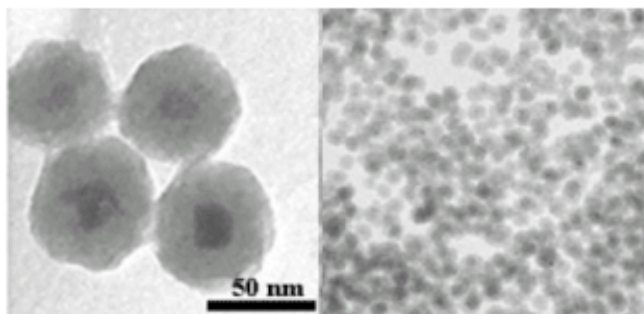


Magnetic & Fluorescent Nanoparticles (NFP)

NFP (Fluorescent Nanoparticle)

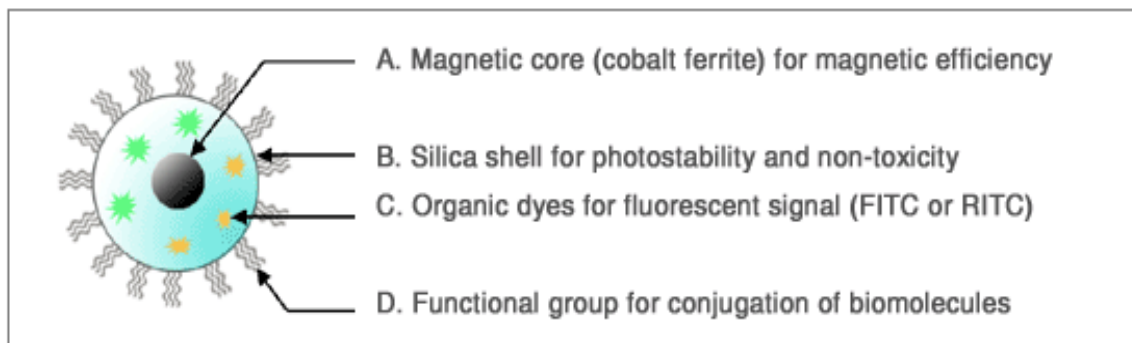
NFP (Nano Fluorescent Particle) is a fluorescent nanoparticle providing high fluorescent intensity compared to the common organic fluorescent dyes. NFPs contain FITC or RITC dyes inside of the silica shell structure so the incorporated dyes increase the photochemical stability even after multiple exposures to light and it enables long-term cell imaging studies. Also, a magnetic material (cobalt ferrite) can be inserted into the core of the shell for magnetic properties. The silica shell surrounds the cobalt ferrite magnetic core and contains organic dyes such as FITC or RITC inside, so that it can have both magnetic and optical properties. The outer surface of silica shell is water-soluble and easily modified with a various trialkoxysilane

Structure of a NFP



Left : Transmission electron micrograph (TEM) image of nanoparticles containing magnetic core and silica shell component

Below : Schematic structure of a NFP



No toxicity • Photostability • Brightness • Water solubility

SPECIFICATION

• Bio-Imaging

NFP nanoparticle can be internalized into the live cells by endocytosis and provides a long-term photostability for imaging and dynamic studies. It is available to use to get an in vivo imaging by MRI detection without giving damage to the animal.

• Stem Cell Tracking

NFP nanoparticle is useful for stem cell studies such as detection of stem cell differentiation, in vivo distribution, stem cell sorting or image monitoring etc., because NFP is easily taken up by stem cells and remains in the cytoplasm for several weeks. Cultured stem cells treated with NFP are injected to the experimental animal and then in vivo tracking of stem cell differentiation can be observed by the presence of fluorescence at the target organs or tissues.

• Non-toxicity and Safety

NFP is coated with a shell of stable and biocompatible material such as silica (SiO₂, the compound approved by F.D.A., U.S.A. in its safety), so it does not have any toxicity in vitro and in vivo test. Also, since the silica is stable at the strong basic and acidic conditions, the internal magnetic and/or fluorescent properties remain stable.

• Non-photobleaching and High fluorescent intensity

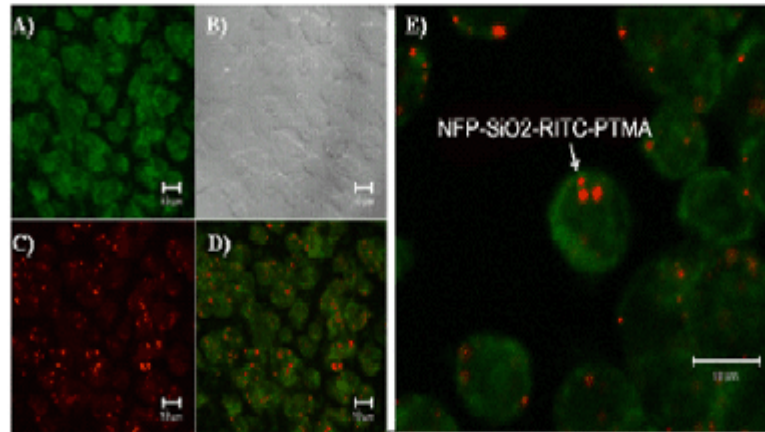
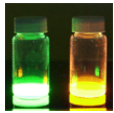
NFP is more photostable than any other organic fluorescent conjugates because the organic dyes are surrounded by silica inside of the shell, the photostable fluorescence is maintained under various biological conditions. Also, NFPs are not transferred to adjacent cells in the population. (Red color: RITC 543/554nm, Green color: FITC 492/518nm).

• Application

- Cell Staining
- Stem Cell Tracking
- Protein / Antibody conjugation

NFP-BASED ASSAYS
(1) Transfection / Gene or drug delivery carrier

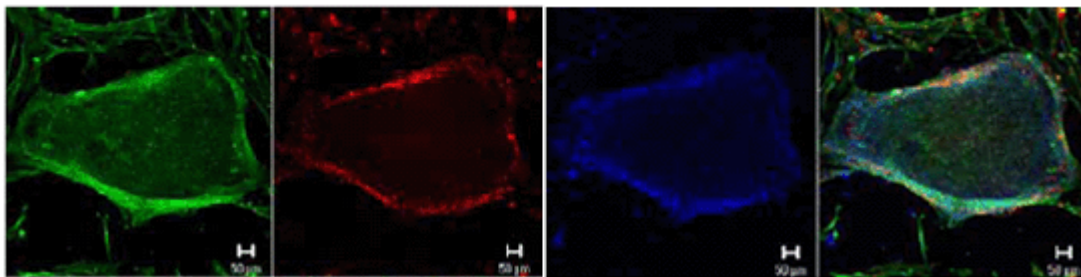
Positive charged nanoparticles are possible to apply as gene or drug delivery carrier. And it can overcome carrier on a commercial scale limitation in safety, and efficiency. A uniform ionic surface of the nanoparticle shows more than 95% transfection efficiency.



CLSM images of A549 cells transfected by the plasmid DNA bound NFP-PTMA-RITC system. Green fluorescence image (A), bright field image (B), red fluorescence image (C), all merged image (D), and high magnification merged image (E). Green fluorescence by GFP expression was shown at all cells and red fluorescence dots were also existed in the cytoplasm of cells.

(2) Stem Cell Staining

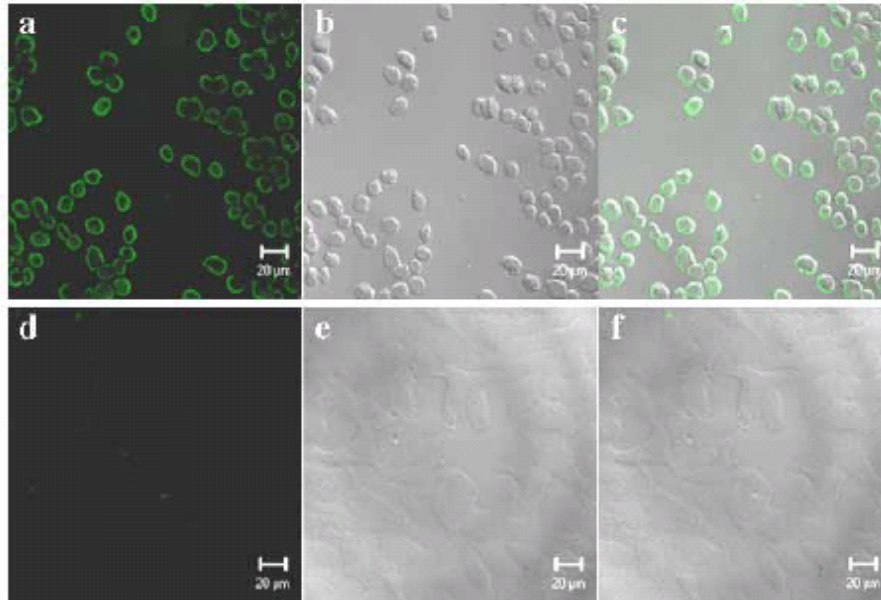
NFP is easily uptaken by stem cells and remains within the cell, so it helps to distinguish stem cells from others as well as continuous image monitoring of stem cells.



The cell was stained with FITC-conjugated Anti-Oct4 (Green), NFP-RITC (Red) and DAPI (Blue), respectively. The Oct-4 (Octamer-4), a member of the POU family of transcription factors, has been noted to be expressed in embryonic stem cells. The red fluorescence shows that the NFP was incorporated into the ES cell.

Green: FITC conjugated Anti-Oct4, Red: NFP-RITC, Blue: DAPI staining

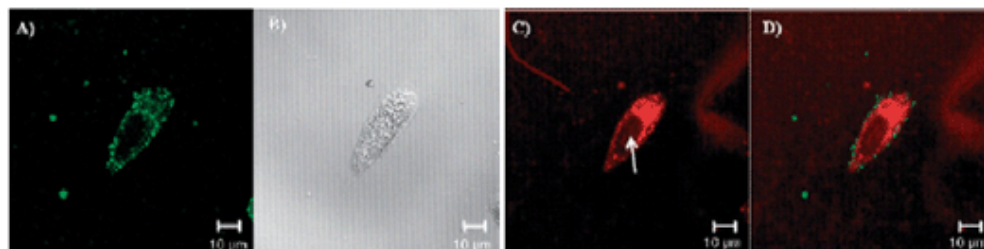
(3) Antibody Conjugation for Cell Sorting



CLSM images of SP2/0 leukemia cells and A549 lung cancer cells on treatment with NFP-FITC-AbCD-10 after 24 h of growth in media. In the case of A549 lung cancer cell (d ~ f), the fluorescence was not detected because the CD-10 antibody modified nanoparticles could be specifically bound to receptors on SP2/0 cell surface (a ~ c).

a and d: green fluorescence images
 b and e: bright field images
 c and f: show the merged fluorescence and bright field images

