

## **Polymer-drug Conjugate for Sustained Dermal Delivery of Retinoids**

Technology #17491

### **Applications**

- Treatment of acne and skin diseases
- Anti-aging product

### **Problem Addressed**

This technology introduces a novel, non-greasy formulation to deliver all-trans retinoic acid (ATRA) for cosmetic applications.

### **Technology**

Retinoids are a broadly used class of therapeutics. All-trans retinoic acid (ATRA), in particular, has been widely used in formulations for anti-aging and wrinkle reduction, in addition to being a first line cancer therapy in lymphoblastic leukemia. The challenge in ATRA delivery is that the molecules are very hydrophobic, making them water-insoluble, so formulations of ATRA rely on emulsifiers that are greasy and may damage areas of application. This novel approach, by contrast, conjugates ATRA to an FDA approved, soluble polymer through an ester-bond linkage, creating water-soluble polymer-drug nanomicelles with controlled ATRA release characteristics. The ATRA is conjugated to poly-(vinyl alcohol) (PVA) by DCC chemistry in a one-pot synthesis reaction. These nanomicelles have high aspect ratio nanofiber structures which facilitate uptake into the dermis while at the same time reducing mobility in the tissue, thereby enforcing controllable ATRA release. In vitro studies demonstrate ATRA as an effective anti-proliferative. In vivo studies in mice suggest that these nanomicelles ensure controlled release of ATRA, reducing irritation and inflammation at the sight of interest and promoting application and retention of the structures. The new technology could find applications in treatment of acne and skin diseases, improving therapy efficacy and reducing side effects with more controlled delivery mechanisms, while allowing for a user friendly, non-greasy formulation of the active agent.

### **Advantages**

- Includes a non-greasy formulation due to water solubility of nanomicelles
- Better control of ATRA delivery and reduction of side-effects such as irritation and inflammation
- PATRA (PVC-bound ATRA) synthesis is easily scalable
- Improved stability of ATRA as the ATRA-bound polymer protects it from light degradation

### **Categories For This Invention:**

Life Sciences

Biomaterials

---

255 Main Street, room NE 18-501

Cambridge, MA 02142-1601

Phone: 617-253-6966 Fax: 617-258-6790

<http://tlo.mit.edu>

Contact the Technology Manager: [tlo-inquiries@mit.edu](mailto:tlo-inquiries@mit.edu)

Micro/nanoparticles (Biomaterials)  
Clinical Applications  
Dermatology

## Intellectual Property:

Nano-fibular nanoparticle polymer-drug conjugate for sustained dermal delivery of retinoids  
PCT  
2016-210087  
Nano-fibular nanoparticle polymer-drug conjugate for sustained dermal delivery of retinoids  
US Patent Pending  
2018-0185513

## Inventors:

Paula Hammond  
Steven Castleberry  
Mohiuddin Quadir

## External Links:

Hammond Lab  
<https://hammondlab.mit.edu/>

## Image Gallery:

