay)

‡ Beta-minus particles: $E_{max}\beta^-$=0.579 MeV (0.39/decay)

§Auger and IC electrons: 48 eV (0.877/decay); 79 eV (0.112/decay);0.77 keV (0.581/decay); 6.5 keV (0.183/decay).

SUPPLEMENTAL TABLE 9

Contribution of Geometry and Radiation Emissions of ^{64}Cu to the S_{cross}

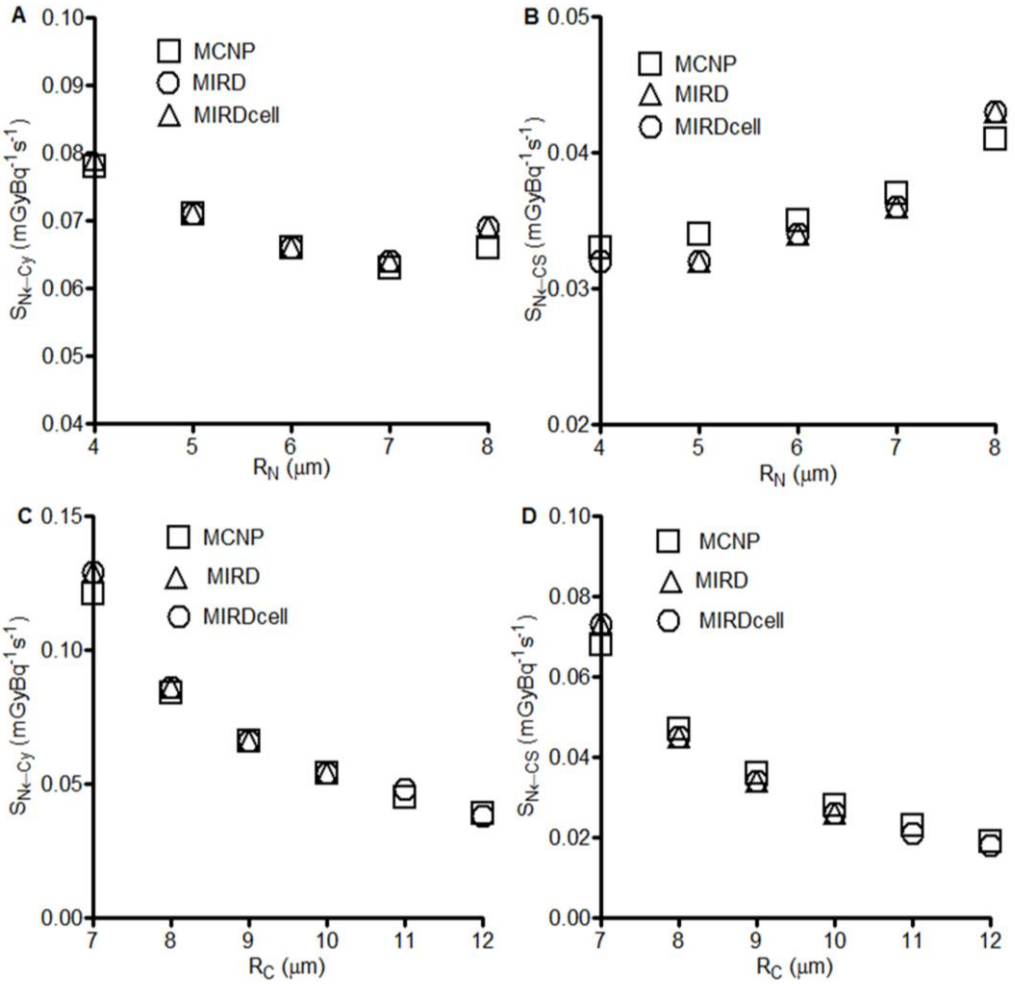
	Contribution to S_{cross} (%)			
Geometry	Monolayer (d=0.2 mm)	Monolayer (d=3.5 cm)	Sphere (d=0.5 mm)	Sphere (d=1.2 cm)
Photons *	0.57-0.61	0.8-1.1	0.68-0.69	3.06-3.09
Positron (β^+) †	24.7-26.6	28.9-30.9	30.4-30.8	37.6-37.9
Beta-minus particle (β^-) ‡	70.3-71.7	67.3-82.1	68.4-68.5	58.8-59.0
Auger and IC Electrons §	1.2-4.5	0.8-2.6	0.2-0.4	0.05-0.11

* Photons: Eγ=0.0145 keV (2.24/decay); 511 keV (0.35/decay).

†Positrons: $E_{max}\beta^+$=0.65 MeV (0.174/decay)

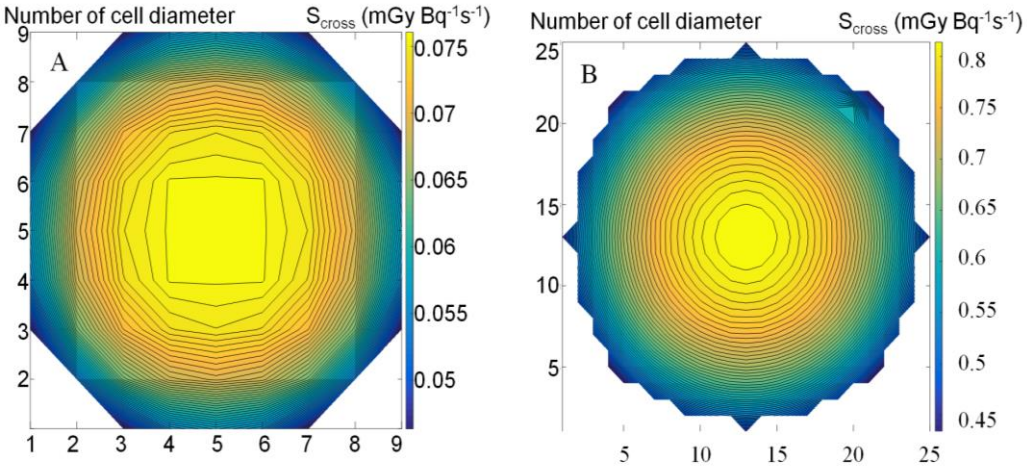
‡Beta-minus particles: $E_{max}\beta^-$ =0.579 MeV (0.39/decay)

§Auger and IC electrons: 48 eV (0.877/decay); 79 eV (0.112/decay);0.77 keV (0.581/decay); 6.5 keV (0.183/decay).



SUPPLEMENTAL FIGURE 2. Effects of cell and nucleus radii on the self-dose $S_{N\leftarrow Cy}$ and $S_{N\leftarrow CS}$ values calculated with MCNP, in comparison with MIRD published and MIRDcell calculated values: Dependence of $S_{N\leftarrow Cy}$ (A) and $S_{N\leftarrow CS}$ (B) on the nucleus

radius with a constant cell radius of 9 μ□□□□□□□□□□□□□□□□□□□□□$_{N\leftarrow Cy}$ (C) and $S_{N\leftarrow CS}$ (D) on the cell radius with a constant nucleus radius of 6 μm.



SUPPLEMENTAL FIGURE 3. S_{cross} distribution on (A) a 100 μm radius circular monolayer and (B) a center plane of a 250 μm radius sphere of cells (R_C=10 μm, R_N=8 μm).

REFERENCES

1. Cai Z, Chattopadhyay N, Liu WJ, Chan C, Pignol JP, Reilly RM. Optimized digital counting colonies of clonogenic assays using ImageJ software and customized macros: comparison with manual counting. *Int J Radiat Biol*. 2011;87:1135-1146.