TEXAS A&M UNIVERSITY
CORPUS CHRISTI

POTENTIAL SKIN ABSORPTION AND PENETRATION OF ENVIRONMENTAL NANOPLASTIC PARTICLES

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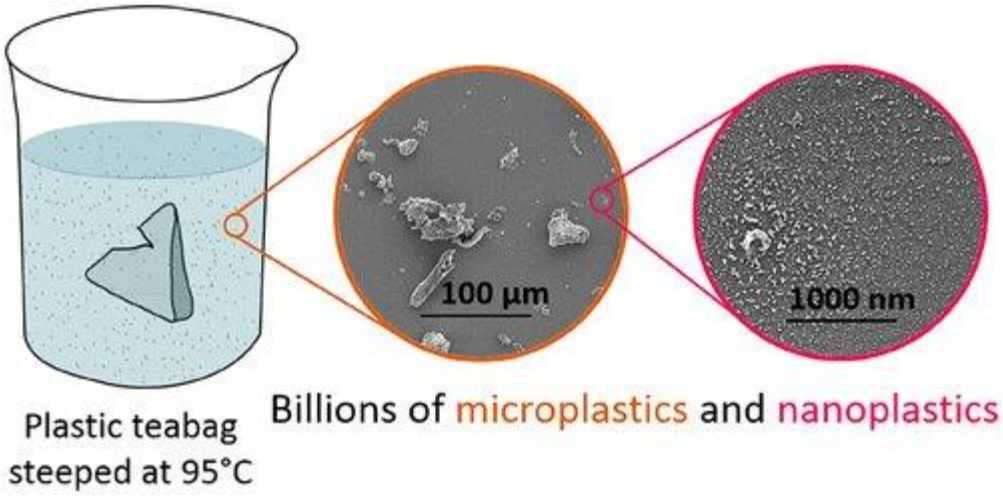
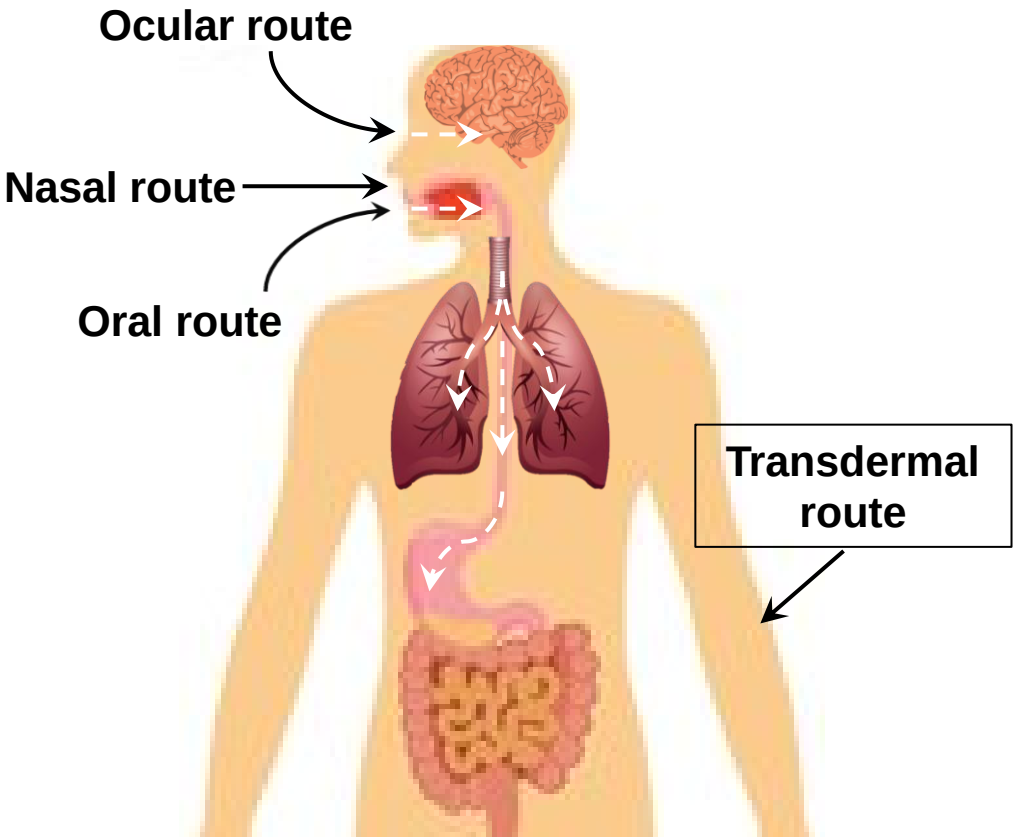
Nanoplastics

