evropský sociální fond v ČR
EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Název: Postupy a přístupy pro syntézu magnetizovatelných částic

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Reg.č.projektu: CZ.1.07/2.4.00/31.0023

Název projektu: Partnerská síť centra excelentního bionanotechnologického výzkumu

NanoBioMetalNet

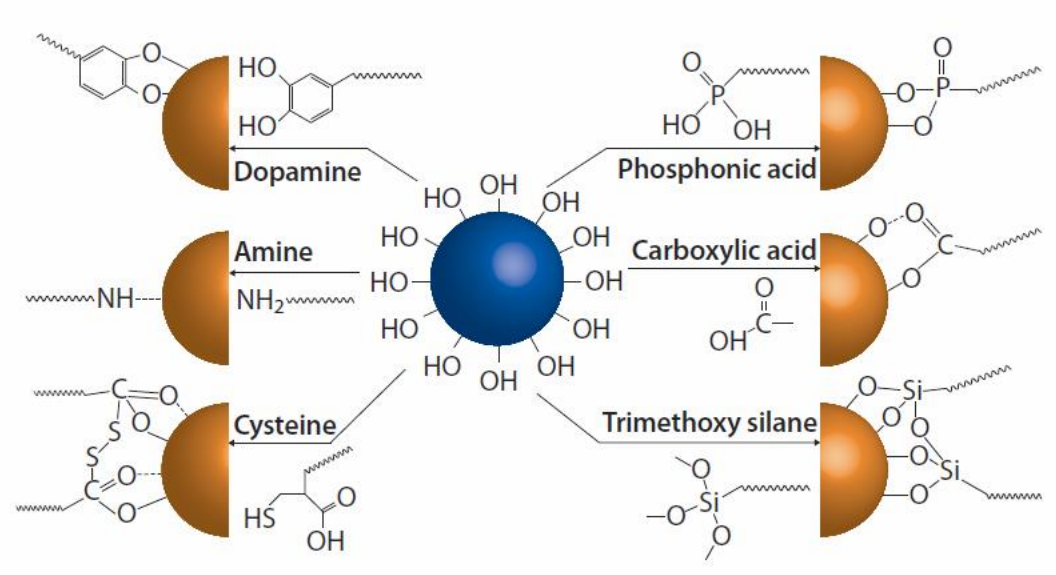
Synthetic methods for iron oxides preparation

Synthetic method	Synthesis	Reaction temp. [°C]	Reaction period	Solvent	Surface-capping agents	Size distribution	Shape control	Yield
co-precipitation	very simple, ambient conditions	20–90	minutes	water	needed, added during or after reaction	relatively narrow	not good	high/ scalable
thermal decomposition	complicated, inert atmosphere	100–320	hours–days	organic compound	needed, added during reaction	very narrow	very good	high/ scalable
microemulsion	complicated, ambient conditions	20–50	hours	organic compound	needed, added during reaction	relatively narrow	good	low
hydrothermal synthesis	simple, high pressure	220	hours ca. days	water-ethanol	needed, added during reaction	very narrow	very good	medium

- Co-precipitation is a facile and convenient way to synthesize iron oxides (either Fe3O4 or g-Fe2O3) from aqueous Fe2+/Fe3+ salt solutions by the addition of a base under inert atmosphere at room temperature or at elevated temperature. The size, shape, and composition of the magnetic nanoparticles depends on the type of salts used (e.g. chlorides, sulfates, nitrates), the Fe2+/Fe3+ ratio, the reaction temperature, the pH value and ionic strength of the media.

- Preparation of paramagnetic microparticles
- Maghemite nanoparticles were prepared by sodium borohydride (NaBH4) reduction of iron chloride (FeCl3.6H2O) according to Magro et al. and Prucek et al [11, 14]. 10 g of FeCl3 • 6H2O was dissolved in 800 mL of water. Briefly, 2 g of FeCl3•6H2O was dissolved in 80 mL of MiliQ water and a solution of 0.2 g of NaBH4 in ammonia (10 mL, 3.5 % m/v) was poured into the first solution with vigorous stirring. The obtained solution was heated at boiling temperature for 2 h. After cooling and standing for 2 h at room temperature, the obtained magnetic nanoparticles were separated by external magnetic field and washed several times with water. The nanoparticles, prepared as described above were suspended in 80 mL of water and Ti(isopropox)4 was added. Resulting product was stirred on Biosan OS-10 through whole night. Then microparticles were separated by external magnetic field, washed with MiliQ water and finally dried at 40 °C.