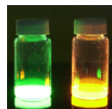
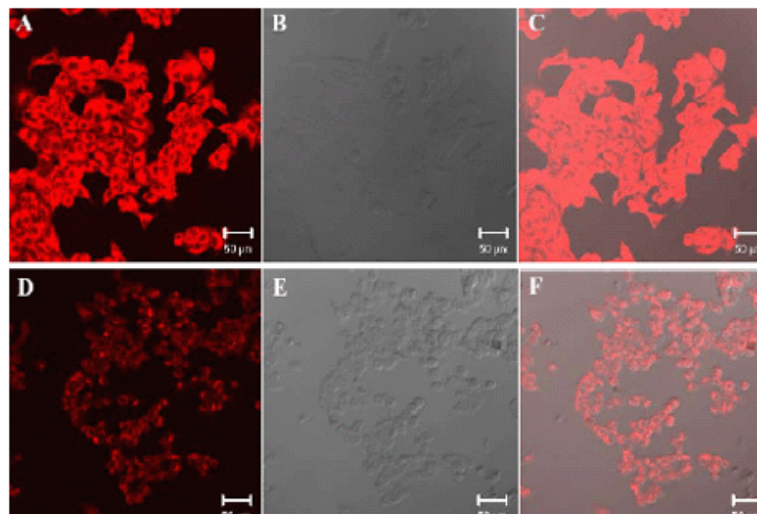
(4) Cell Targeting



CLSM images of MCF-7 cells after targeting and internalization of the NFP-FITC-AbHER-2 and NFP-RITC

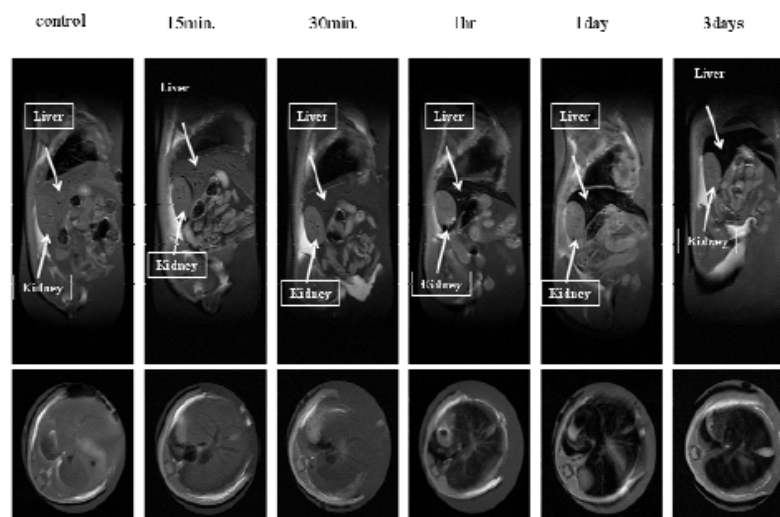
The green colored NFP-FITC-AbHER-2 and unmodified orange colored NFP-RITC was specifically located on the membrane surface (A) and in the cytoplasm (C) of MCF-7 cells. (D) is the merged image of (A) and (C). The white arrow in (C) indicates the nucleus.

(5) In vivo Imaging



CLSM images of breast cancer cells (MCF-7) after 24 h of growth in media containing PEG-modified NFP-PEG-RITC (A ~ C) or unmodified NFP-PEG-RITC nanoparticles (D ~ F). (A and D: fluorescence images, B and E: bright field images, C and F: overlay of the fluorescence and bright field images)
 From the difference in fluorescence intensity of these images, it was corroborated that the PEG groups on the surface could enhance the internalization efficiency of nanoparticles.

(6) MRI Detection



Sampling : NFP-RITC after IP injection (2.5mg/kg) 2 hrs.

The MRI signal of NFP system was provided as negative sign (black signal) were successfully detected in in vivo mouse model by commercial MRI instrument (4.7 Tesla). According to this study, the unmodified NFP was accumulated in the liver when it was administered through IP, which is clearly enumerated in a series of figures left.

