

The background features several 3D molecular models of magnetic carriers. These models consist of a central core, often spherical or irregular, surrounded by a complex, porous network of interconnected fibers or strands. The models are rendered in shades of teal and grey, with some appearing as wireframes and others as more solid, textured surfaces. They are scattered across the top half of the slide, with a larger, more detailed model on the right side.

14TH INTERNATIONAL CONFERENCE ON THE
SCIENTIFIC AND CLINICAL APPLICATIONS
OF MAGNETIC CARRIERS

BARCELONA | SPAIN
JUNE 17-21, 2024

Short Review of the Last Two Years of Magnetic Carriers (2022-2024)

Urs Häfeli

This is Already the 28th Year of Our Meetings !



First Conference in Rostock 1996 of scientists, engineers, clinicians, start-ups, industry and students followed in:

Cleveland 1998, Rostock 2000, Tallahassee 2002, Lyon 2004, Krems 2006, Vancouver 2008, Rostock 2010, Minneapolis 2012, Dresden 2014, Vancouver 2016, Copenhagen 2018, London 2022

First Names – Please

Sie

vd

Vous

Du

YOU

First Names – Please



Just: You!

Thank You

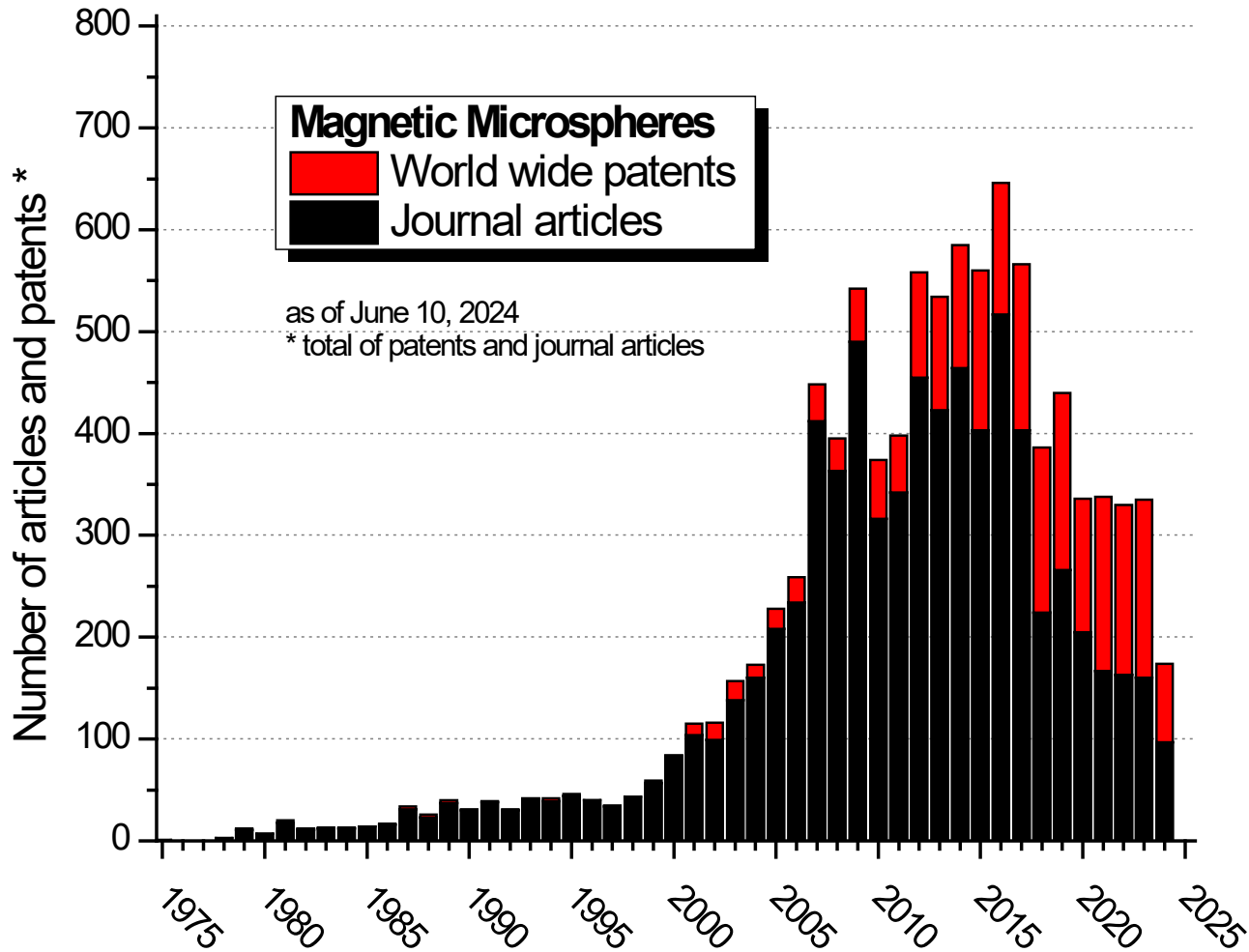


**Switch mobile
phone off or
to silent**



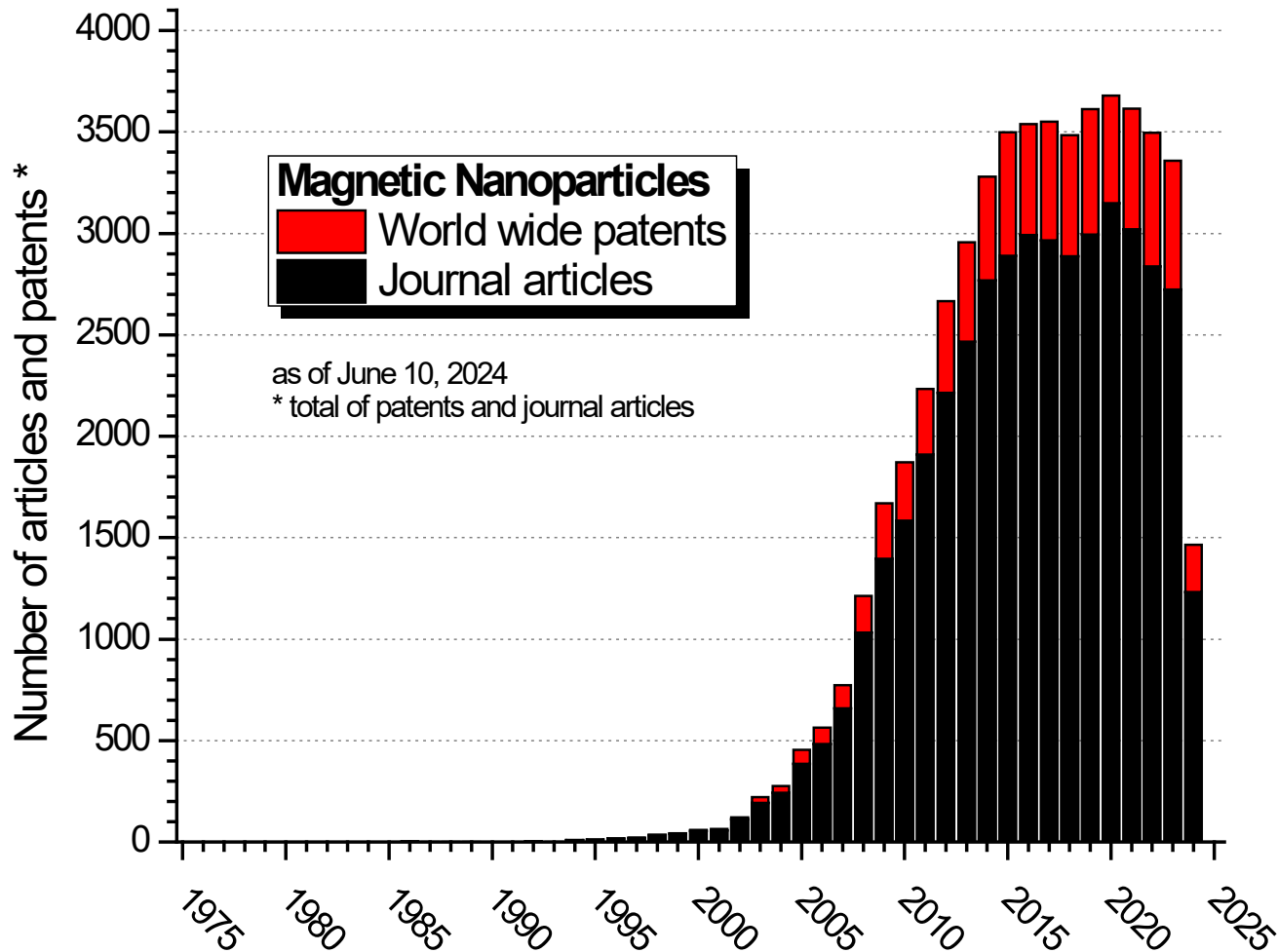
Journal Update:

Is Publishing about Magnetic Microspheres Still Trendy ?



Journal Update:

Publishing about Magnetic Nanoparticles, That's Trendy !



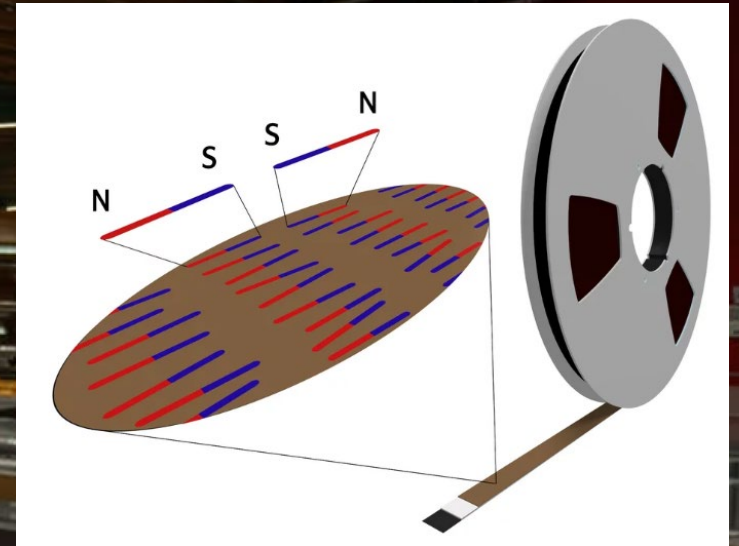
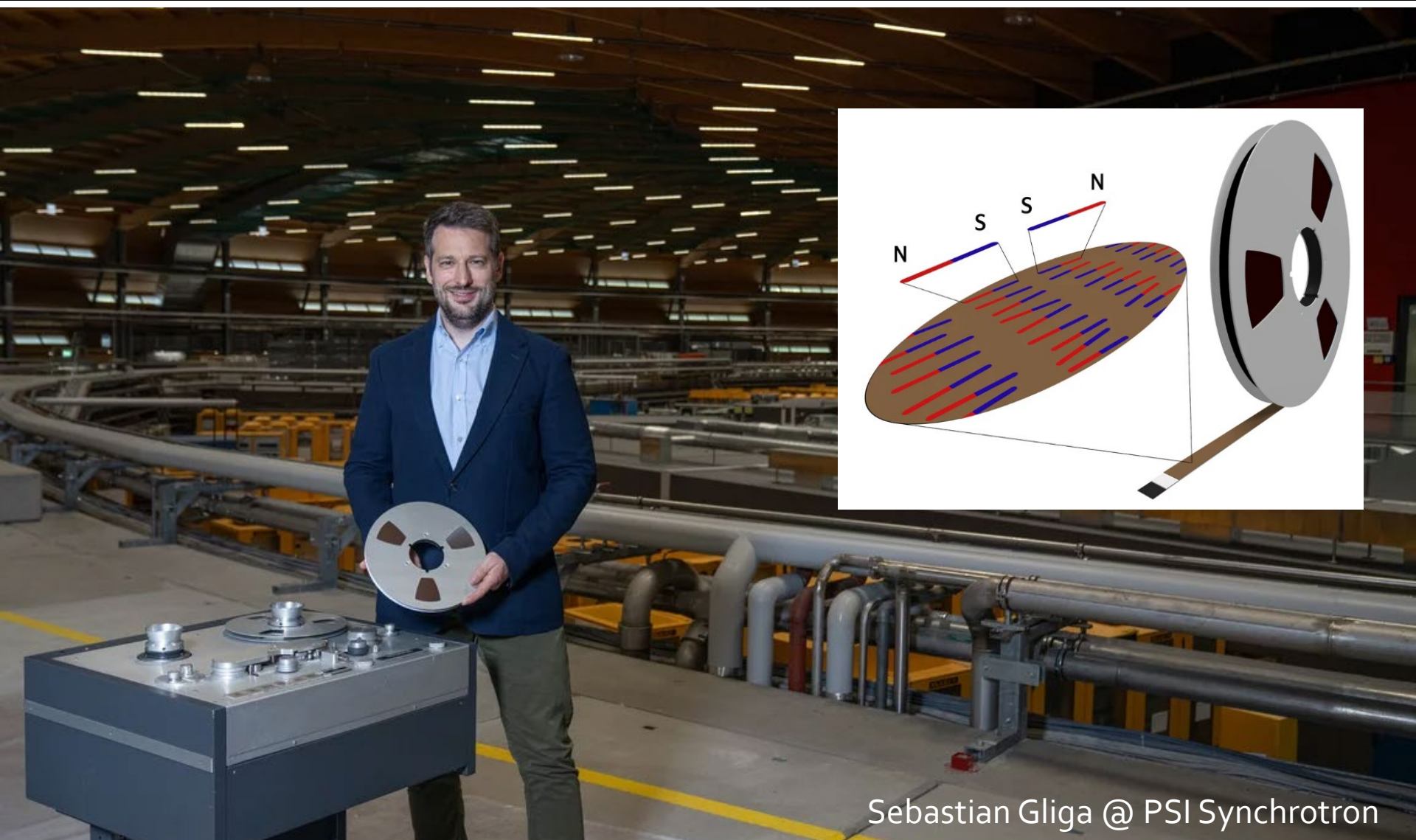
DISCLAIMER

- This presentation is rather incomplete, opinionated, one-sided, and might NOT mention your research
- But that's why you have to stay around for the next 4 days ...