Coating of SPION nanoparticles



(Ionic)

Poly(N,N-dimethyl ethylamino acrylate)

Poly(imine)

Poly(acrylic acid)

(Steric)

Dextran

Poly(ethylene oxide)

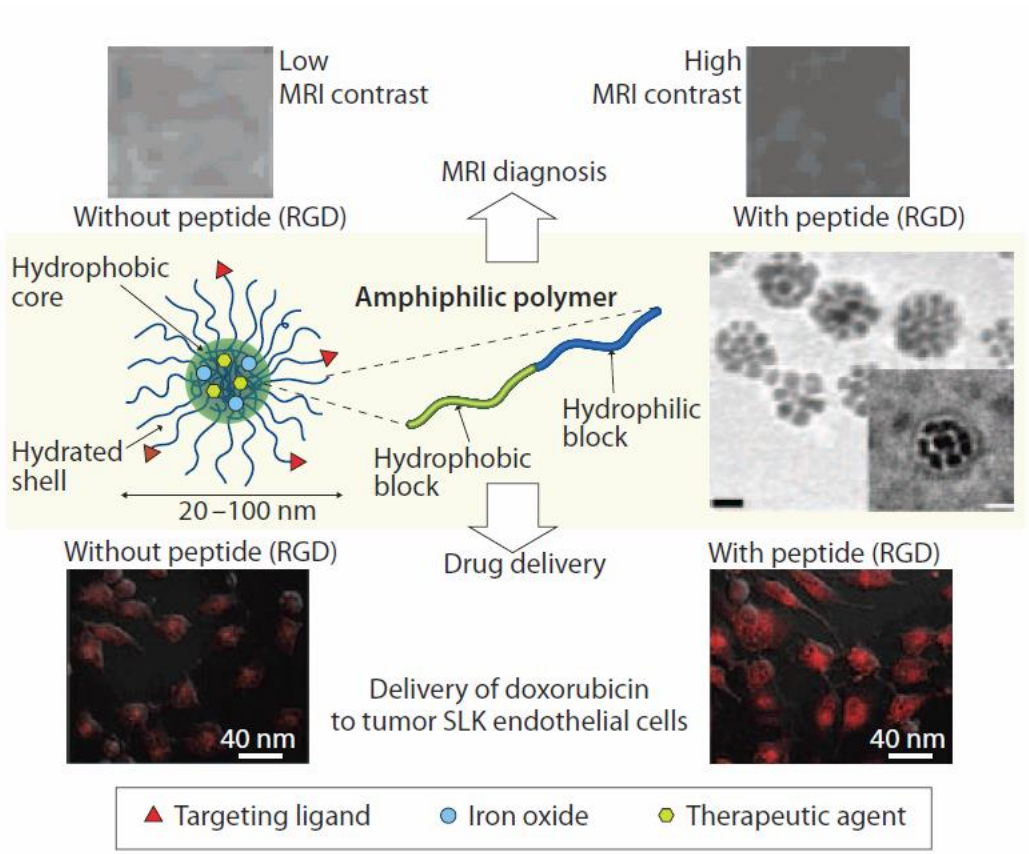
Poly(vinyl alcohol)

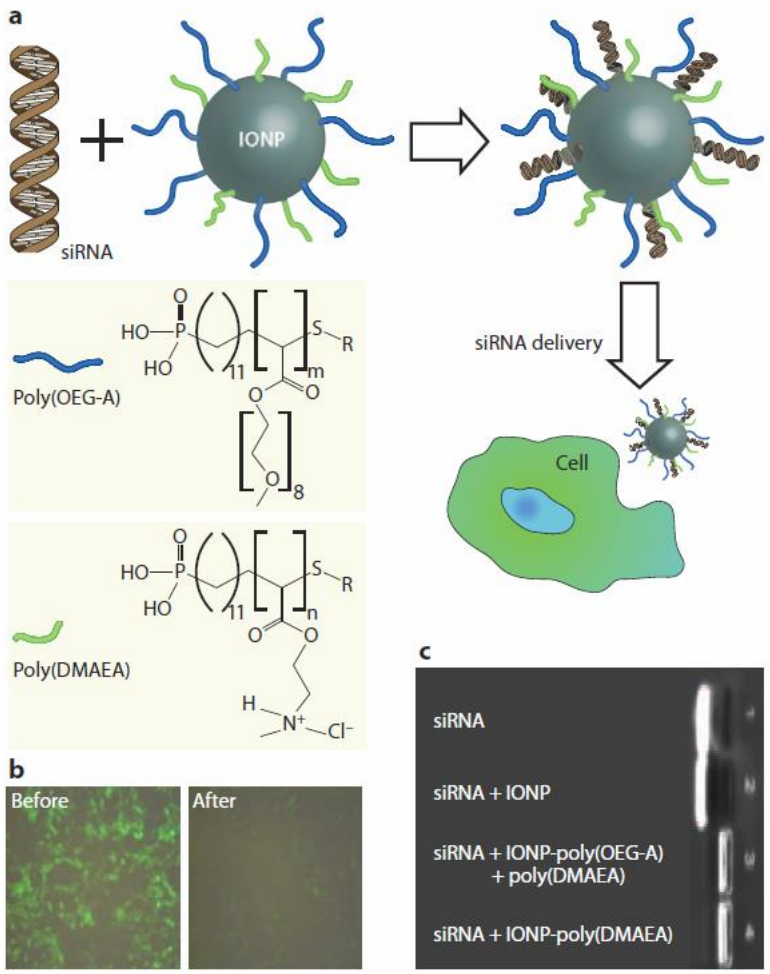
Poly(N-isopropylacrylamide)