- **Particles < 1µm**
- **Sources:** Degraded plastic wastes in nature
- **Bioaccumulation and cell penetration**



Credit: American Chemical Society

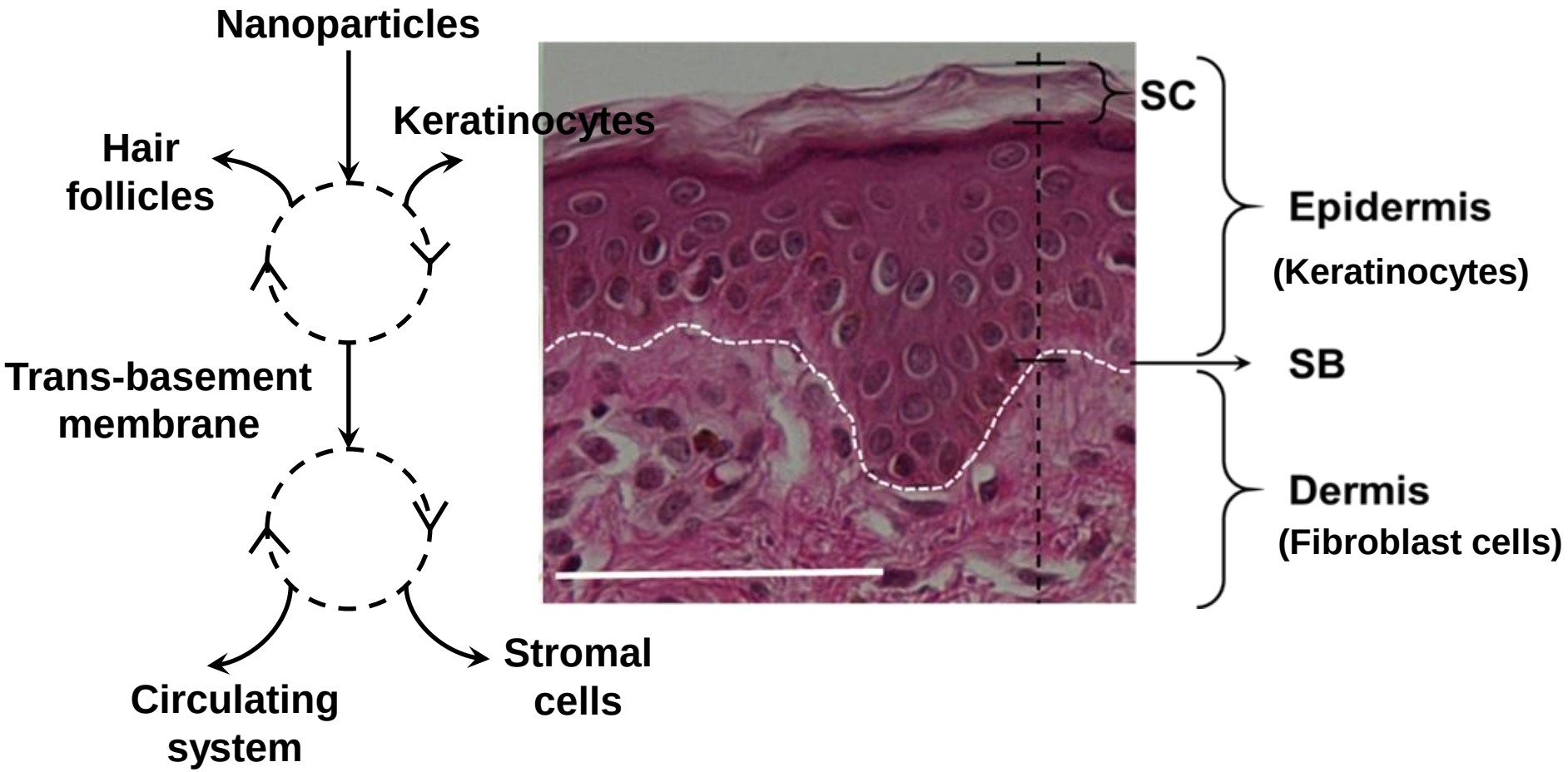
Nanoplastics and Human Health



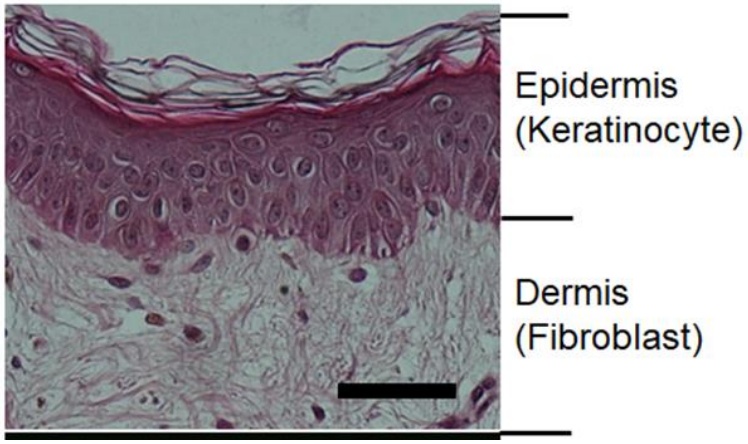
Objectives

- To identify the transdermal route of nanoplastic entry to human tissues;
- To understand the skin cell absorption of nanoplastics;
- To understand the pathogenic effects of nanoplatics to human skin diseases.

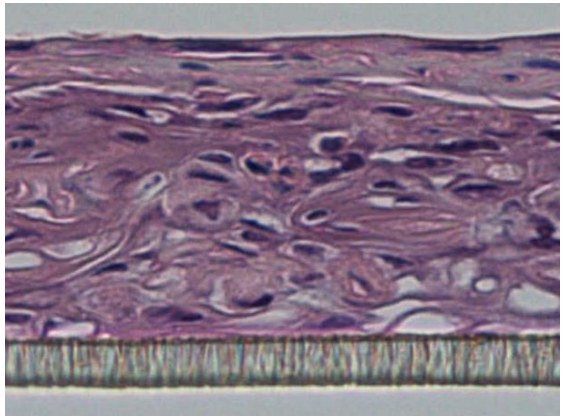
Hypothesis


Nanoparticles
Keratinocytes
Hair follicles
Trans-basement membrane
Circulating system
Stromal cells
SC
Epidermis
(Keratinocytes)
SB
Dermis
(Fibroblast cells)