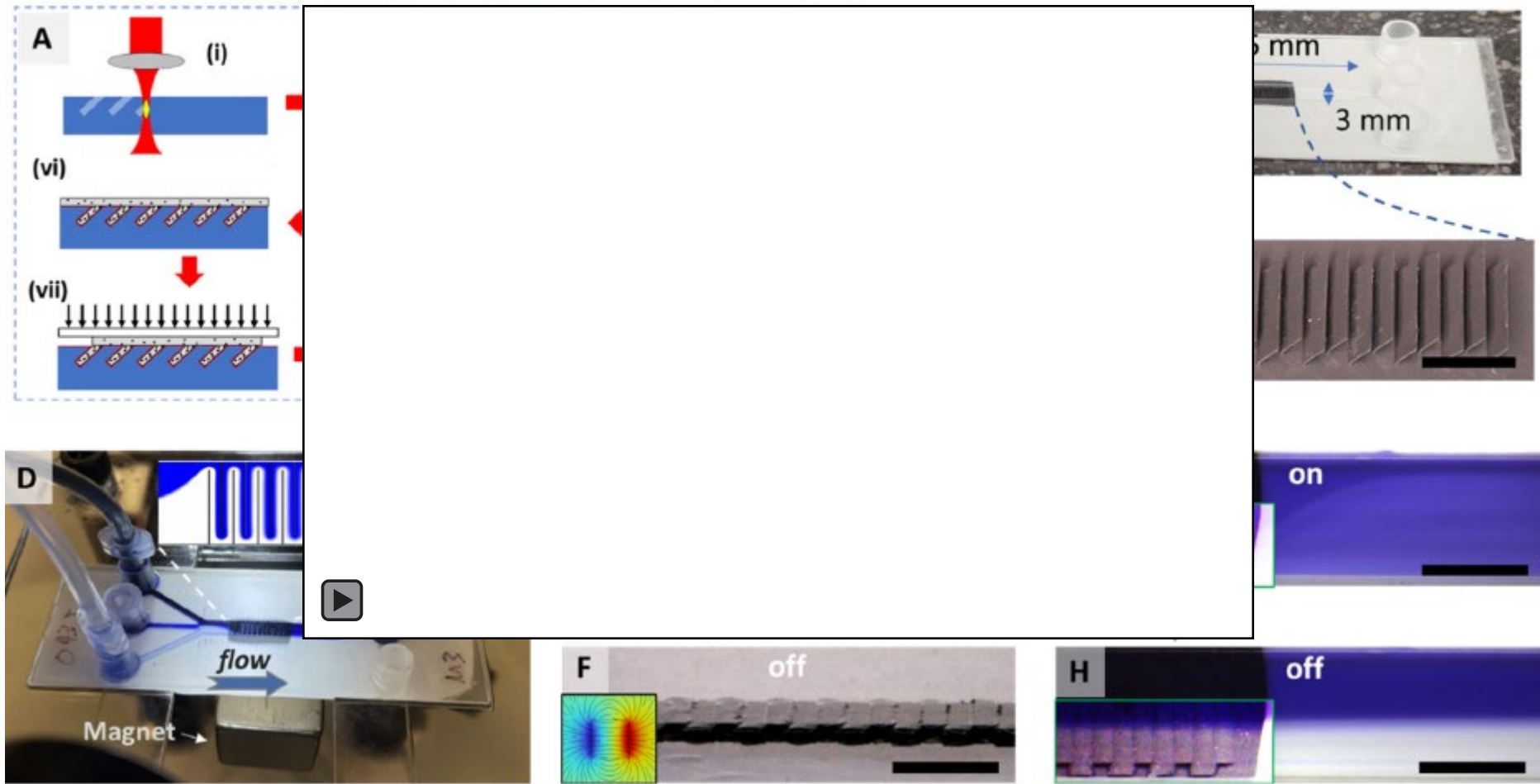


Technical Applications

Rescuing Music With X-Rays



On Demand Microfluidic Mixing

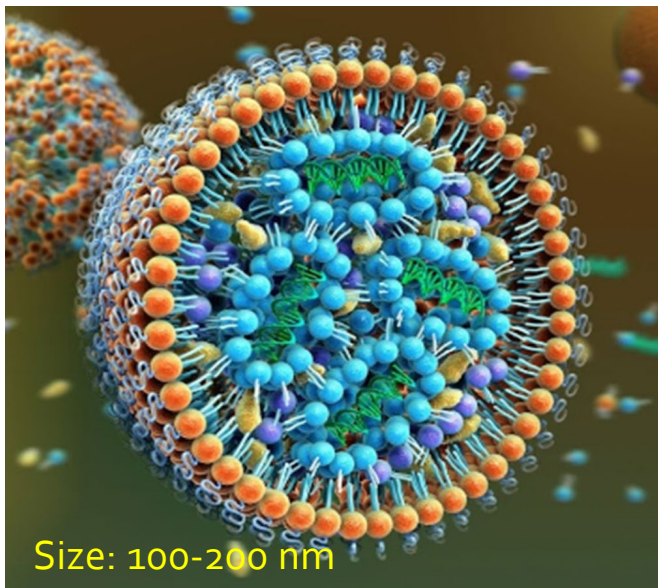


Synthesis

Still Needed in Nanomedicines: Magnetic Delivery of Lipid Nanoparticles

- Still needed
- Still a hot topic

But Vaccine Applications are Just the Tip of the Iceberg, LNP mRNA Technology Will Enable a Multitude of Gene Therapies



Infectious Diseases (Vaccines):

- COVID-19
- Universal influenza vaccine
- HIV
- Zika
- Malaria, etc

Chronic diseases

- Cancer
- Heart disease
- Alzheimer's, etc

Inherited diseases

- Sickle cell anemia
- Huntington's disease
- Cystic fibrosis, etc



Drew Weissman

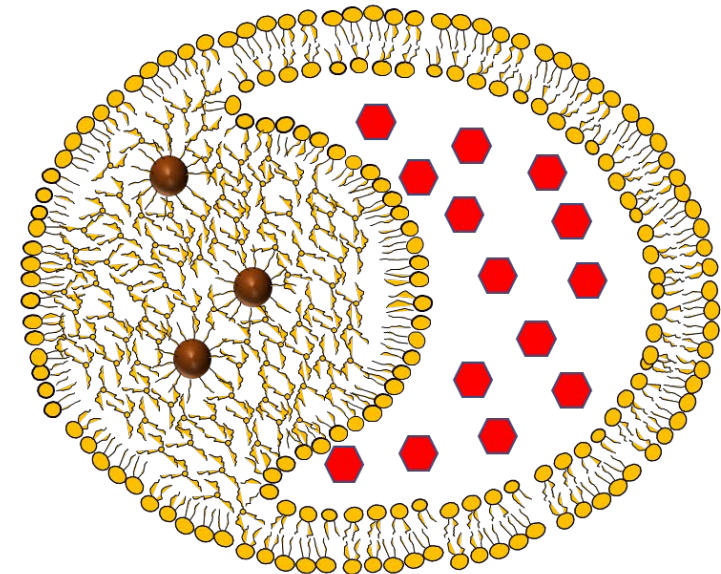
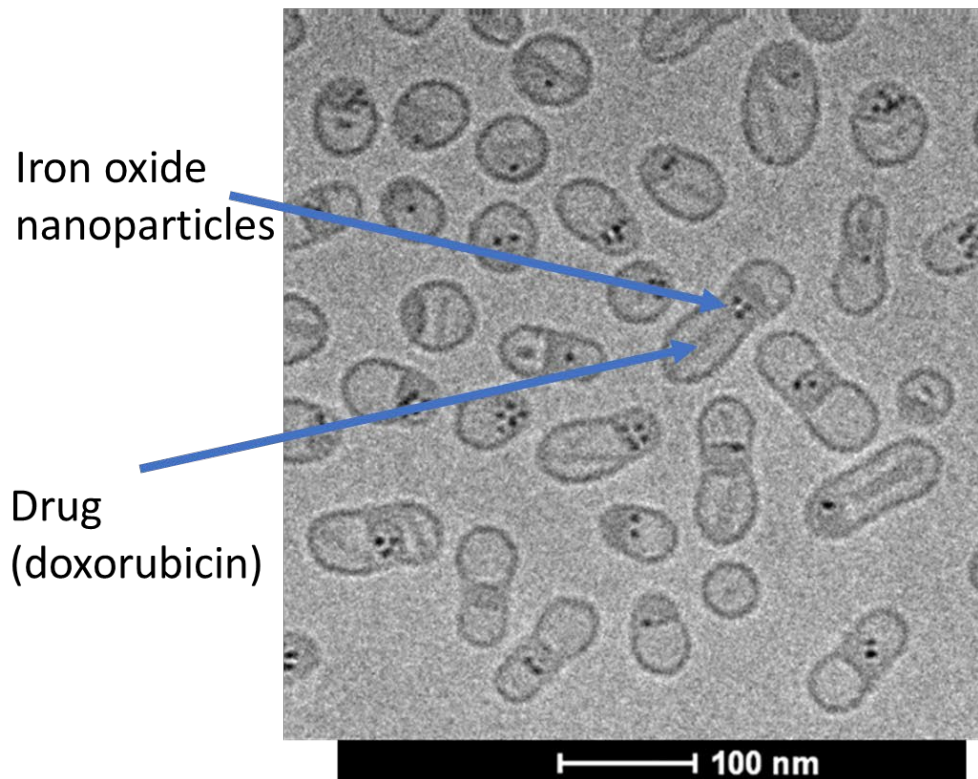


Katalin Karikó



First Approach of Magnetic LNPs

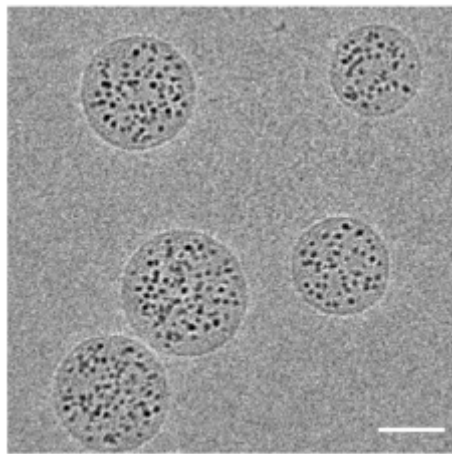
We Can Now Make Hybrid Liposomes Containing IONP Or GNP As Well As An Anticancer Drug



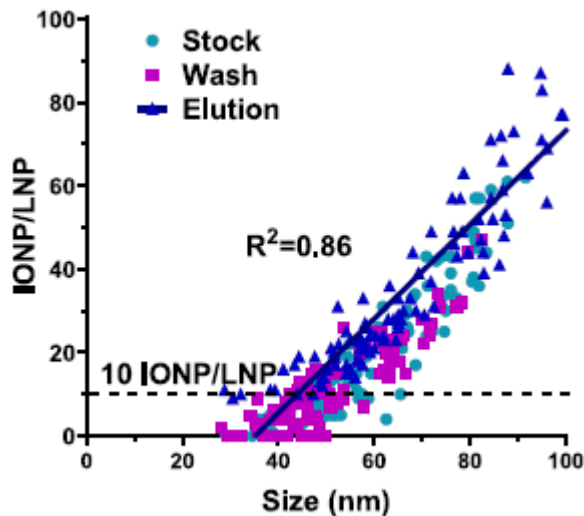
Haven't got them to explode yet...

Second Approach of Magnetic LNPs

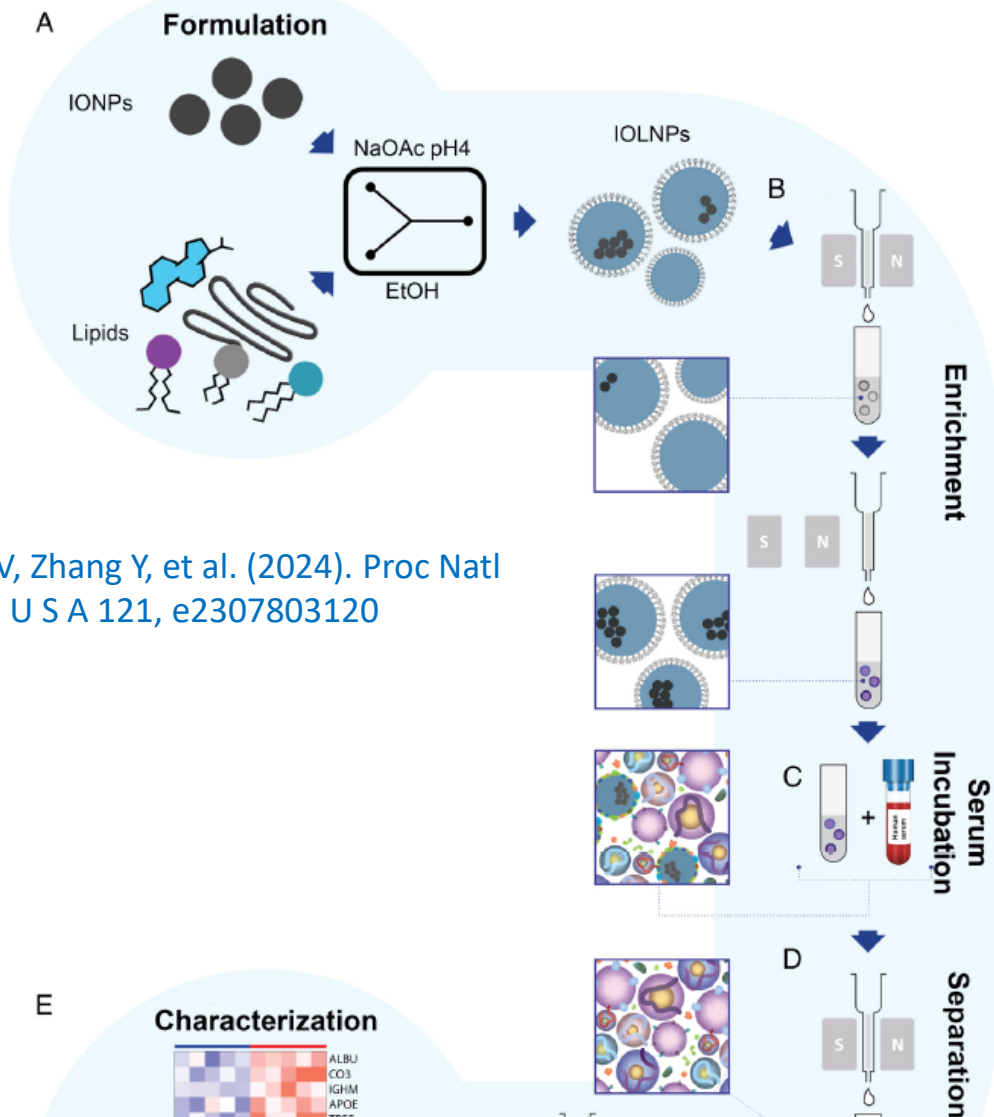
Magnetic Separation of Biomolecular Corona with LNPs