Cat.No	Description	Functional Group	Magnetic core	Size	Conc.
K2501502	NFP Silanol FITC 50	Silanol	No	50nm	2mg/ml
K2501505	NFP Silanol FITC 50	Silanol	No	50nm	5mg/ml
K2503502	NFP Silanol RITC 50	Silanol	No	50nm	2mg/ml
K2503505	NFP Silanol RITC 50	Silanol	No	50nm	5mg/ml
K2505502	NFP Silanol Magna FITC 50	Silanol	Yes	50nm	2mg/ml
K2505505	NFP Silanol Magna FITC 50	Silanol	Yes	50nm	5mg/ml
K2507502	NFP Silanol Magna RITC 50	Silanol	Yes	50nm	2mg/ml
K2507505	NFP Silanol Magna RITC 50	Silanol	Yes	50nm	5mg/ml
K2521502	NFP PEG/Amine FITC 50	PEG/Amine	No	50nm	2mg/ml
K2521505	NFP PEG/Amine FITC 50	PEG/Amine	No	50nm	5mg/ml
K2523502	NFP PEG/Amine RITC 50	PEG/Amine	No	50nm	2mg/ml
K2523505	NFP PEG/Amine RITC 50	PEG/Amine	No	50nm	5mg/ml
K2525502	NFP PEG/Amine Magna FITC 50	PEG/Amine	Yes	50nm	2mg/ml
K2525505	NFP PEG/Amine Magna FITC 50	PEG/Amine	Yes	50nm	5mg/ml
K2527502	NFP PEG/Amine Magna RITC 50	PEG/Amine	Yes	50nm	2mg/ml
K2527505	NFP PEG/Amine Magna RITC 50	PEG/Amine	Yes	50nm	5mg/ml
K2531502	NFP PEG FITC 50	PEG	No	50nm	2mg/ml
K2531505	NFP PEG FITC 50	PEG	No	50nm	5mg/ml
K2533502	NFP PEG RITC 50	PEG	No	50nm	2mg/ml
K2533505	NFP PEG RITC 50	PEG	No	50nm	5mg/ml
K2535502	NFP PEG Magna FITC 50	PEG	Yes	50nm	2mg/ml
K2535505	NFP PEG Magna FITC 50	PEG	Yes	50nm	5mg/ml
K2537502	NFP PEG Magna RITC 50	PEG	Yes	50nm	2mg/ml
K2537505	NFP PEG Magna RITC 50	PEG	Yes	50nm	5mg/ml
K2541202	NFP Amine FITC 20	Amine	No	20nm	2mg/ml
K2541205	NFP Amine FITC 20	Amine	No	20nm	5mg/ml
K2543202	NFP Amine RITC 20	Amine	No	20nm	2mg/ml
K2543205	NFP Amine RITC 20	Amine	No	20nm	5mg/ml
K2545402	NFP Amine Magna FITC 40	Amine	Yes	40nm	2mg/ml
K2545405	NFP Amine Magna FITC 40	Amine	Yes	40nm	5mg/ml
K2547402	NFP Amine Magna RITC 40	Amine	Yes	40nm	2mg/ml
K2547405	NFP Amine Magna RITC 40	Amine	Yes	40nm	5mg/ml
K2551202	NFP Active Ester FITC 20	Active Ester	No	20nm	2mg/ml
K2553202	NFP Active Ester RITC 20	Active Ester	No	20nm	2mg/ml
K2555402	NFP Active Ester Magna FITC 40	Active Ester	Yes	40nm	2mg/ml
K2557402	NFP Active Ester Magna RITC 40	Active Ester	Yes	40nm	2mg/ml
K2561502	NFP PTMA FITC 50	PTMA	No	50nm	2mg/ml
K2563502	NFP PTMA RITC 50	PTMA	No	50nm	2mg/ml
K2575502	NFP PMP Magna FITC 50	PMP	No	50nm	2mg/ml
K2577502	NFP PMP Magna RITC 50	PMP	No	50nm	2mg/ml
K2587502	NFP-STEM Silanol Magna RITC 50	Silanol	Yes	50nm	2mg/ml
K2583502	NFP-STEM Silanol RITC 50	Silanol	No	50nm	2mg/ml
K2593502	NFP-STEM Silanol-PVP RITC 50	Silanol	No	50nm	2mg/ml

