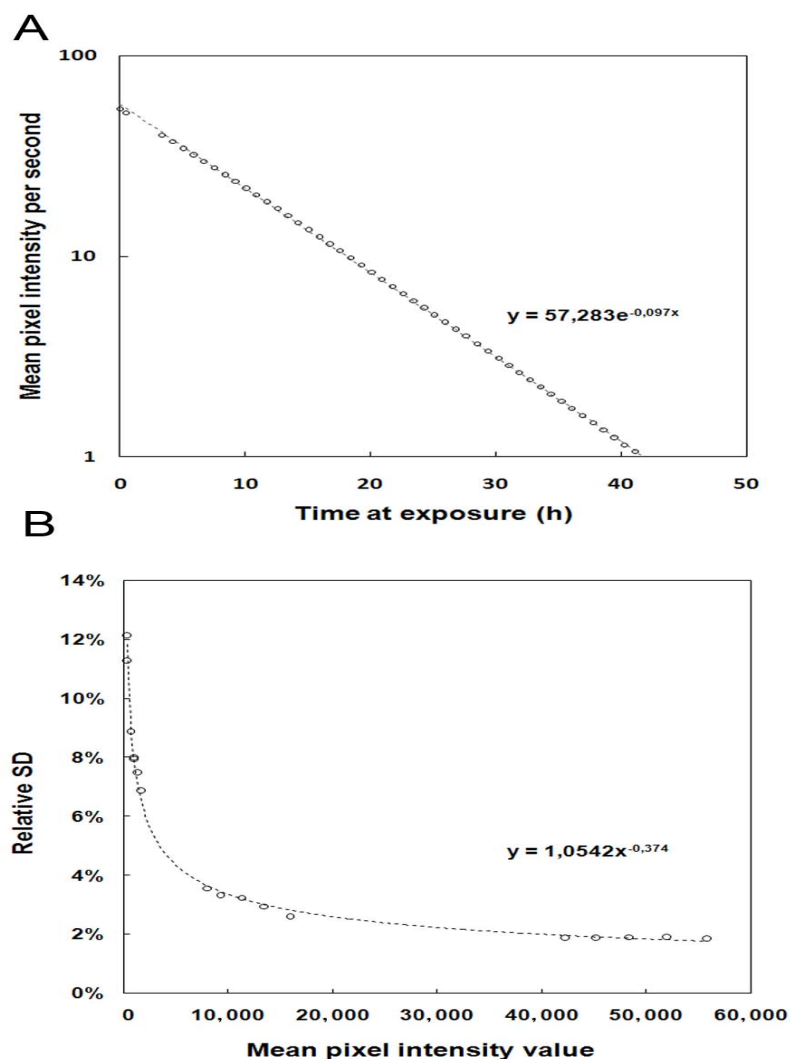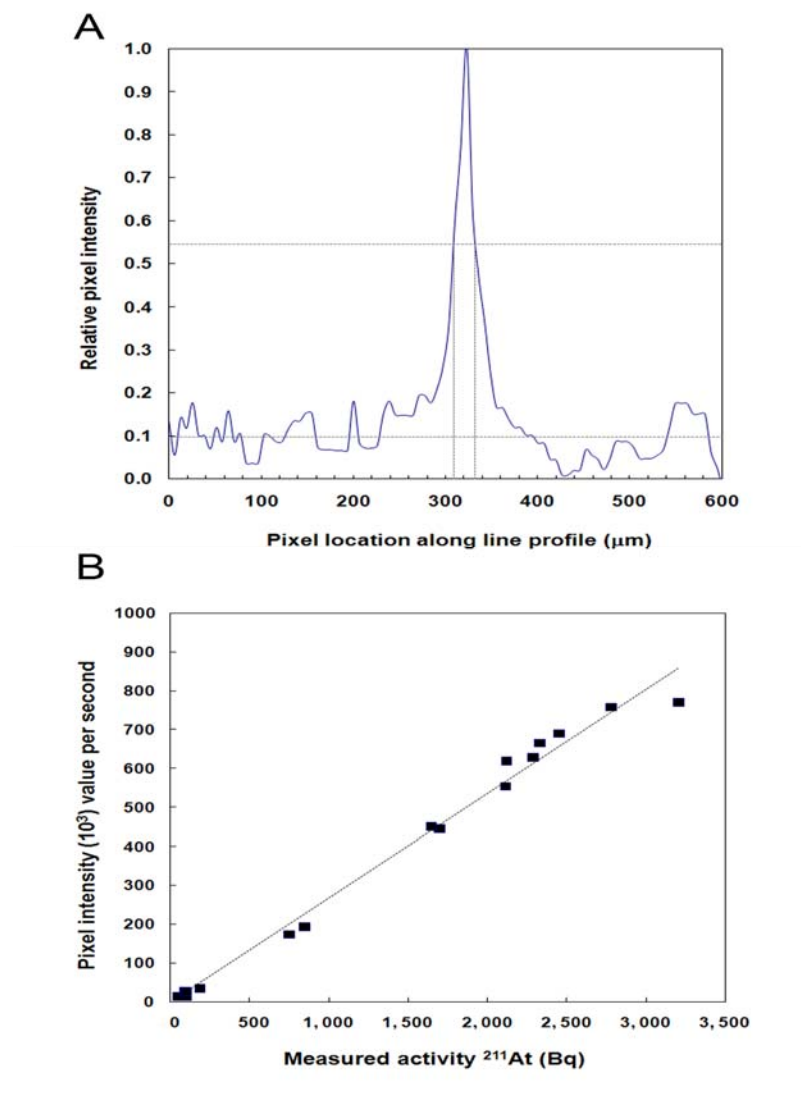**SUPPLEMENTAL FIGURE 1**. The setup of the Alpha Camera, consisting of (A) CCD-detector; (B) lens adapter; (C) extension bellows; (D) optical lens; (E) glass slide holder; (F) adjustable stand.