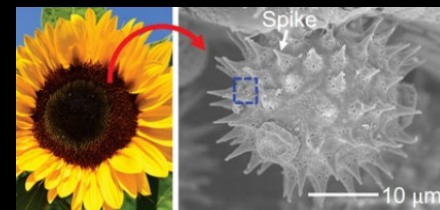
Elution



Francia V, Zhang Y, et al. (2024). Proc Natl Acad Sci U S A 121, e2307803120



Spiky Magnetic Microspheres



Mu Y et al. (2024) *Small*, 2402292

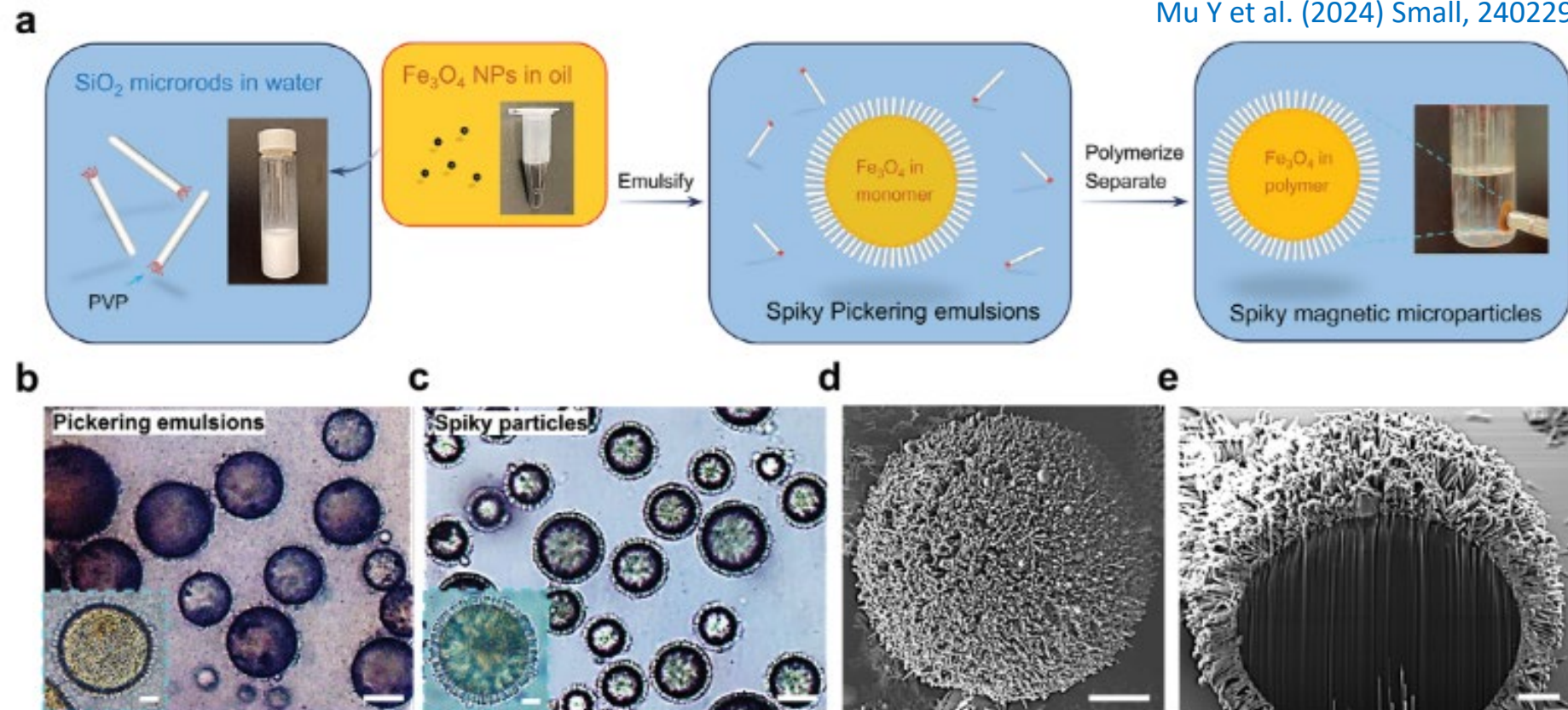
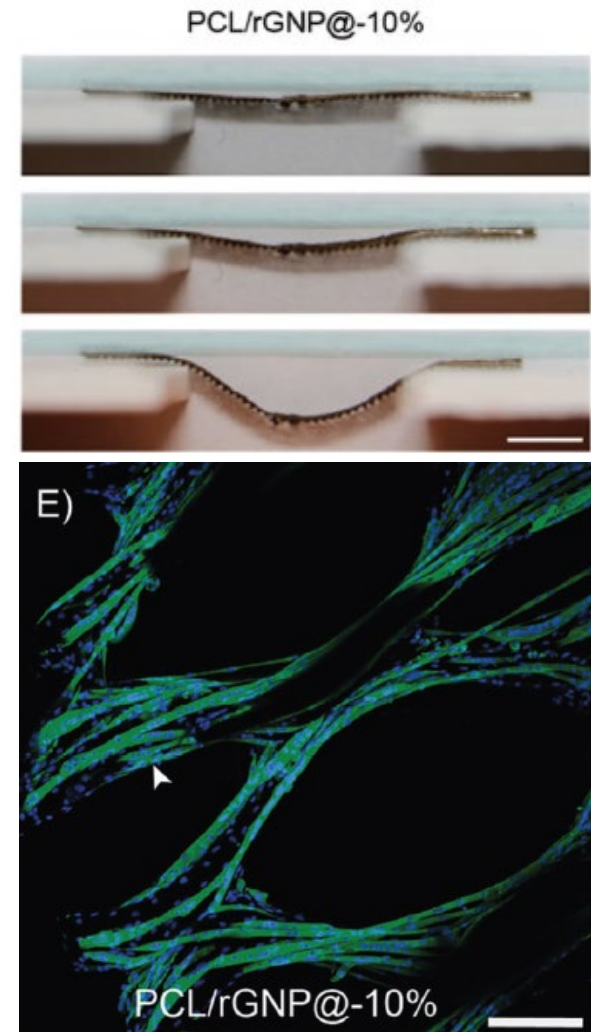
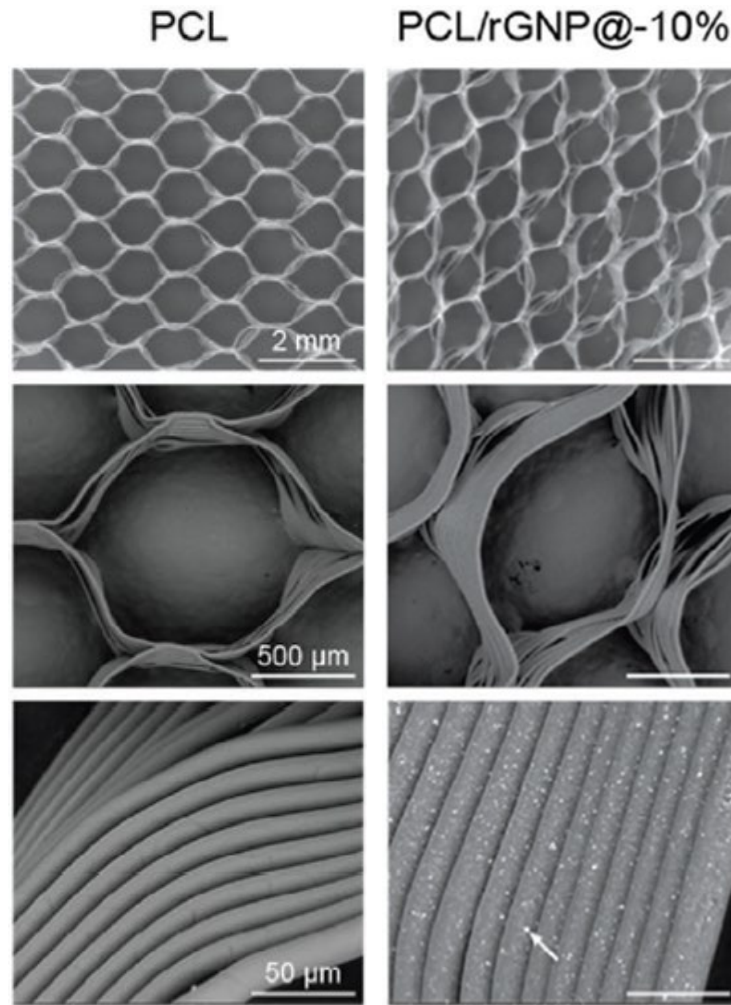
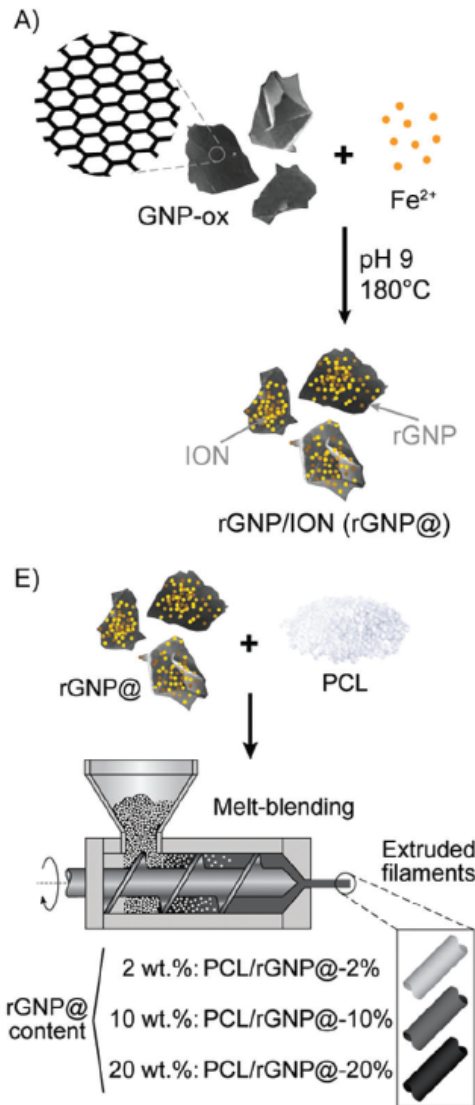


Figure 1. Synthesis and characterization of spiky magnetic microspheres. a) Schematic illustration shows that SiO₂ microrods with chemical residues (e.g., PVP) stabilize oil droplets to form spiky Pickering emulsion droplets, which are solidified by photopolymerization. b) Optical microscope image shows spiky Pickering emulsion droplets with SiO₂ microrods attached perpendicularly to the oil droplet surface. Scale bar, 20 μm. Inset showing a zoom-in image of a Pickering emulsion. Scale bar, 5 μm. c) Optical microscope image of polymerized spiky magnetic microparticles. Scale bar, 20 μm. Inset showing a zoom-in image of a spiky magnetic particle. Scale bar, 5 μm. d) Scanning electronic microscope (SEM) image of a spiky magnetic particle. Scale bar, 10 μm. e) Focused ion beam scanning electronic microscope (FIB-SEM) image shows the cross-section of a spiky magnetic particle. Scale bar, 5 μm.

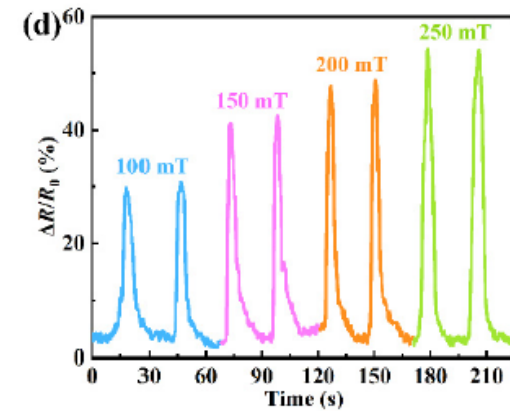
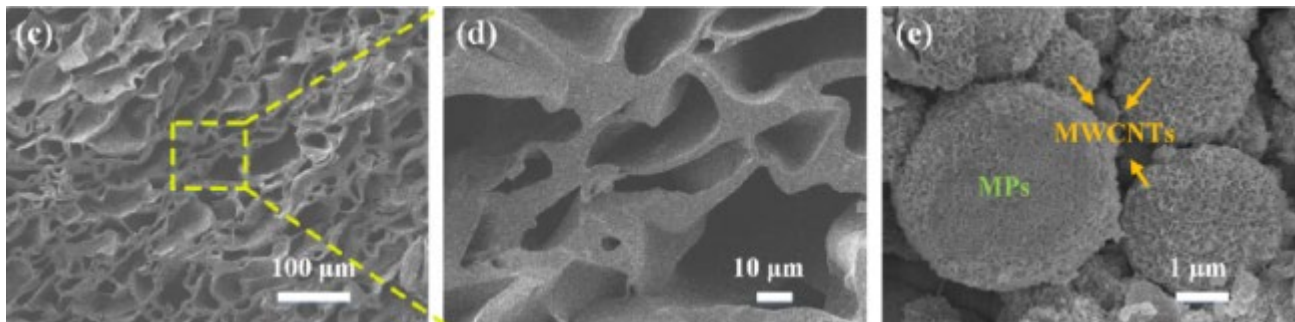
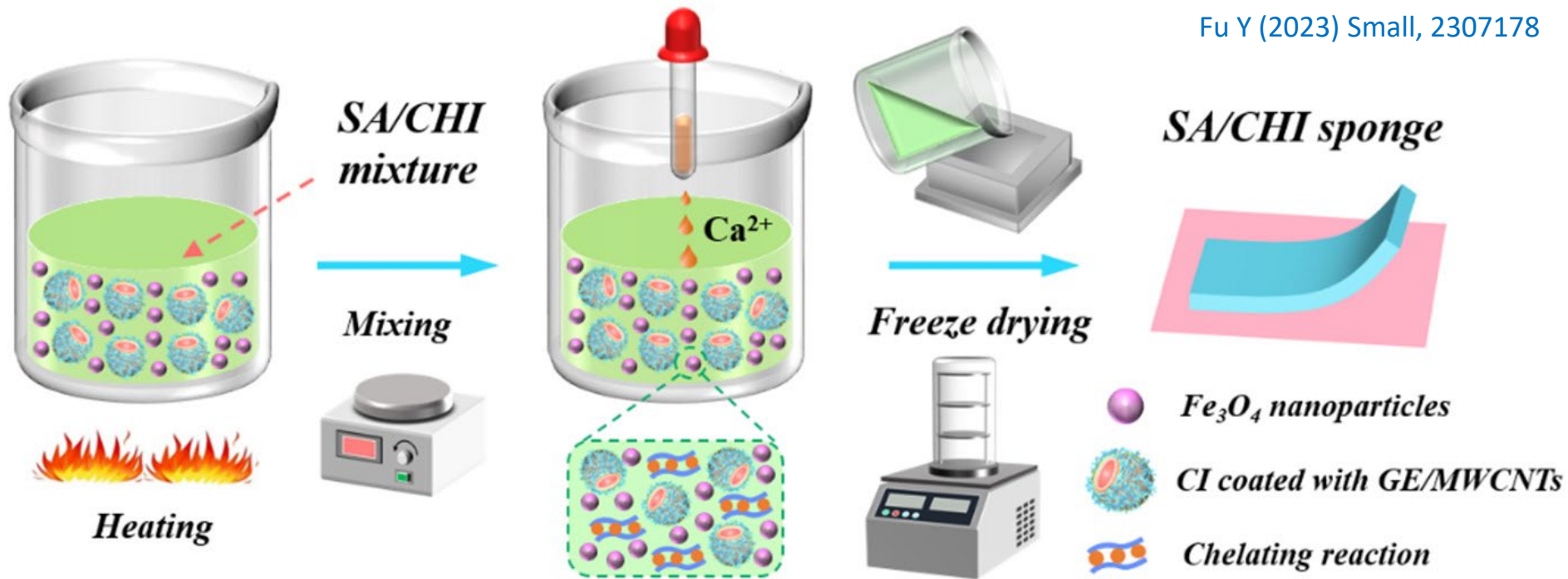
Preparation of Artificial Muscles That Can Be Activated Magnetically