Poly(vinylpyrrolidone)

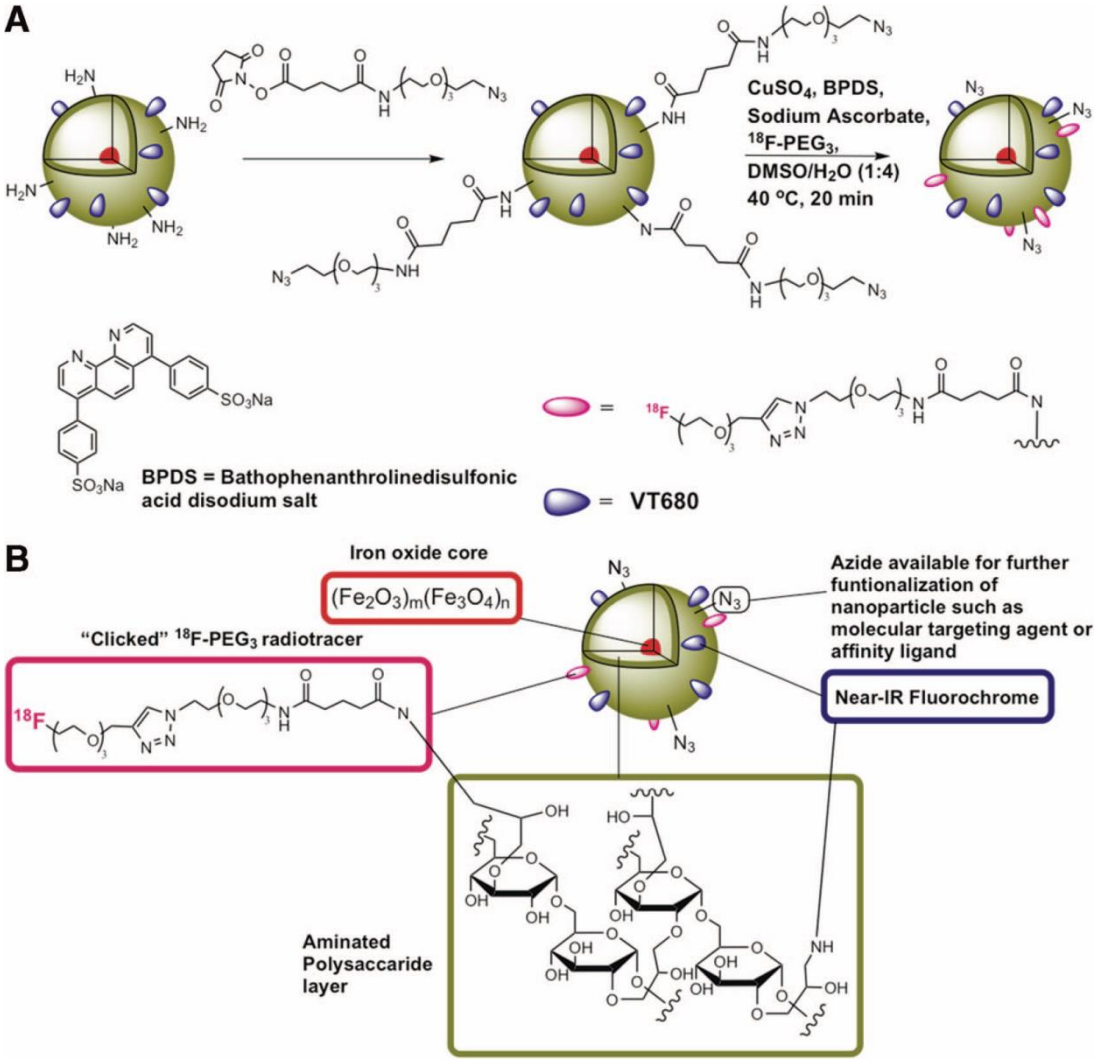
Poly(oligoethylene oxide)