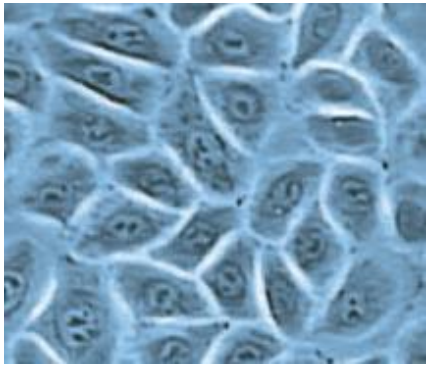
in vitro Human Epidermal Models



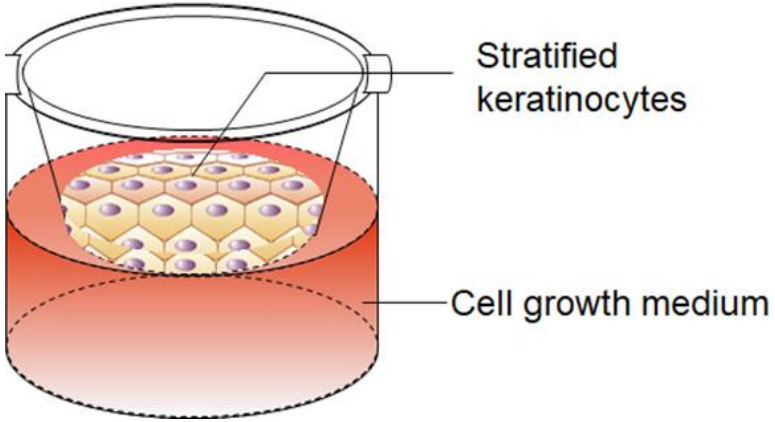
Human skin



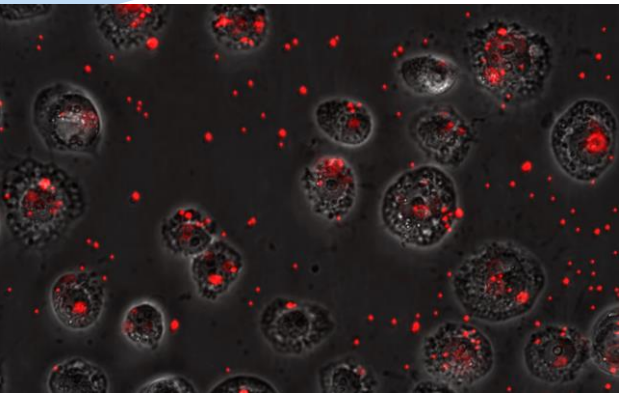
3D keratinocyte culture



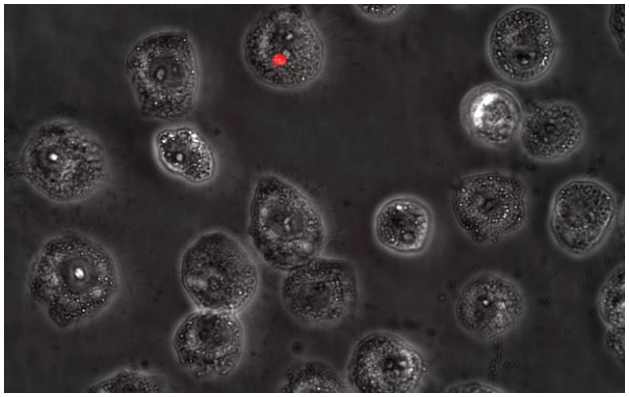
2D keratinocyte culture



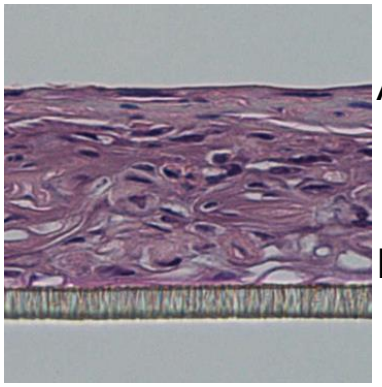
Pathway of Nanoplastics in Epidermis