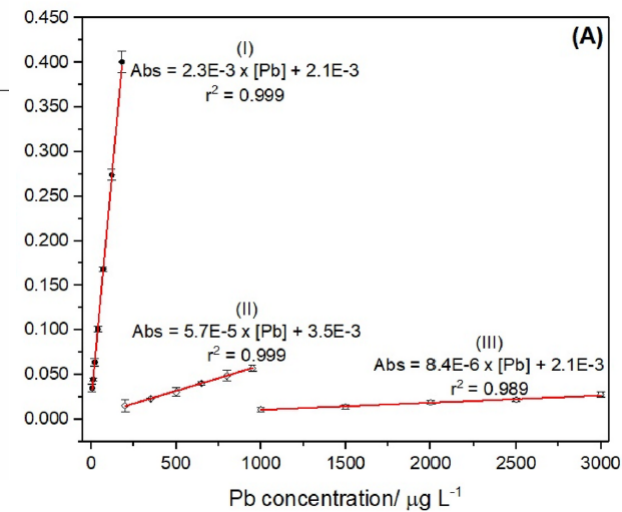
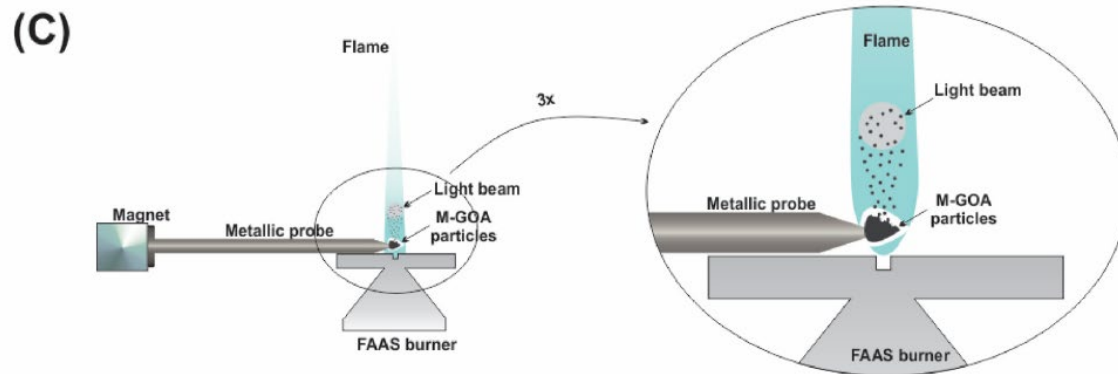
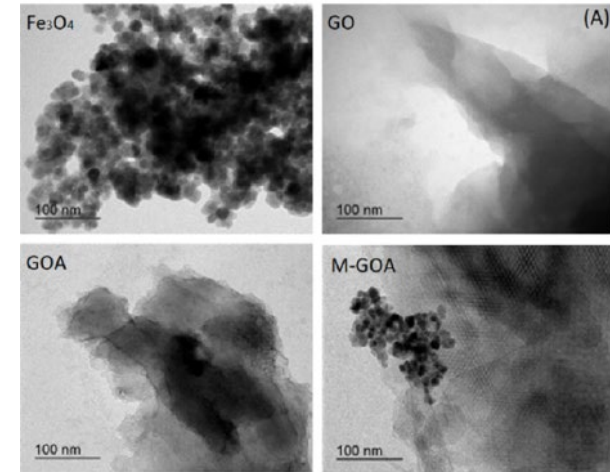
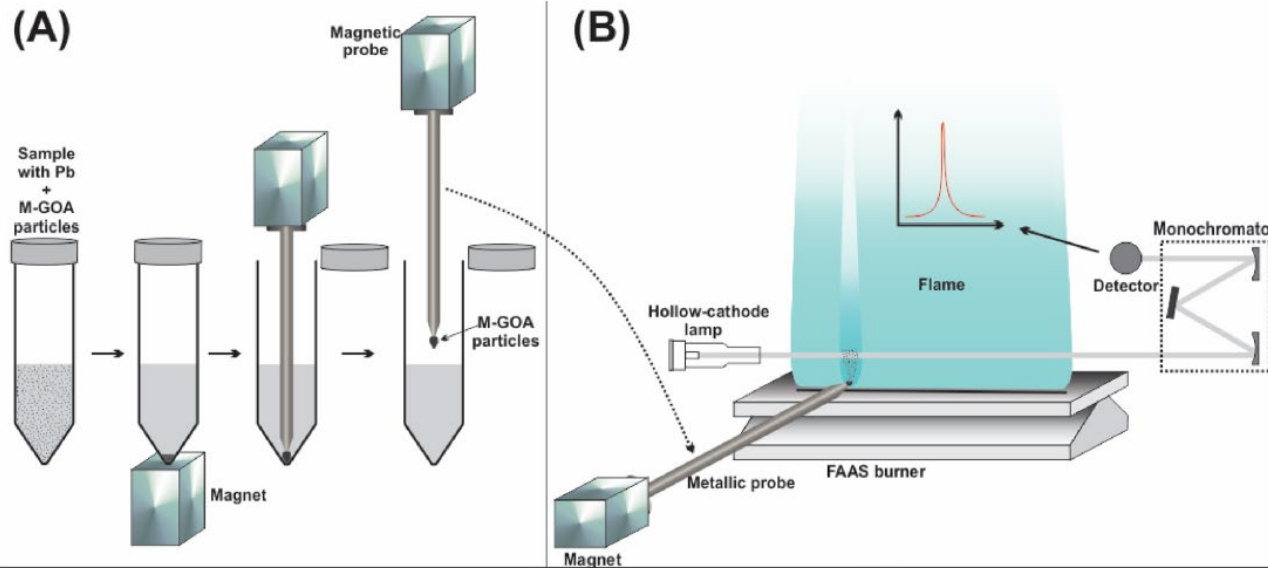
Assays and Diagnostics

Polymeric Magnetic Sponge as Strain and Magnetic Field Sensor

Fu Y (2023) Small, 2307178



Direct Magnetic Sorbent Sampling (DMSS) for Flame Atomic Absorption Spectroscopy (FAAS)



Analysis of Environmental Pollution

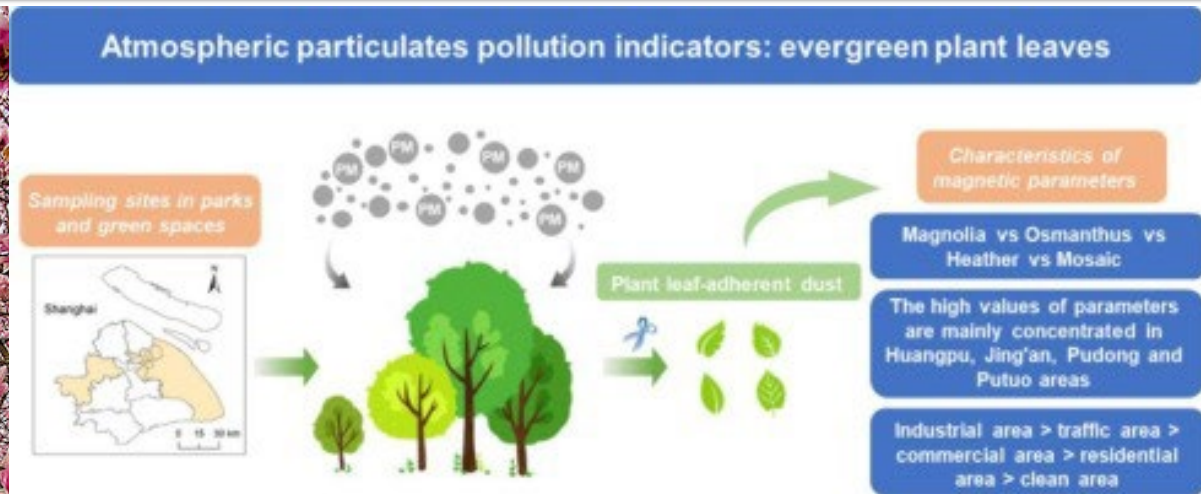
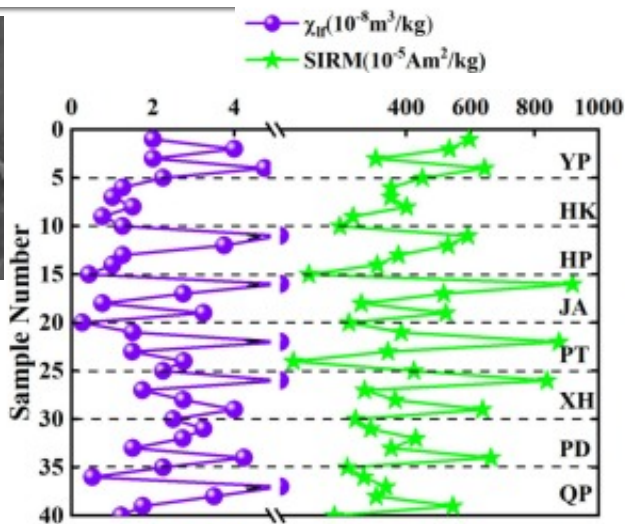
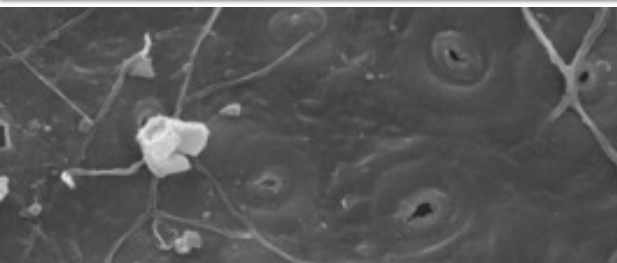


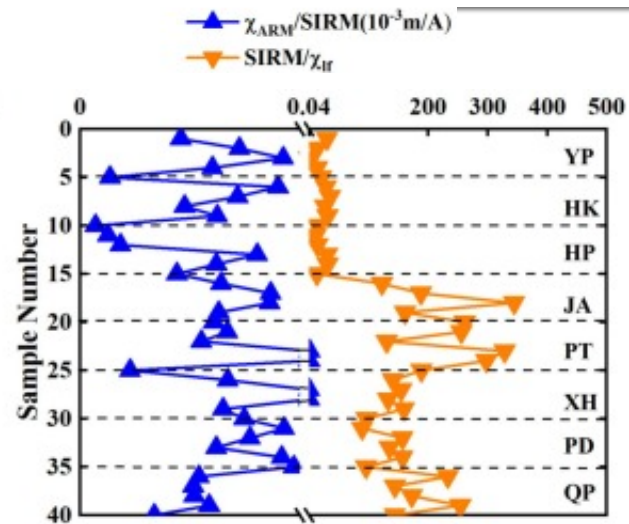
Table 1. Statistics of magnetic parameters of plant leaf-adherent PM.

	Range	Mean	Median	SD
plant leaves PM				
χ_{lf} ($10^{-8}m^3kg^{-1}$)	0.250–18.879	2.600	2.311	1.626
χ_{ARM} ($10^{-8}m^3kg^{-1}$)	1.538–45.573	9.773	9.326	4.923
SIRM ($10^{-5}Am^2kg^{-1}$)	1.939–1059.724	405.816	386.44	174.772
HIRM ($10^{-5}Am^2kg^{-1}$)	0.028–112.750	7.588	3.197	17.190
S-ratio	0.778–0.955	0.895	0.878	0.100
χ_{ARM}/χ_{lf}	0.489–45.430	5.628	4.284	3.935
$\chi_{ARM}/SIRM$ ($10^{-3}mA^{-1}$)	0.002–5.221	0.122	0.023	0.586
$SIRM/\chi_{lf}$ (kAm^{-1})	0.152–861.621	121.215	111.568	110.652

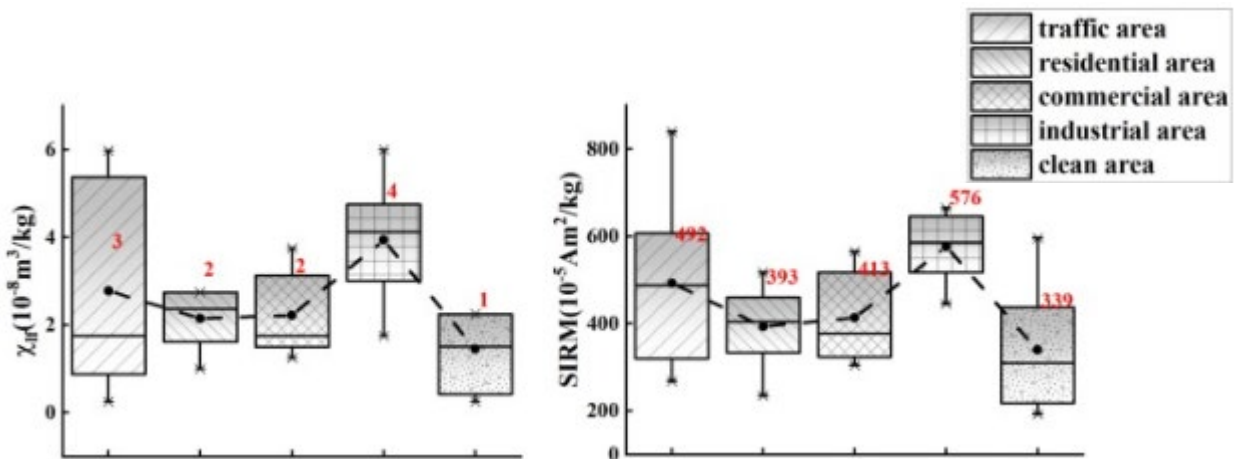
Analysis of Environmental Pollution



(B₁) *M. grandiflora*

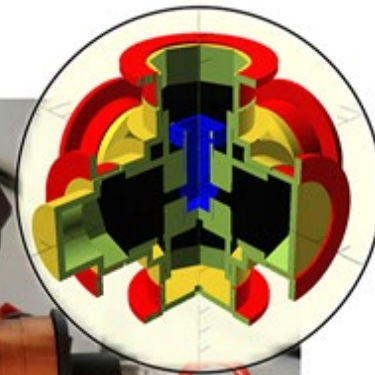
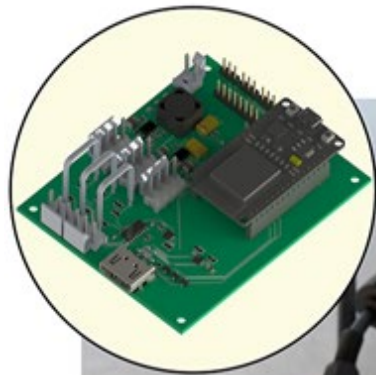