A

$y = 57{,}283e^{-0.097x}$

B

$y = 1{,}0542x^{-0.374}$

SUPPLEMENTAL FIGURE 2. (A) Linearity of the Alpha Camera system. The mean pixel intensity value per second plotted as a function of time for an ROI of a repeated-exposure series of a given decaying [211]At sample. The dashed line represents the exponential fit used to estimate the [211]At half-life. (B) Pixel-to-pixel intensity variation with pixel intensity. Relative standard deviation is plotted as a function of the mean pixel intensity value for an ROI of a repeated-exposure series of a given decaying [211]At plane source.

SUPPLEMENTAL FIGURE 3. (A) Spatial resolution of the Alpha Camera system. The pixel intensity values along the line profiles of an imaged line source are plotted as a function of pixel location. The dashed lines represent an estimated FWHM of 26 μm for one position along the line source. (B) Pixel intensity in Alpha Camera images of kidney sections (quantified from ROIs) is plotted as a function of the measured [211]At activity in the corresponding sample.
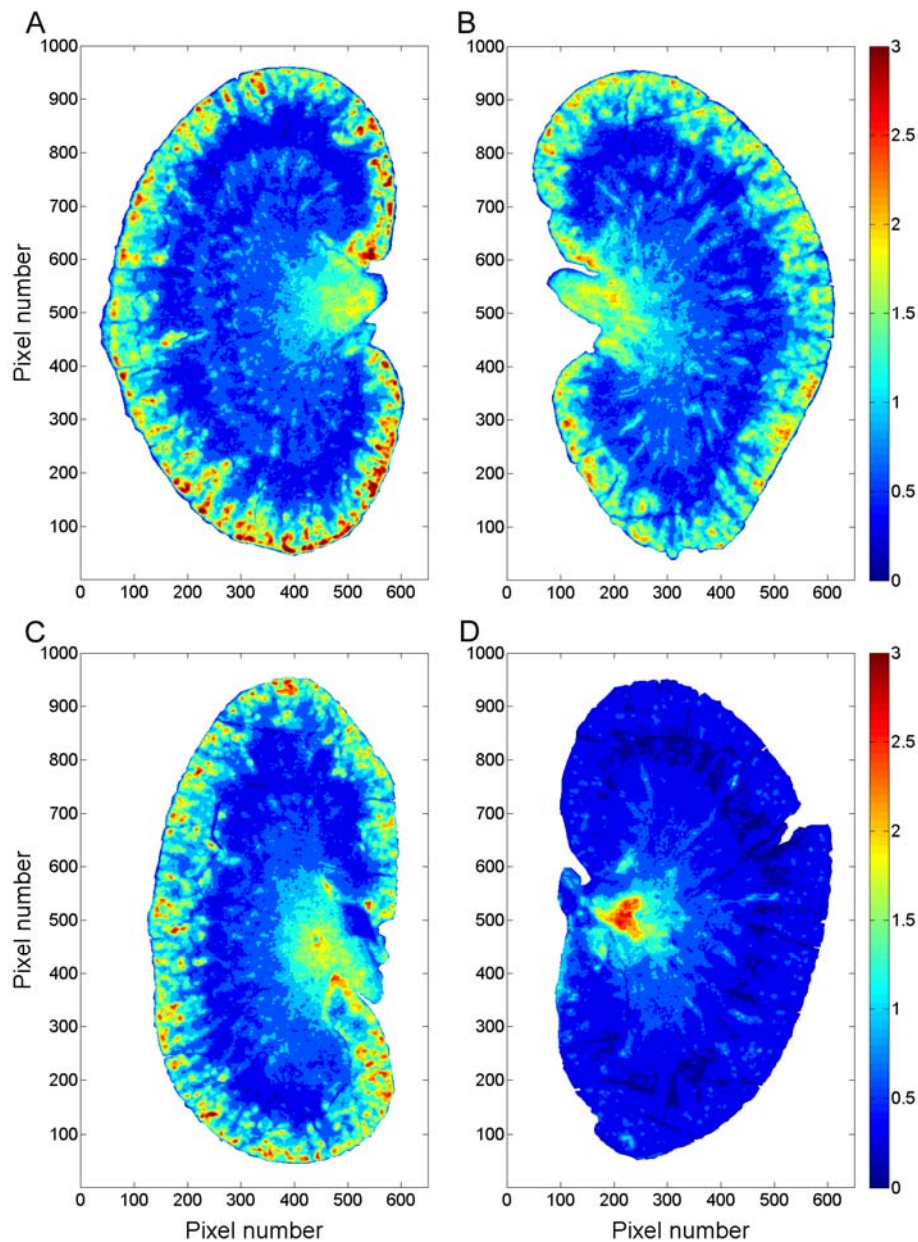
SUPPLEMENTAL FIGURE 4. Activity distribution of ^{211}At-F(ab')$_2$ and ^{211}At-IgG Trastuzumab in kidneys 20 minutes (A, B) and 2 hours (C, D) after intravenous injection. The left panels (A, C) depict ^{211}At-MX35-F(ab')$_2$, while the right panels (B, D) display ^{211}At-IgG Trastuzumab. Each pixel intensity value was normalized to the mean pixel intensity of the whole kidney. The normalized data were divided into ten bins between 0 and 3.0, and each level was color-coded.