



# Office of Technology Management

## *Targeted Drug Delivery of Pain Therapeutics via Sensory Neuron Specific Markers*

### Technology Reference

CY029

### Contact

Konstantin Kostov  
Office of Technology Management  
1737 West Polk  
Suite 312 AOB  
MC 682  
Chicago, Illinois  
60612

[kostov@uic.edu](mailto:kostov@uic.edu)

Phone: 312-996-1039

Fax: 312-996-1995

### Inventor

Zaijie Jim Wang

### Field

Pain management therapy

### Key Words

Pain relief

Opioid analgesics

Mu opioid receptor (MOR)

Targeted drug delivery

Dermorphin

Nanotechnology

### License Status

Seeking licensing partners

### Patent Status

Provisional patent filed

### Overview

Various techniques for pain management, including the use of opioids analgesics, are a common topic of research studies. Traditionally, opioids have been used to manage acute pain. However, the long-term use of opioids has been discouraged because of the risk of tolerance, physical or psychological dependence, respiratory depression, and other side effects. Thus, there is a desperate need to find a method or agent that will prevent or reverse opioids tolerance and will reduce its side effects. Such method or agent will provide better pain control in a large population of patients who are not adequately treated with opioid analgesics alone and will also be helpful in treating opioid addiction.

Pharmacological studies have established that morphine-induced analgesia, tolerance, and dependence are primarily mediated by mu opioid receptors (MOR). There have been many potential targets to alleviate tolerance but many targets are intracellular, and achieving cell-specific delivery presents a challenge to the traditional pharmacological approaches.

### Technical Summary

UIC researchers have found a novel approach that may vastly improve the pharmaceutical therapies for pain, opioid tolerance, and opioid addiction. By modifying dermorphin, a mu opioid ligand, they found that it chemically conjugates to a ligand-grafted sterically stabilized liposome and helps to target the tissue/cells that only express MOR. After binding to neurons expressing these specific receptors, dermorphin or other pain drugs that are encapsulated inside the liposome will stop intracellular signaling events that foster opioid tolerance and addiction. The same construct can also be used to deliver analgesics in lower doses due to cell/tissue specificity. This delivery concept can be used to deliver any cell-permeable or non-permeable compounds (chemicals, peptides, or nucleotides) to many specific tissues and cells, and can be used to reach any intracellular target. The method will be limited by the available selective inhibitors/antagonists, but not compounds' cell/tissue-specificity or cell permeability. This method may be modified for the targeting of other diseases.

Combining the cell biology knowledge (receptor-mediated internalization) and pharmaceutical methods (liposome, polymer or other carrier systems) to invent/improve pain and addiction therapies is novel. In summary, dermorphin or a suitable substitute is conjugated to nanoparticles with surface ligands specific to the MOR or likes, so it can be actively targeted to specific cell/ tissue population. This is a promising drug carrier for the treatment of pain, opioid tolerance, drug addiction, and potentially other diseases.

### Benefits

- Improved pain and addiction therapies

### Areas of Application

- Chronic and acute pain
- Diabetic neuropathy
- Arthritis
- Cancer pain

### Stage of Development

- *In vivo* experiments planned
- *In vitro* and cell-based experiments completed