

## Magnetic "nanospheres" for biomedical applications

### Tiny particles could help treat stroke, heart attack



Biodegradable particles smaller than a red blood cell — designed to detoxify humans following exposure to chemical, biological, or radiological contamination — have opened the door to better medical treatments for an array of conditions, including drug detoxification, trauma-related kidney failure, stroke and heart attack.

Argonne and The University of Chicago are leading a team of scientists, engineers, and medical doctors from several universities and hospitals in a research program that is focusing on a range of medical uses for the nanospheres, which are between 100 and 5,000 nanometers (one nanometer is one ten-millionth of a centimeter) in size.

The foundation for this novel and versatile technology was laid when the Department of Defense funded Argonne to find a way to detoxify soldiers exposed to radiological, biological, or chemical contamination. A system was envisioned that would be administered in the field by injecting the nanospheres into the victim's bloodstream, letting them circulate to do their work, and then recovering them via a small magnetic filter. That work has progressed well and researchers recently reached a major milestone with the development of a prototype magnetic filter. Laboratory trials of the detoxification treatment are currently underway.

Physical chemist Carol Mertz mixes a polyethylene glycol (PEG) coating for synthesized polymer nanospheres as polymer chemist Martha Finck examines a different PEG formulation. The coated nanospheres can be injected into humans following exposure to chemical, biological, or radiological toxins. The nanospheres selectively pick up these toxins and then are drawn out through a magnetic filtration system outside the body. The formulation of the PEG coating is critical to the nanospheres' ability to circulate in the bloodstream undetected by the immune system, and to their ability to effectively capture toxins.

Discoveries made during the human detoxification work have led the research team to other important medical uses for the nanospheres, including the delivery of therapeutics such as genes and other therapies that would not otherwise be deliverable.

### Potential Applications of Magnetic Nanosphere Technology

*Emergency medical technicians would be able to administer treatment, an important advantage in treating conditions where time is critical.*

- Biological and chemical detoxification
- Radiological detoxification and protection from exposure
- Internal hemorrhage
- Brain swelling
- Stroke therapy
- Cancer therapy
- Acute trauma leading to kidney failure

### For More Information

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