Delivery of drugs and siRNA



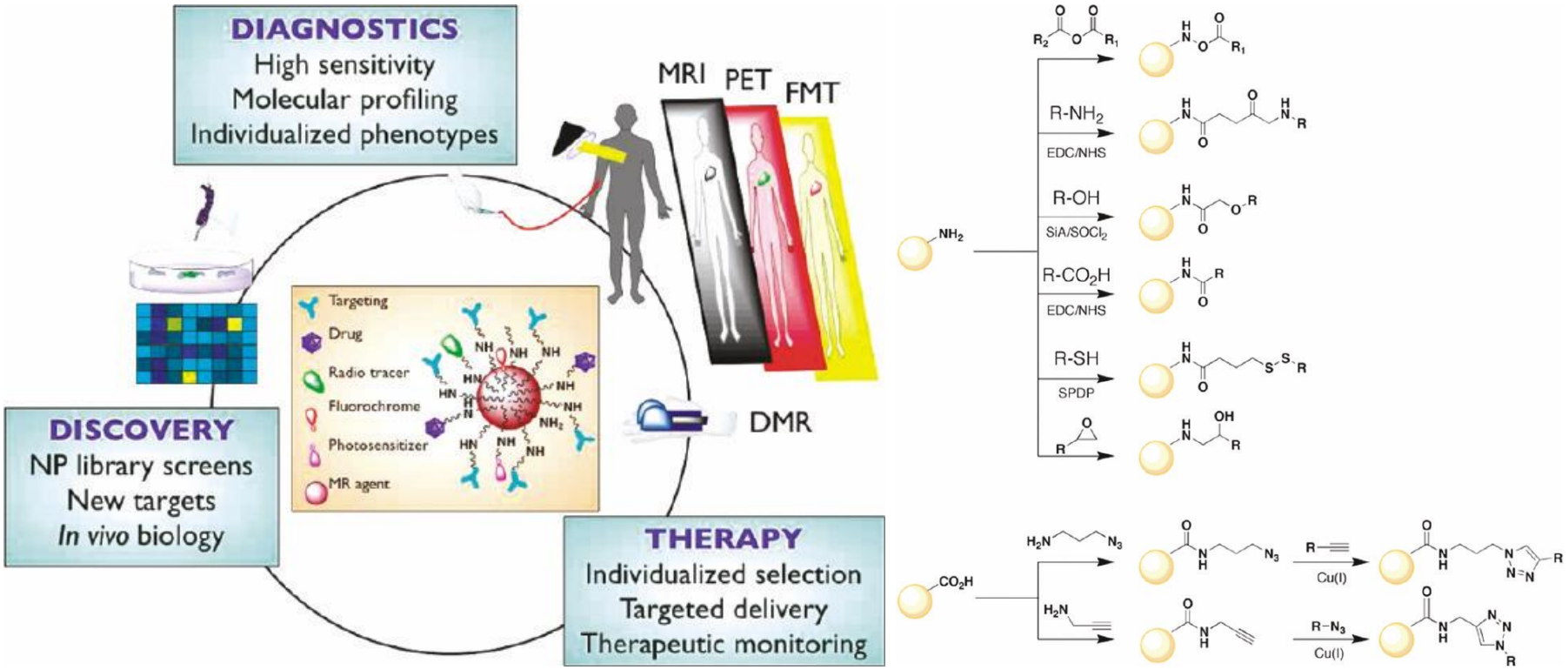


18F Labeled Nanoparticles for in Vivo PET-CT Imaging



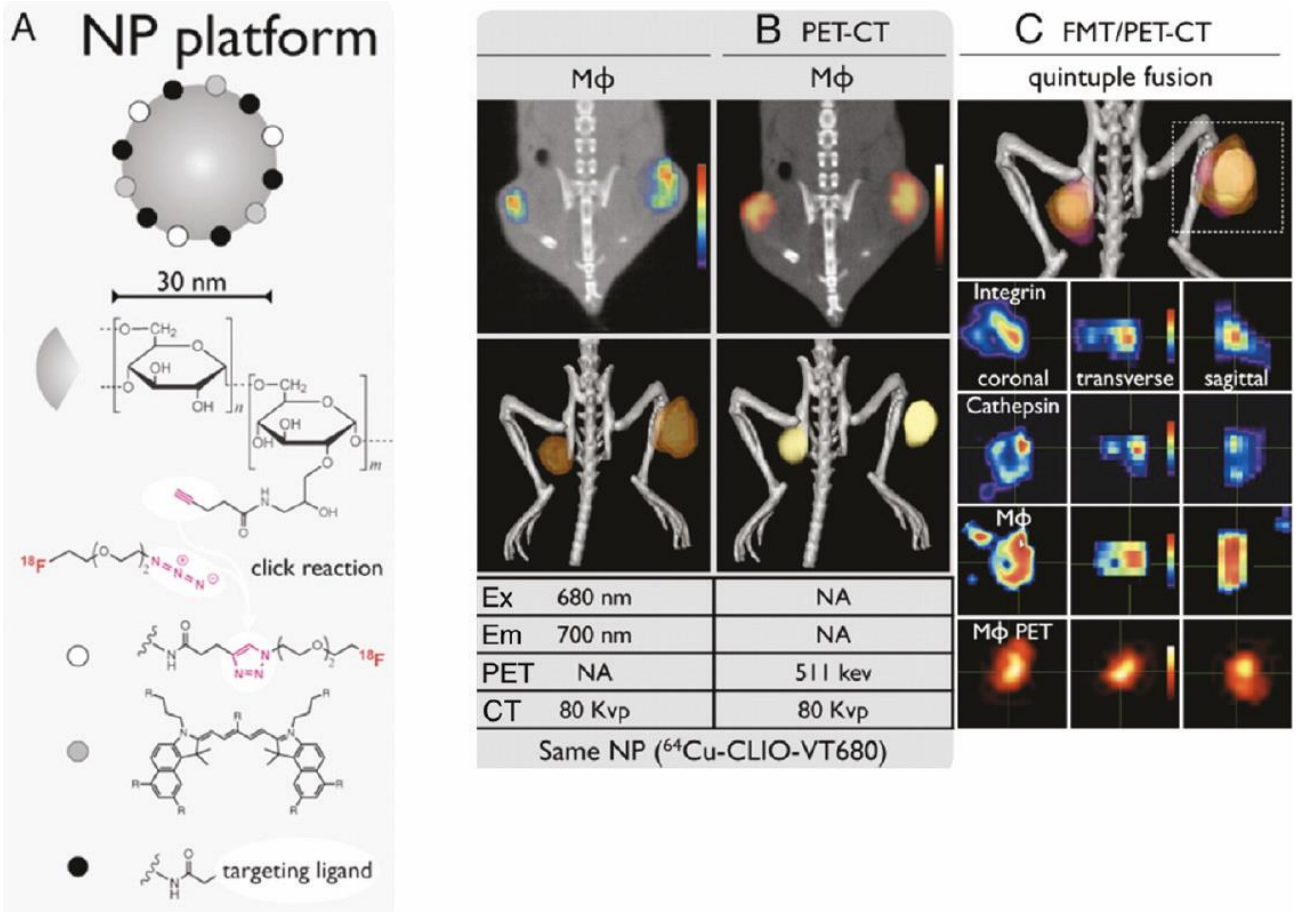
- Preparation of 18F-CLIO. (A) Derivatization of primary amines on CLIO-VT680 (near-infrared fluorochrome Vivotag-680 (VT680) with the NHS ester (N-Hydroxysuccinimide) of 1-azido-13-oxo-3,6,9-trioxa-12- azaheptadecan-17-oic acid followed by chemoselective "click" of 18F-PEG3 radiotracer. (B) Schematic of 18F-CLIO.
- Bioconjugate Chem. 2009, 20, 397–401

Dextran-Coated Iron Oxide Nanoparticles: A Versatile Platform for Targeted Molecular Imaging, Molecular Diagnostics, and Therapy



- Conjugation chemistries to attach small molecules to CLIO
- ACCOUNTS OF CHEMICAL RESEARCH ’ 842–852 ’ 2011 ’ Vol. 44, No. 10

Dextran-Coated Iron Oxide Nanoparticles: A Versatile Platform for Targeted Molecular Imaging, Molecular Diagnostics, and Therapy



- Multimodal PET imaging using nanoparticles. (A) Versatile conjugation capabilities of CLIO, e.g., to 18F using click chemistry, but also to peptides or other targeting ligands. (B, C) In vivo multichannel PET-CT (B) and FMT/PET-CT (C) of tumor-bearing mice, coinjected with fluorescent peptide against integrins, a fluorescent cathepsin sensor, and 64Cu-CLIO-VT680 (labeling macrophages).

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Acknowledgements

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Thank you for Your attention

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