SI Materials and Methods

**PC12 Neurite Outgrowth Assay.** PC12 cells were plated at a density of ≈4000 cells per well in a 96-well plate precoated with poly-d-lysine. The normal culture medium was replaced with DMEM containing a minimal level of serum (1% FCS) and supplied with various concentrations of NGF, biotinylated NGF (BtNGF) or QD-NGF. Neurites were measured 48 h after plating, using a phase-contrast microscope coupled with a ×100 objective. Five fields, each containing ≈100 cells, were randomly selected. The percentage of the cells bearing neuritic processes of >2 cell diameter was measured for each sample. Cells in clusters were not counted.

**Data Analysis.** On average, the fluorescence signal from a single endosome spans to an area of 5 by 5 pixels on the digitized image. After background subtraction, the endosomes were identified as the local maxims whose fluorescence intensity was at least three times above the background noise. Spatial distribution of the fluorescence intensity of individual endosomes was fitted to a two-dimensional Gaussian function. The fitted center, corresponding to the position of the endosome, was located with a precision of 10-20 nm. After measuring the position of endosomes at consecutively timed images, the trajectories were constructed by linking the time-resolved endosome positions. The average speed was determined by measuring the distance the endosome traveled over the observation time. Endosomes containing a single QD were identified by the blinking events during the period of observation. The fluorescence intensity of each endosome was measured by integrating the total fluorescence within a 5-pixel diameter circle centered on the endosome.