

# Low-Cost, Efficient Intracellular Delivery of Proteins and Nucleic Acids via Hydrophobic Ion Pairing

---

## Current delivery methods of biomacromolecules can be toxic and inefficient

Delivery of biomacromolecules such as proteins and nucleic acids to the cytosol is very challenging and requires viruses, nanoparticles, physical methods (ie electroporation), or chemical transduction agents (ie Lipofectamine). Though these methods do have efficacy, they have very different efficiencies, toxicities, and costs. Additionally, not all of these methods can be used in all situations (in vivo/in vitro, different classes or sizes of biomacromolecule cargoes, etc.).

Researchers at the Georgia Institute of Technology have developed an approach of mixing cargo and oppositely charged hydrophobic ions with cells to achieve therapeutic delivery. This mitigates toxicity, while improving efficiency and reducing cost.

## Hydrophobic ion pairing has the potential to improve toxicity and reduce cost

This invention can be used to deliver a charged biomacromolecule cargo into cells in vitro or in vivo including proteins and peptides, and various nucleic acids such as siRNA, mRNA, antisense oligonucleotides, microRNA, and plasmid DNA. This can be useful in vivo for delivery of therapeutic versions of these molecules for treatment of disease or vaccination. This can also be useful in vitro as a research reagent as many labs currently purchase Lipofectamine to achieve gene regulation or delivery for experiments.

## Summary Bullets

- Safe and efficient approach of delivering therapeutics to disease by mixing cargo and charged hydrophobic ions with cells.
- Applications in therapeutic/drug delivery, protein transduction reagent, and gene transduction reagent.
- Enables efficacious delivery of a wide range of protein and nucleic acid therapeutics.

## Solution Advantages

- It is safe and does not use viruses or toxic molecules (Lipofectamine).
- Hydrophobic ions can be selected from GRAS list, reducing toxicity.
- Hydrophobic ion pairing can be thousands or millions of times less expensive.
- Increased ease of use across the user base

#### Potential Commercial Applications

- Therapeutic delivery
- Protein transduction reagent
- Gene transduction reagent

#### Inventors

- Dr. Julie Champion  
Associate Professor – Georgia Tech School of Chemical and Biomolecular Engineering

#### IP Status

<p>Provisional Application Filed.</p>:

#### Publications

[A Simple Mixing Method for Cytosolic Delivery of Protein, siRNA, and Plasmid DNA Using Hydrophobic Ion Pairing for Use As a Non-Toxic and Inexpensive Transfection Agent, -](#)

#### Images

Visit the Technology here:

[Low-Cost, Efficient Intracellular Delivery of Proteins and Nucleic Acids via Hydrophobic Ion Pairing](#)

---

<https://s3.sandbox.research.gatech.edu//print/pdf/node/4261>