(B₂) *M. grandiflora*

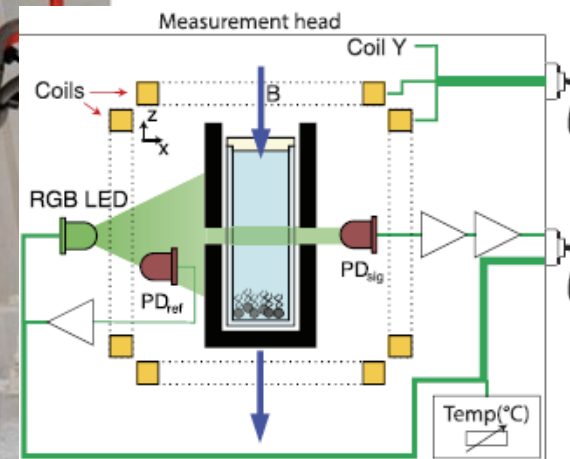
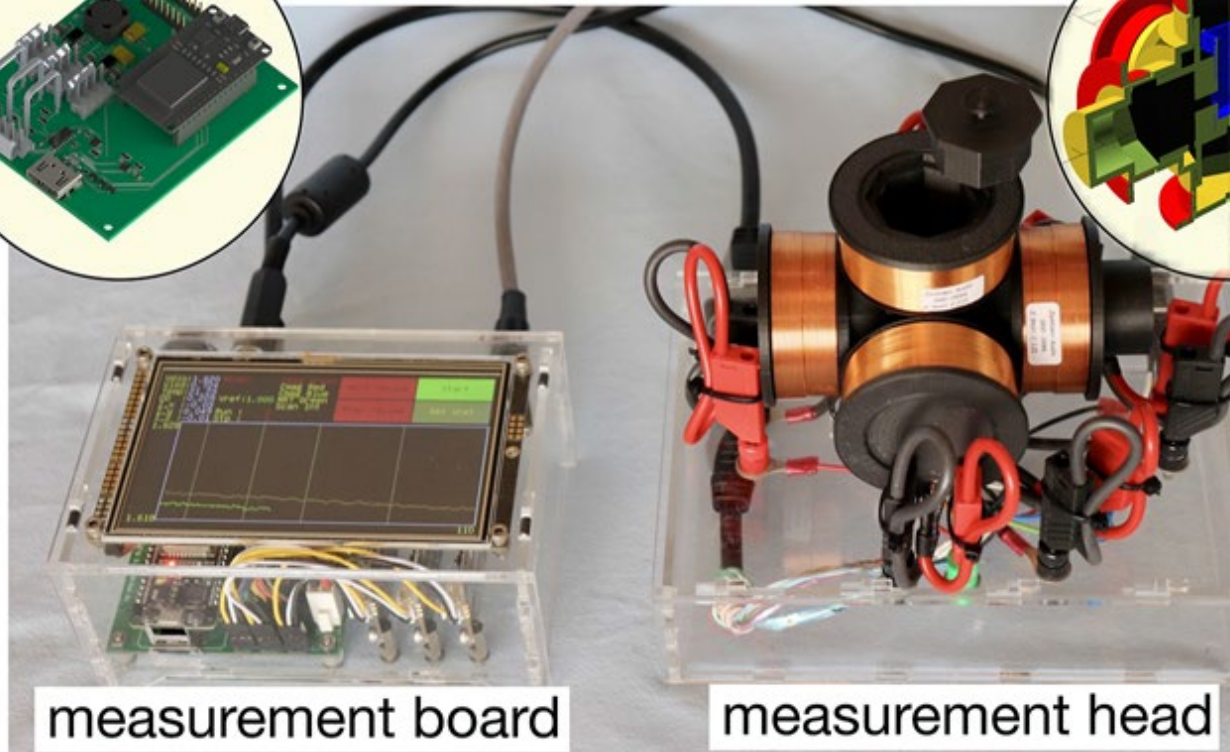


Automated Magnetic Optical Density Meter

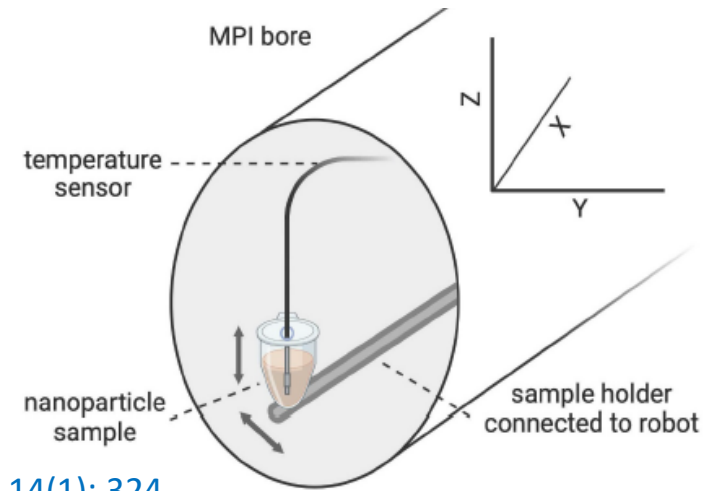
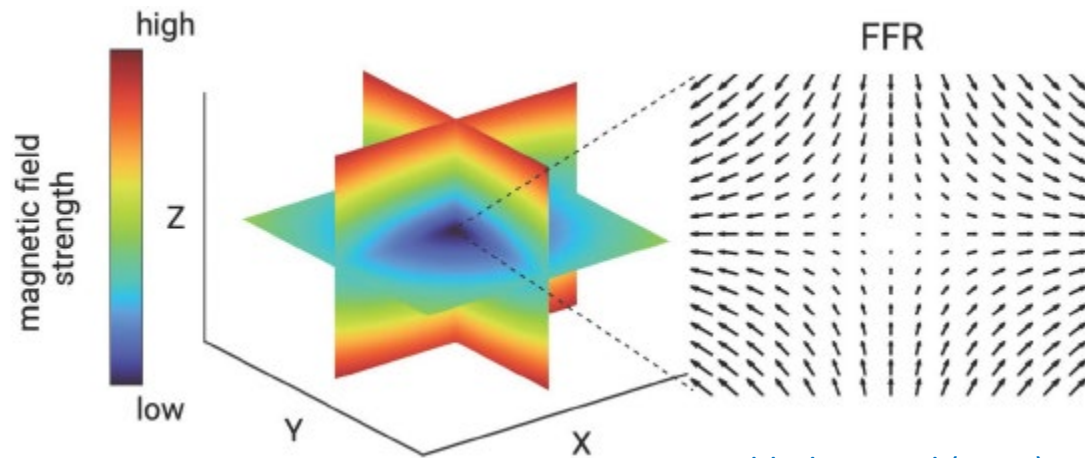
- An open-source automated magnetic optical density meter for analysis of suspensions of magnetic cells and particles



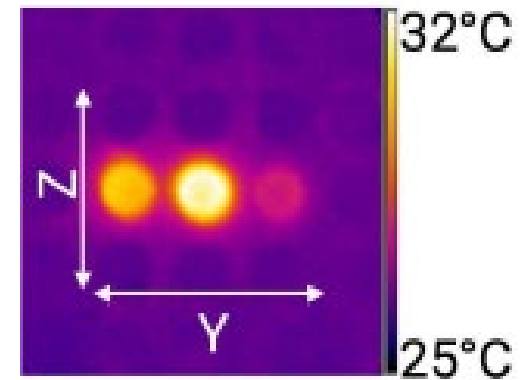
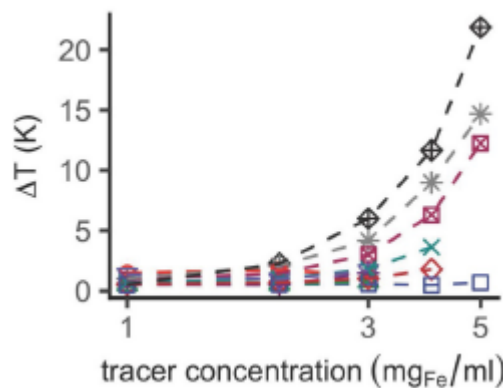
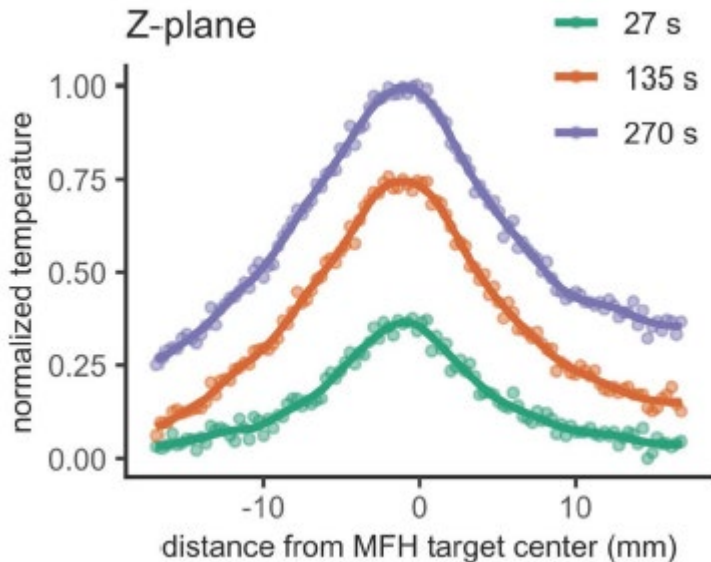
Welleweerd MK (2022)
Rev. Sci. Instrum. 93,
094101 (2022);
doi: 10.1063/5.0098008



Theranostic Platform for MFH, MPI and Thermometry



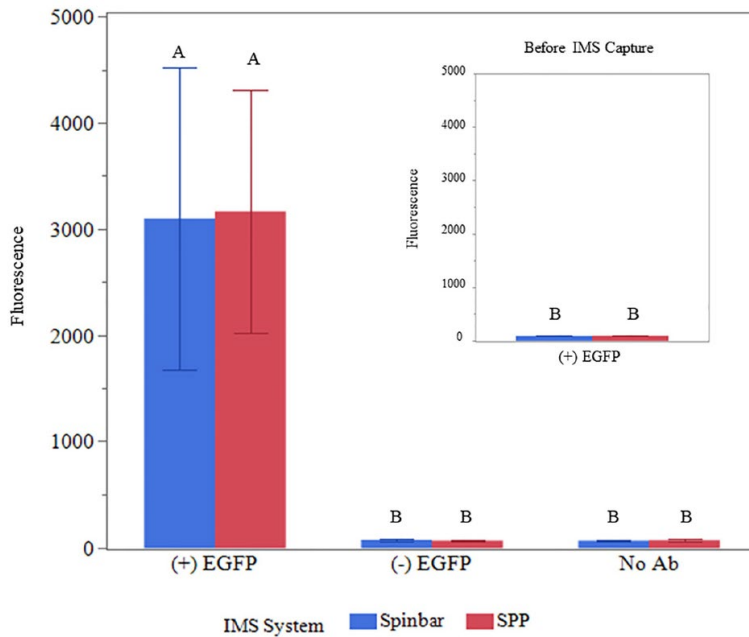
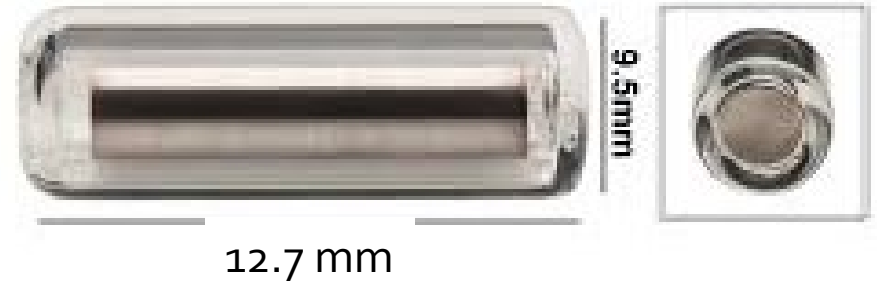
Buchholz O et al (2024) 2024; 14(1): 324



- A good review where we are
- Now we need to get this into *in vivo*

Magnetic Separation of Large Volumes with a Special Spin Bar

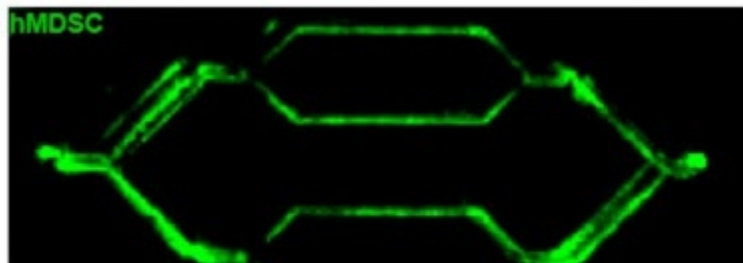
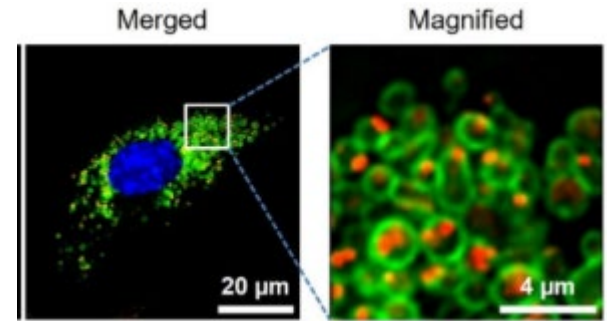
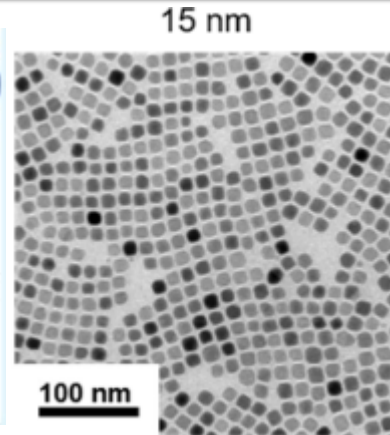
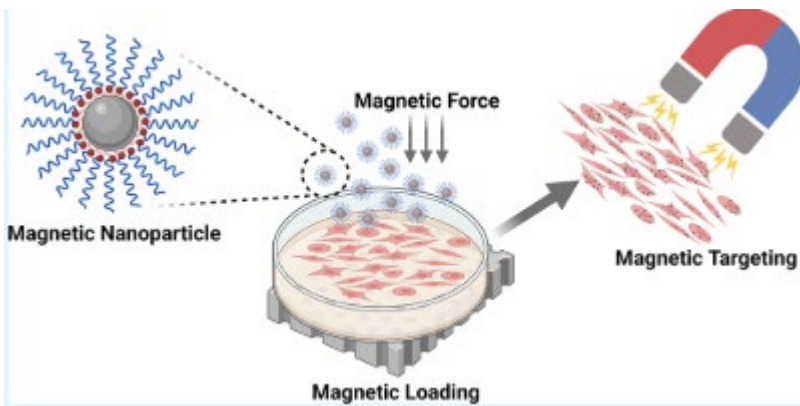
- Coat surface of bar with antibodies
- Comparison to Dynabeads M280 coated with the same antibodies



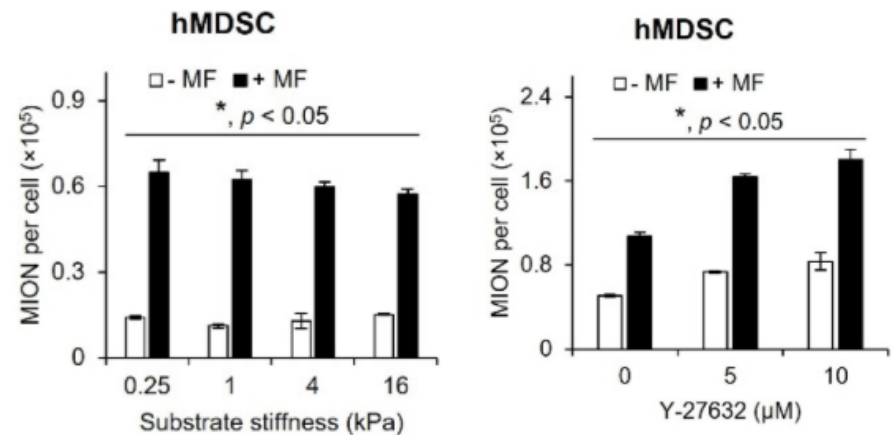
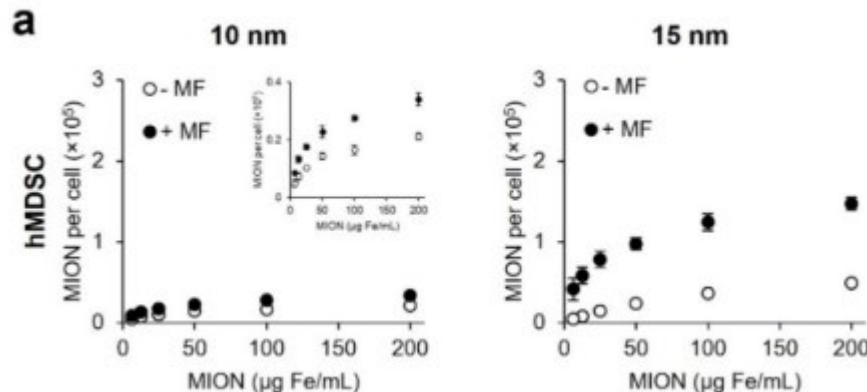
Biological Applications

Rearing Stem Cells Magnetic for Therapy

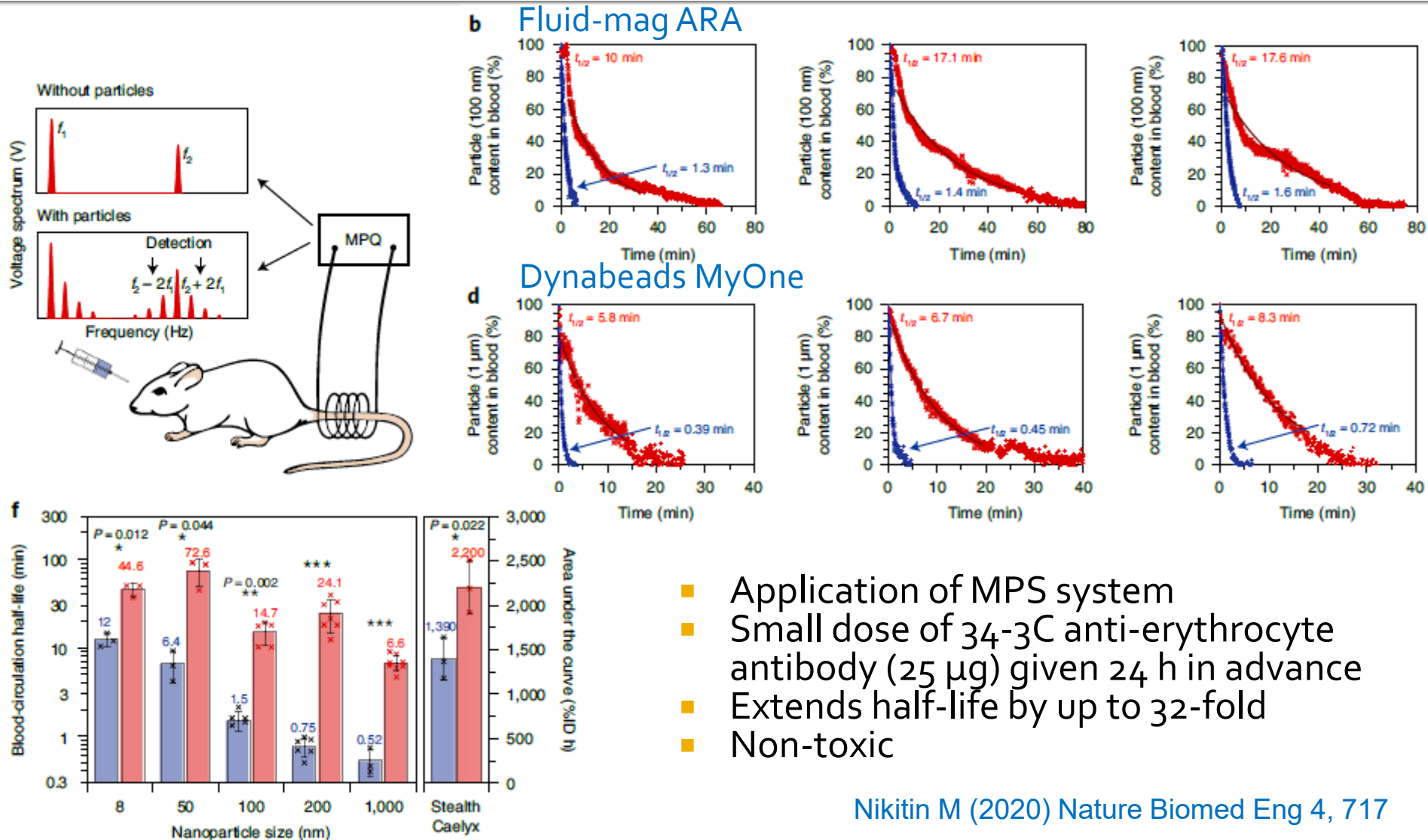
Zhang et al (2023) ACS Appl. Mater. Interfaces, <https://doi.org/10.1021/acsami.2c20265>



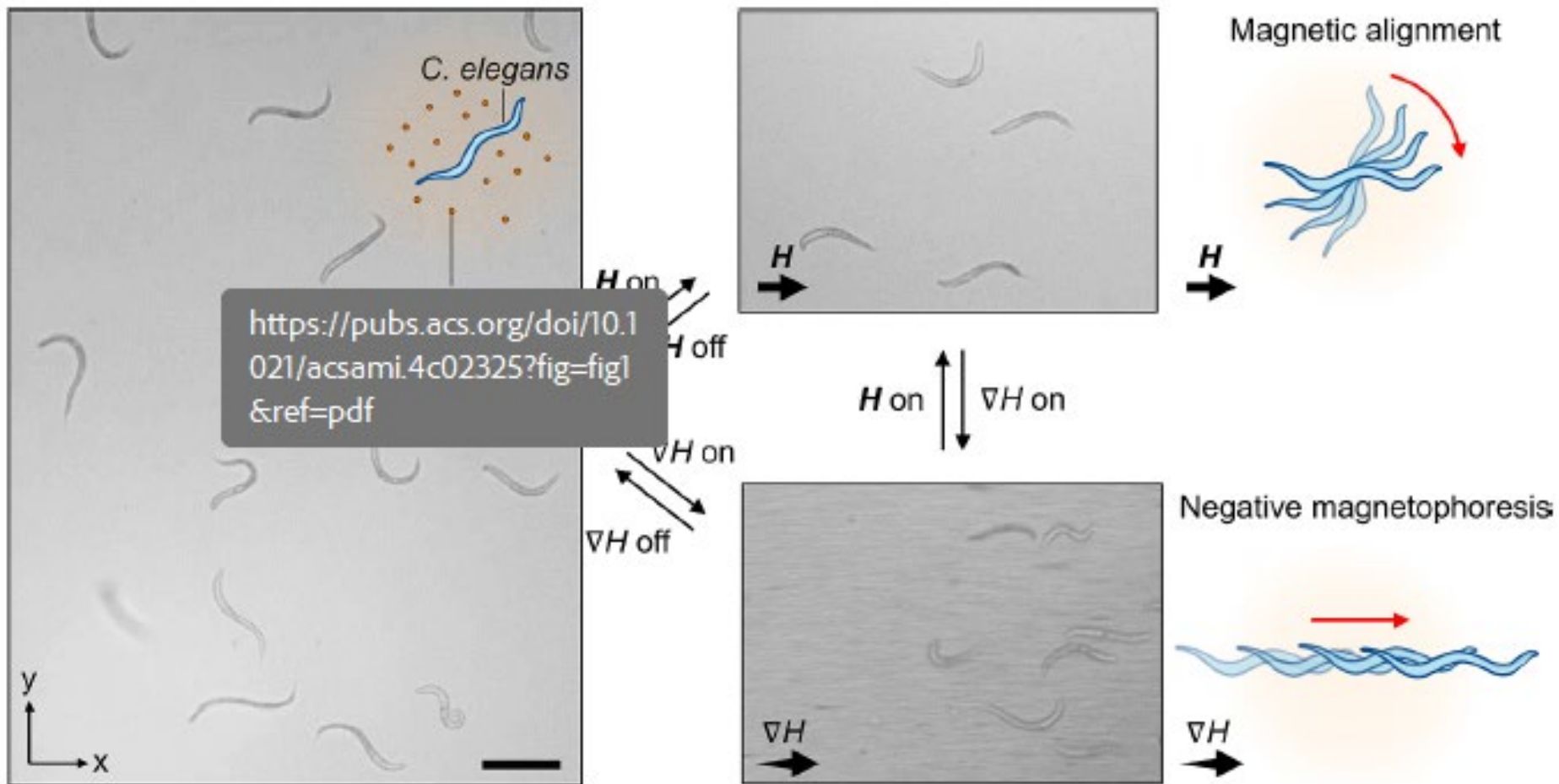
- Cell membrane tension is a critical factor in regulating the endocytic pathways



Extending the Biological Half-Life of Magnetic Particles



Magnetic Control of Nonmagnetic Living Organisms

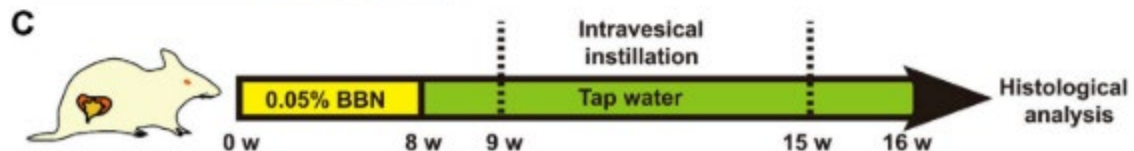
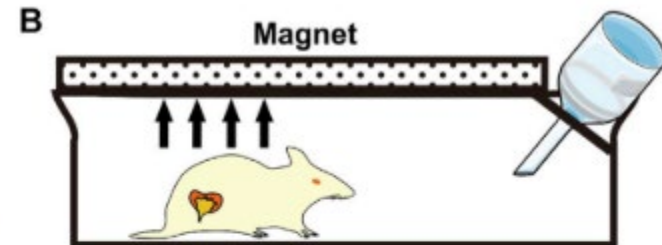
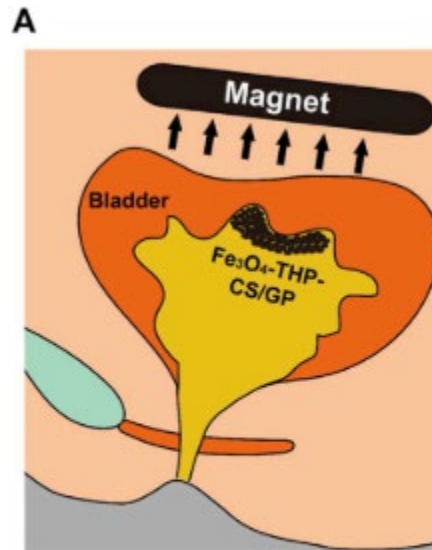
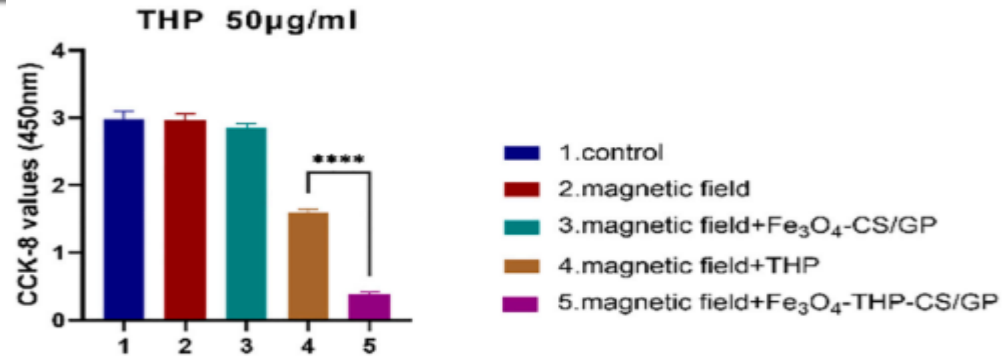
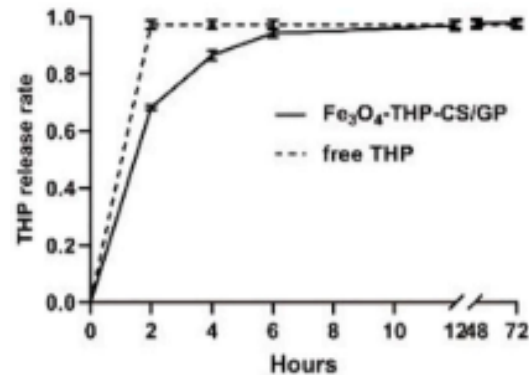
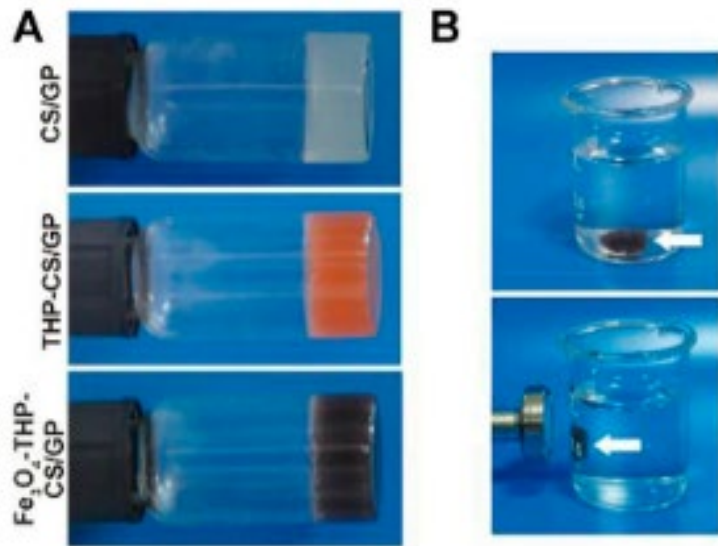


Al Harraq et al (2024) ACS Appl. Mater. Interfaces;
<https://doi.org/10.1021/acsami.4c02325>

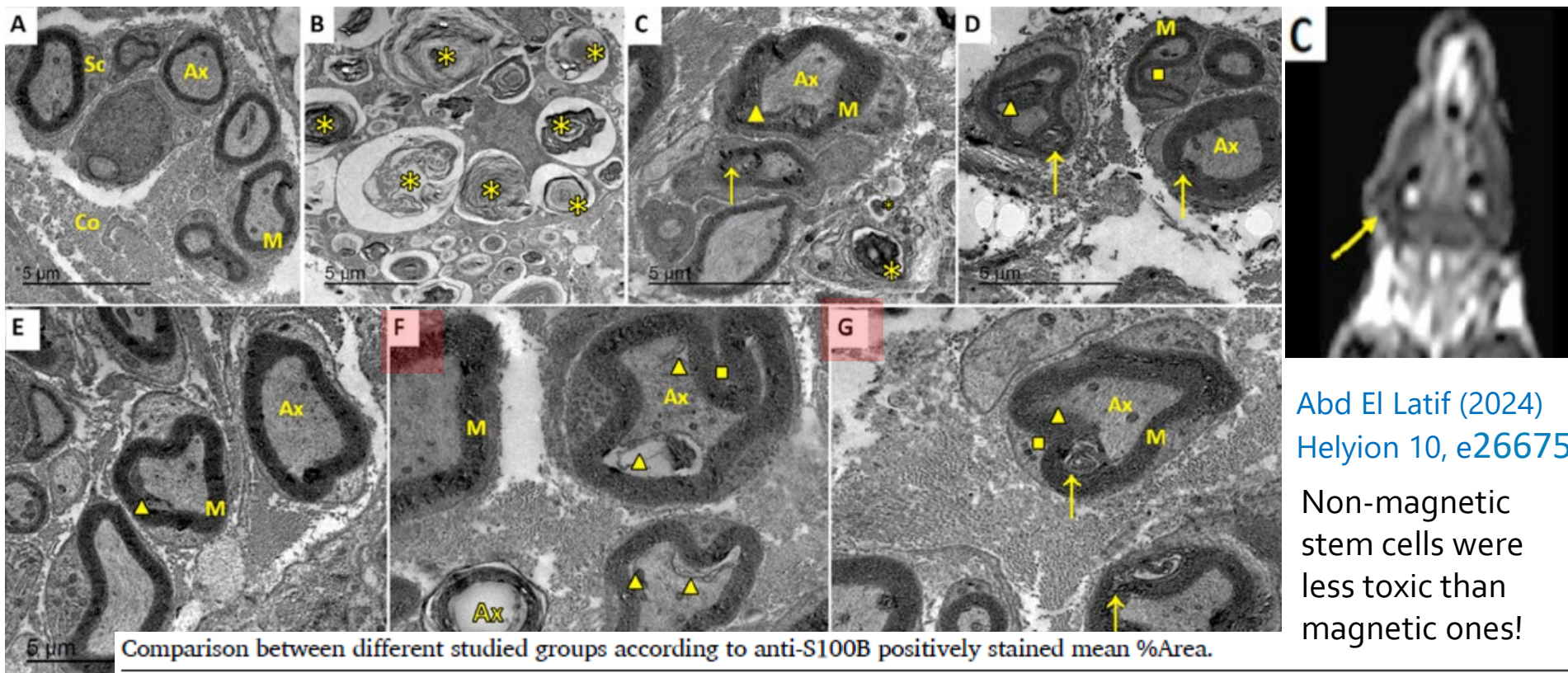
Magnetic separation of non-magnetic “things”
and living organisms in ferrofluids work too!