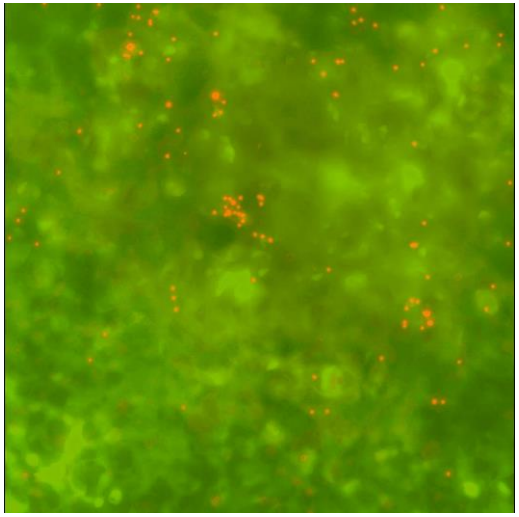


0.5 μm NPs, 1ppm, 24hpt

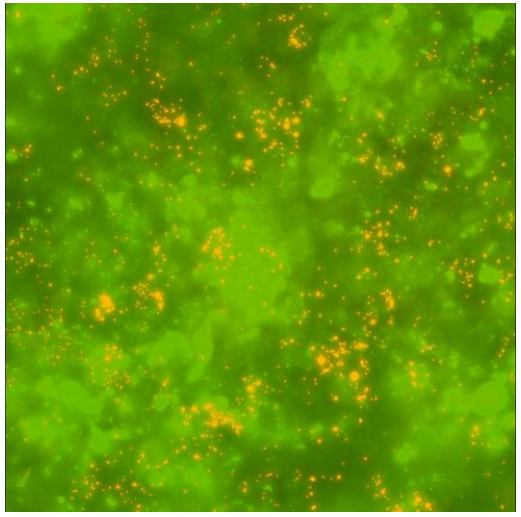


1.0 μm NPs, 1ppm, 24hpt



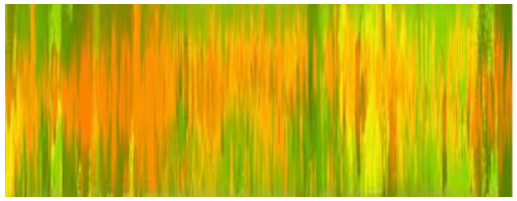


0.5 μm NPs, 1ppm, 4hpt



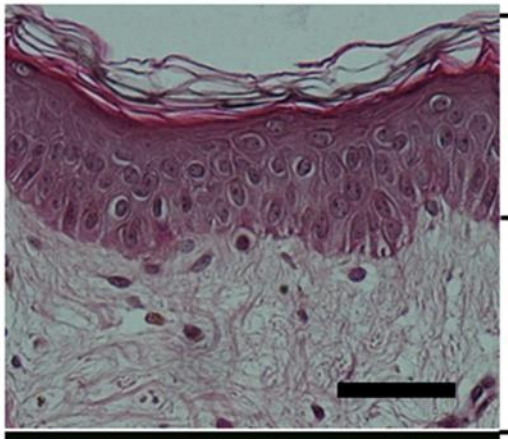
0.5 μm NPs, 1ppm, 24hpt

4hpt



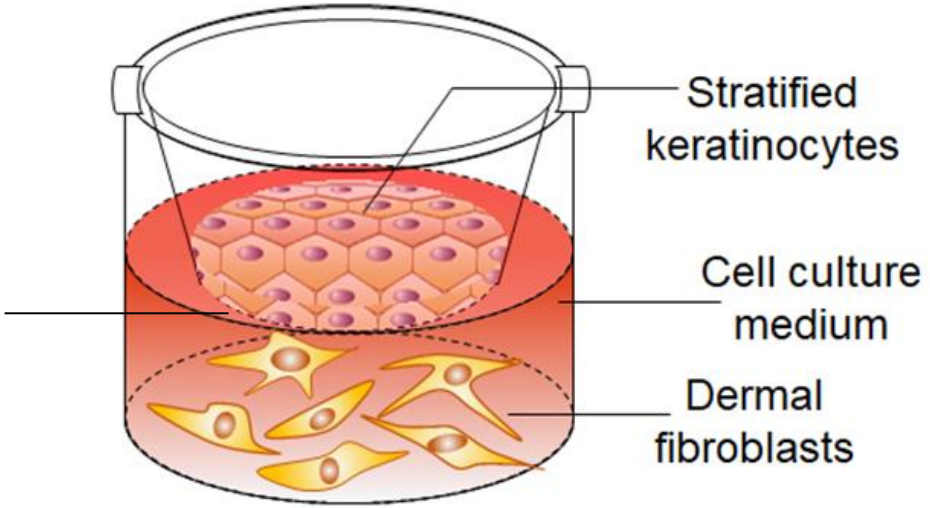
24hpt

3D Keratinocyte-Fibroblast Coculture Model



