Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M22-141L
Published: 10/11/2022

## Inventors

**Shu Wang**

**Zhaoyang Fan**

## Contact

Jovan Heusser
jovan.heusser@skysonginnovations.com

# Brain Targeted Nanoparticles for Therapeutic Delivery

Because the blood brain barrier (BBB) is a highly selective semipermeable complex, only about 2% of small molecules in the blood can penetrate it; most require transporters on the BBB. While this prevents many toxins, pathogens and other dangerous substances from crossing the BBB, it also makes it difficult to effectively treat various diseases including neurodegenerative diseases, opioid overdose, metabolic disorders, temperature regulation and mood disorders. Research into receptors expressed on the BBB is promising, however, many receptors (glucose transporter 1, transferrin receptor, LDL-receptor related protein, etc.) are highly expressed in other tissues, organs or cells, eliciting strong off-target effects.

Researchers at Arizona State University have designed novel nanoparticles coated with ligands for a membrane transport protein that is expressed selectively and abundantly on the endothelial cells of the BBB. These nanoparticles can be used as a vehicle for diagnostic agents in brain imaging, or therapeutic or bioactive compounds for disease treatment. Because these nanoparticles bind to a BBB membrane transport protein, they can enhance drug delivery into the brain through a variety of mechanisms. Administering these nanoparticles can be via IV injection, transdermal patches, intranasal routes, as well as possibly other routes. Mice studies have been conducted to confirm binding, penetrating, and targeting.

These nanoparticles can carry and deliver a variety of agents to the brain for both diagnostic and therapeutic applications with the potential for low off-target effects.

Potential Applications

- Treating various diseases
  - Tumors, neurodegenerative diseases such as AD, PD, ataxia, HD, motor neuron diseases and more, metabolic disorders, infections, drug addiction, mood disorders, body temperature disorders, etc.
- Brain imaging
- Neural research

Benefits and Advantages

- The membrane transport protein that is targeted is expressed abundantly and specifically on the endothelium of the BBB with low expression in other tissues and organs
  - Off-target effects should be very low
  - Target specificity to the brain should be very high
- Targeted delivery of the nanoparticles could enhance therapeutic delivery with decreased side effects and toxicity
- Can be administered via IV injection, intranasally, transdermal patches, and more

-

For more information about the inventor(s) and their research, please see

Dr. Wang's departmental webpage

Dr. Fan's departmental webpage