Medical Applications

Magnetic Pirarubicin Hydrogel for Bladder Cancer Therapy



Neuroregeneration with Stem Cells of Neurolysed Facial Nerves

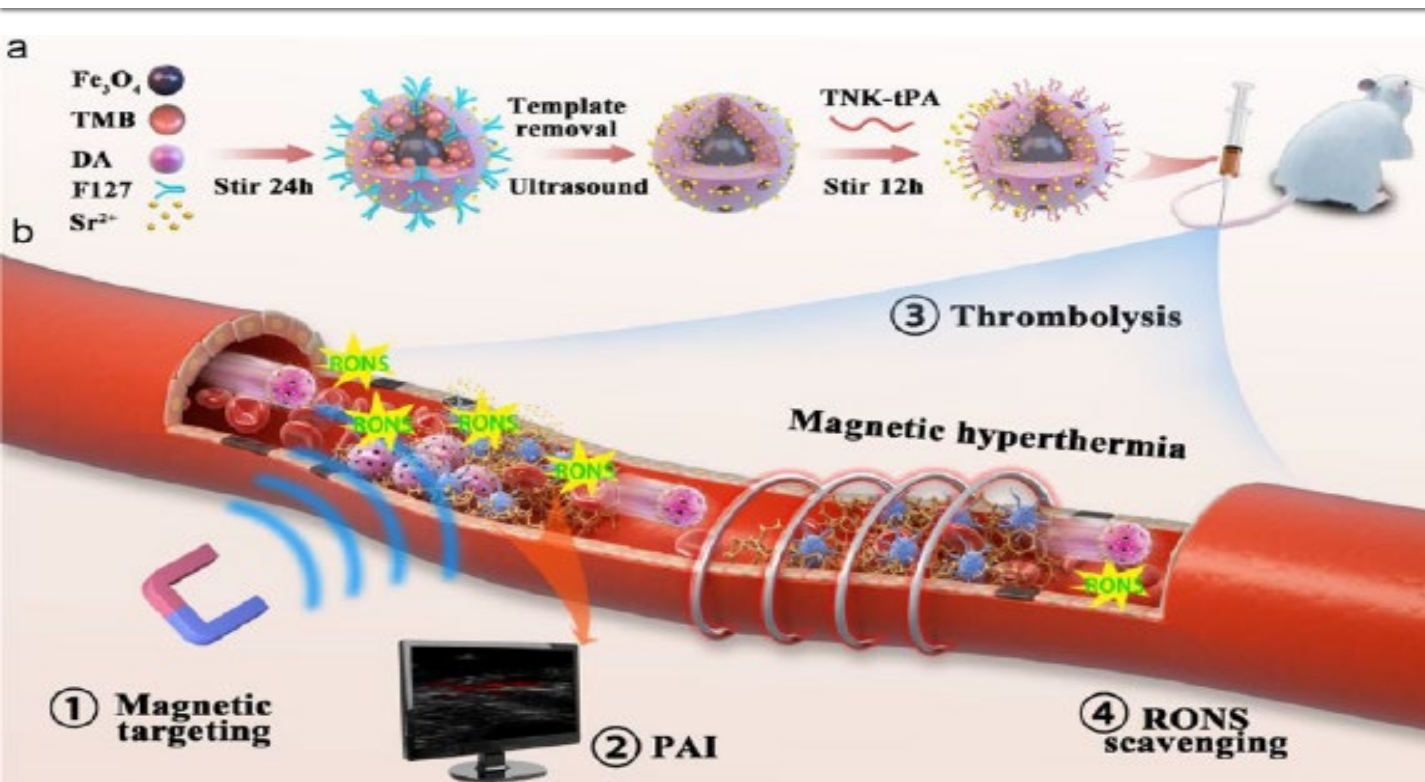


Abd El Latif (2024)
Helyion 10, e26675

Non-magnetic stem cells were less toxic than magnetic ones!

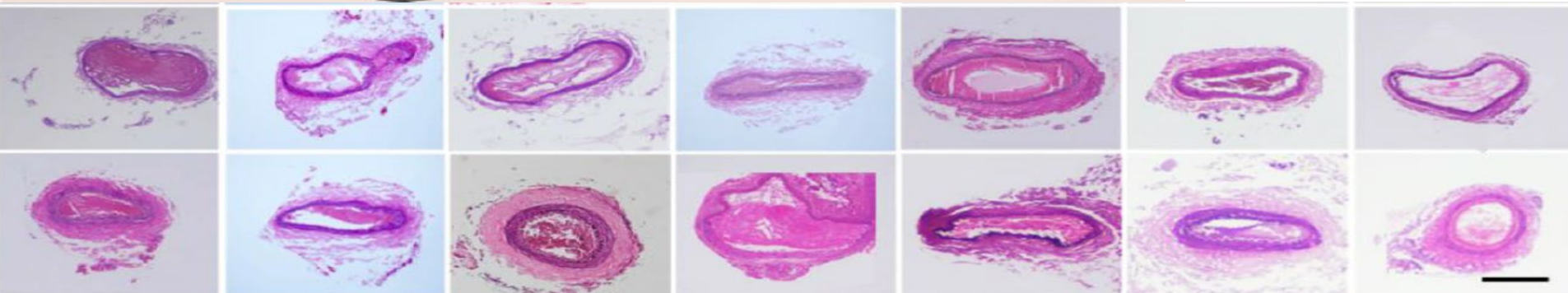
	Negative control		Group I - PBS		Group II - BMSC		Group III - MNP-BMSC	
	4 weeks (n = 5)	8 weeks (n = 5)	4 weeks (n = 5)	8 weeks (n = 5)	4 weeks (n = 5)	8 weeks (n = 5)	4 weeks (n = 5)	8 weeks (n = 5)
% Area								
Mean	16.93 ^{bc} ±	16.93 ^{bc} ±	18.21 ^{abc} ±	13.51 ^c ±	21.99 ^{abc} ±	26.36 ^{ab} ±	28.79 ^a ±	16.62 ^{bc} ±
±								
SD.	0.06	0.06	10.17	8.05	4.05	4.75	3.4	6.48

Theranostic Platform to Extend Thrombolysis and Prevent Renal Ischemia–Reperfusion Injury



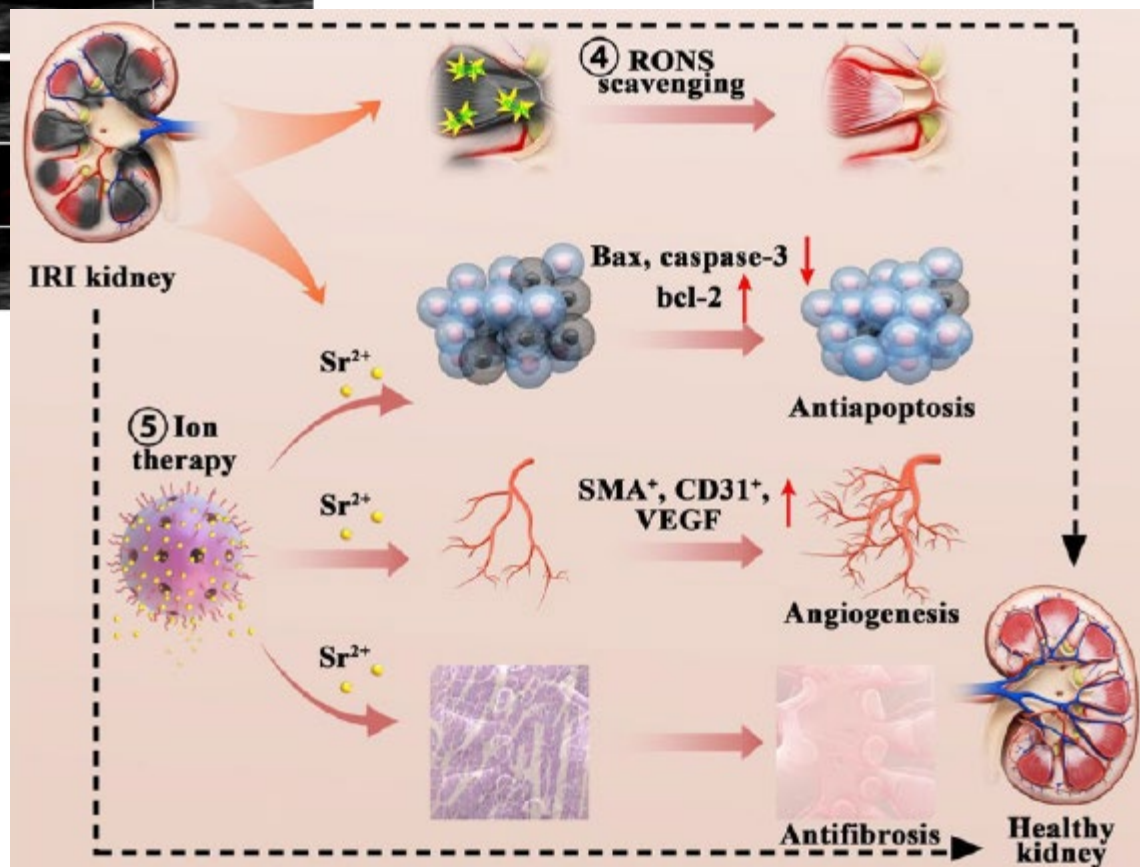
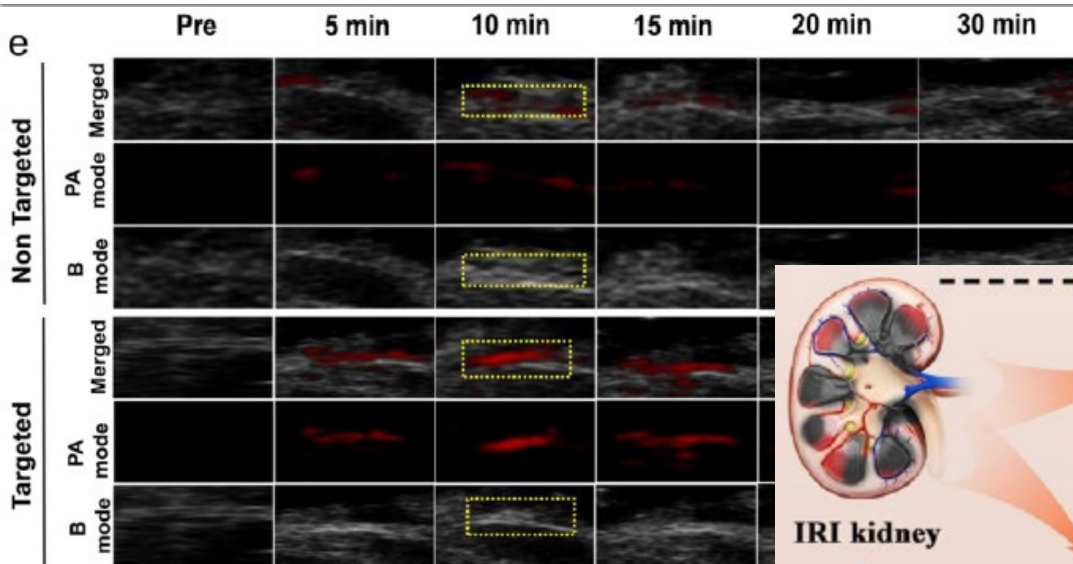
Xu (2023) ACS Nano
17 (6), 5695