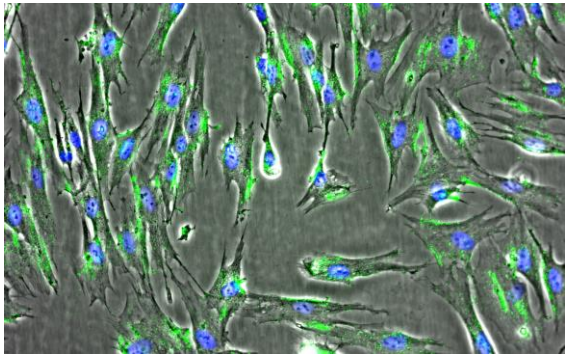
Human skin

Porous Membrane with
a 0.4 µm pore size.



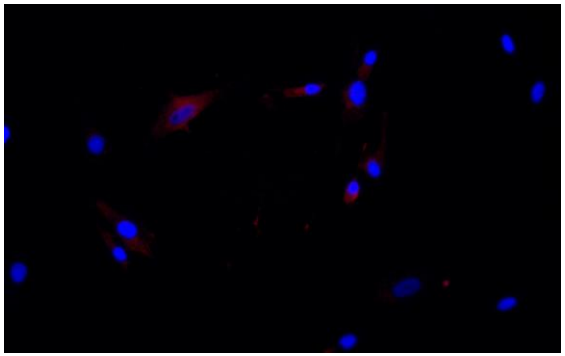
Trans-Basement Membrane of Nanoplatic Particles

Dermal fibroblast cells / 100 nm NPs / Nuclei

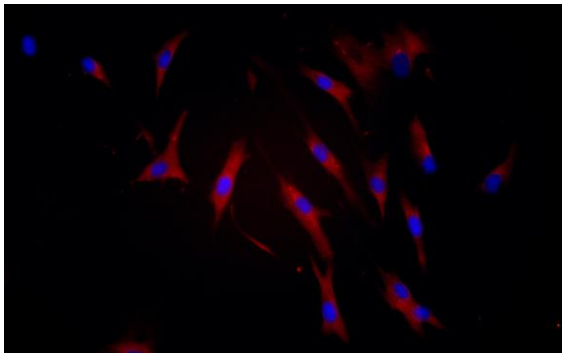


4 hr incubation with NPs
(Dermal fibroblast 2D culture)

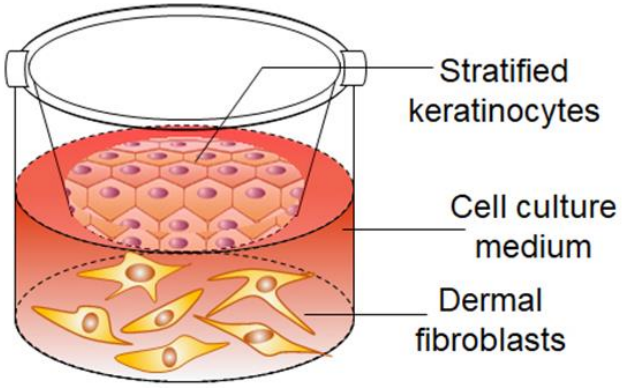
Pro-Collagen Ia / Nuclei



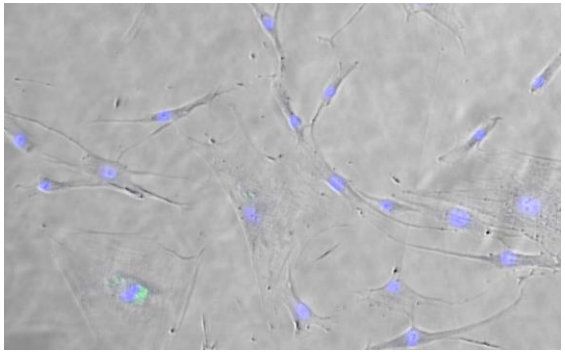
Control cells
(Dermal fibroblast 2D culture)



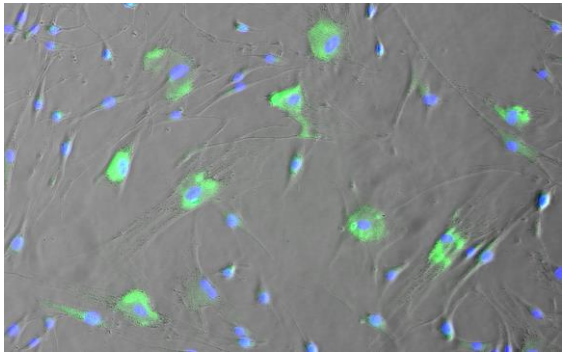
4 hr incubation with NPs
(Dermal fibroblast 2D culture)



Dermal fibroblast cells / 100 nm NPs / Nuclei

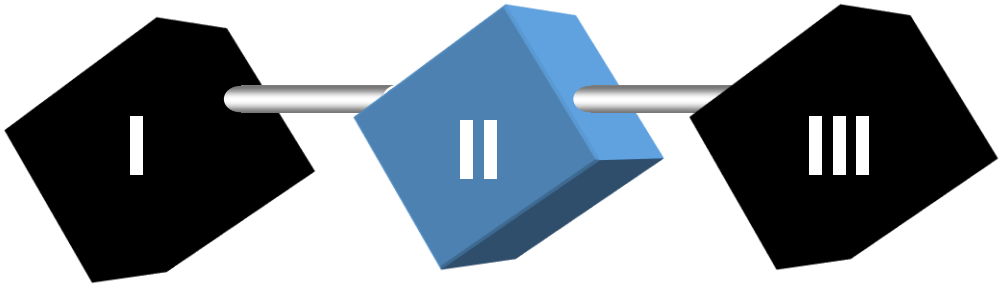


4 hr epidermal penetration
(fibroblast in coculture)



8 hr epidermal penetration
(fibroblast in coculture)

Conclusions



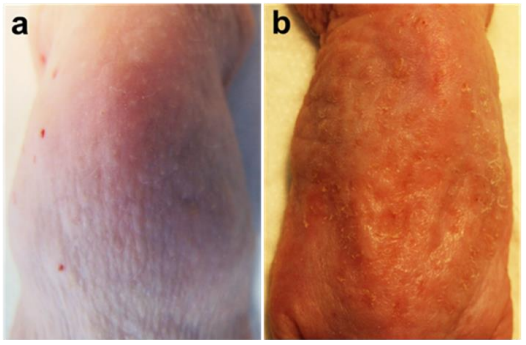
Nanoplastics can penetrate skin epidermal layers and enter the dermis through the pores on basement membrane

Nanoplastics can be accumulated in human kerationcytes and dermal fibroblast cells

Nanoplastics can potentially cause skin inflammation be activating dermal fibroblast cells

Current and Future Research

1. Nanoplastics and human skin inflammatory diseases
2. Entry of nanoplastics to circulating system and organs
3. Effects of nanoplastics to human respiratory and gastrointestinal systems
4. Development of environmental micro/nano-plastic particle removal technique



Xu *et al.*, 2015, Sci Transl Med

Questions ?


PLASTICS AGAIN?
YEAH, THEY WERE OUT OF FISH.
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