Good paper that
takes into account
how to minimize
toxicity to kidneys

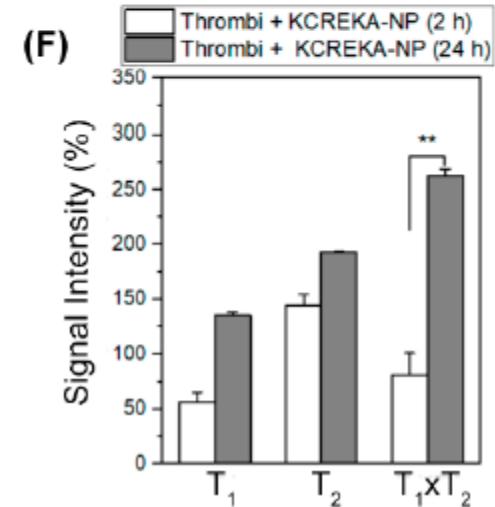
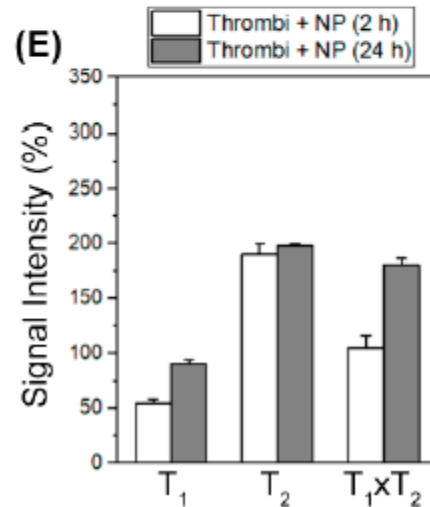
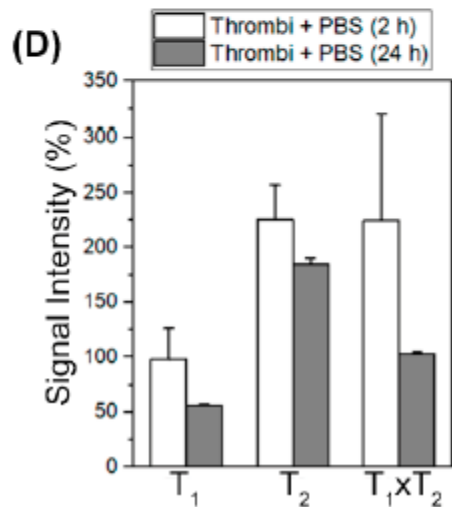
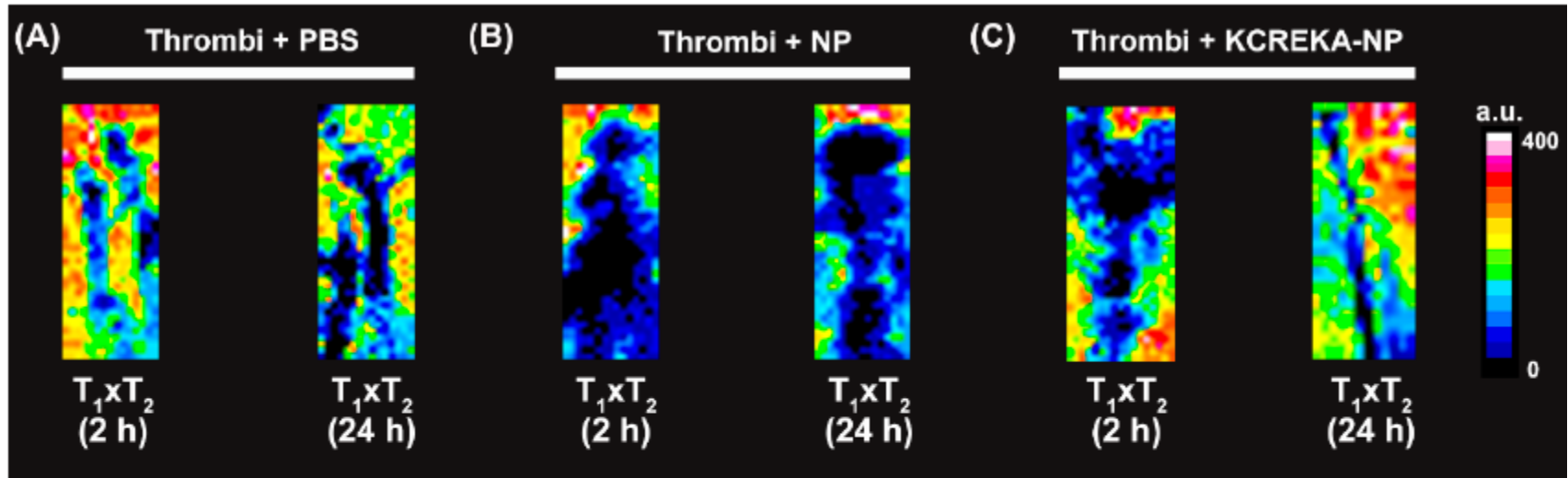


Theranostic Platform to Extend Thrombolysis and Prevent Renal Ischemia–Reperfusion Injury

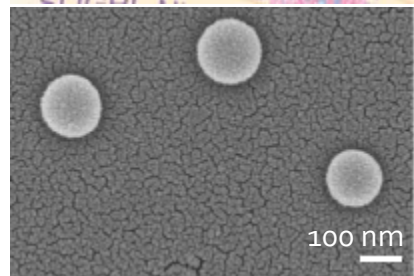
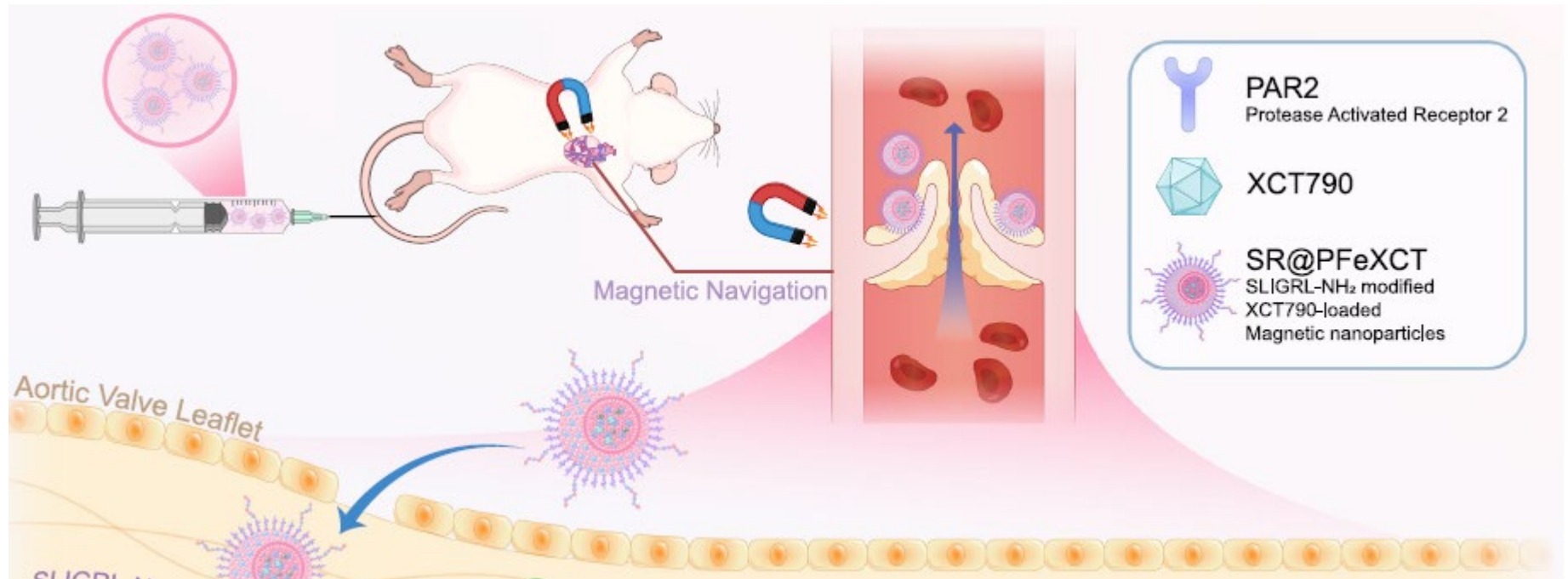
Xu (2023) ACS Nano
17 (6), 5695



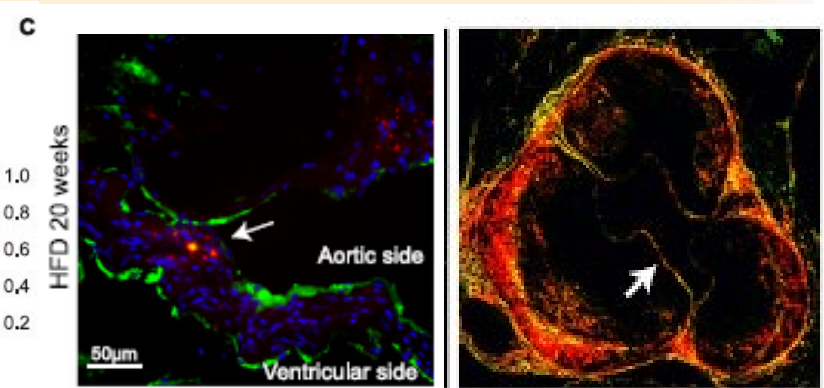
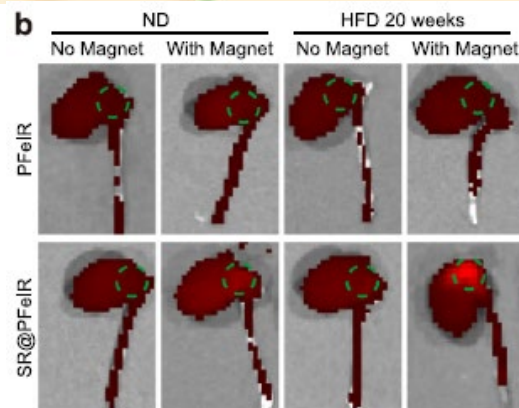
Fibrin-Targeted Nanoparticles for Diagnostic Analysis of Blood Clot Age in Acute Ischemic Stroke



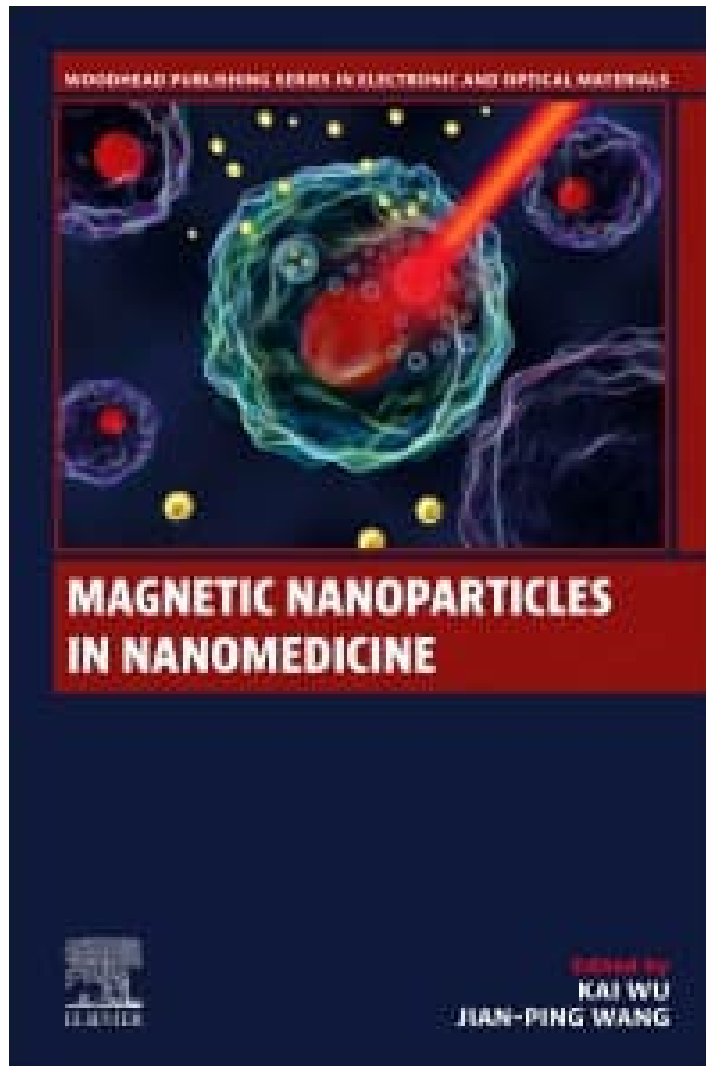
Treatment of Calcified Aortic Valve Disease With PARP2 Targeted MNPs



Chen J (2024) Nature Comm 15, 557

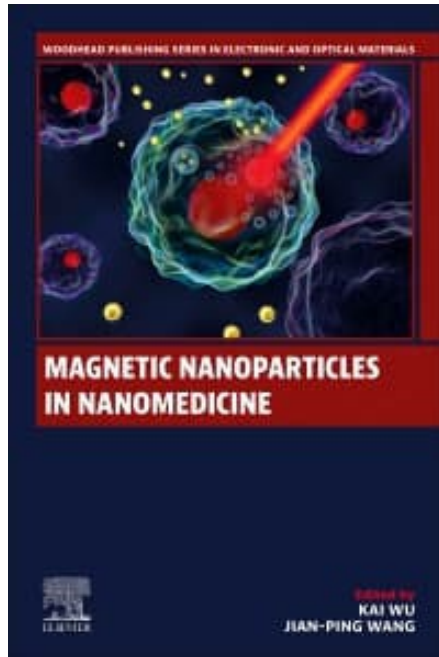


New Books

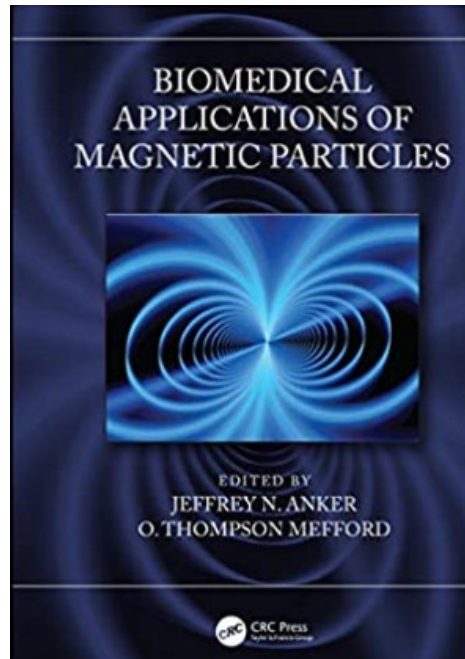


- **Magnetic Nanoparticles in Nanomedicine**
- *Edited by: Kai Wu & Jian-Ping Wang*
 - eBook ISBN: 9780443216695
 - Published: June 14, 2024
 - 542 pages

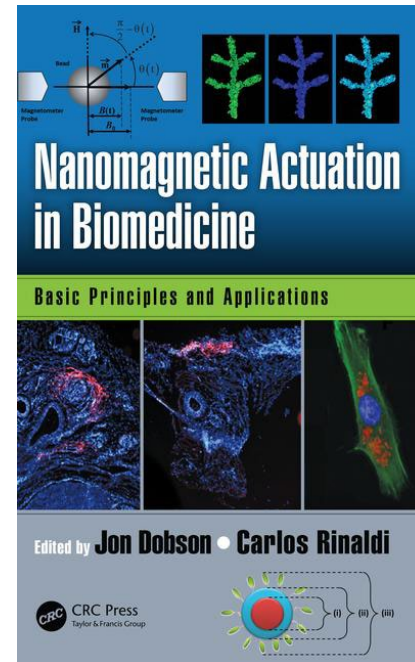
Books as Poster Prizes



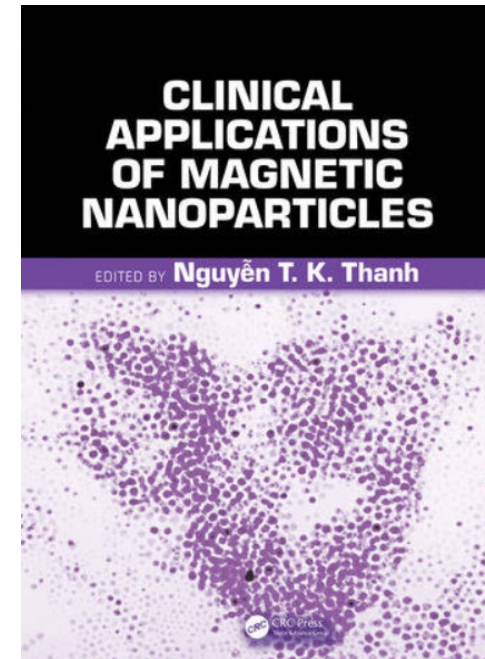
2024



2022



2018



2018

There is Much More

The image features several 3D models of magnetic carriers, which are spherical particles with a porous, interconnected network structure. The models are rendered in a light grey or white color, with a glowing cyan or teal network of lines and nodes overlaid on them, representing the magnetic component. The models vary in size and orientation, with some appearing as smaller, more distant particles and others as larger, more prominent structures. The background is a solid black, which makes the glowing models stand out.

14TH INTERNATIONAL CONFERENCE ON THE
SCIENTIFIC AND CLINICAL APPLICATIONS
OF MAGNETIC CARRIERS

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... from your colleagues during the
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