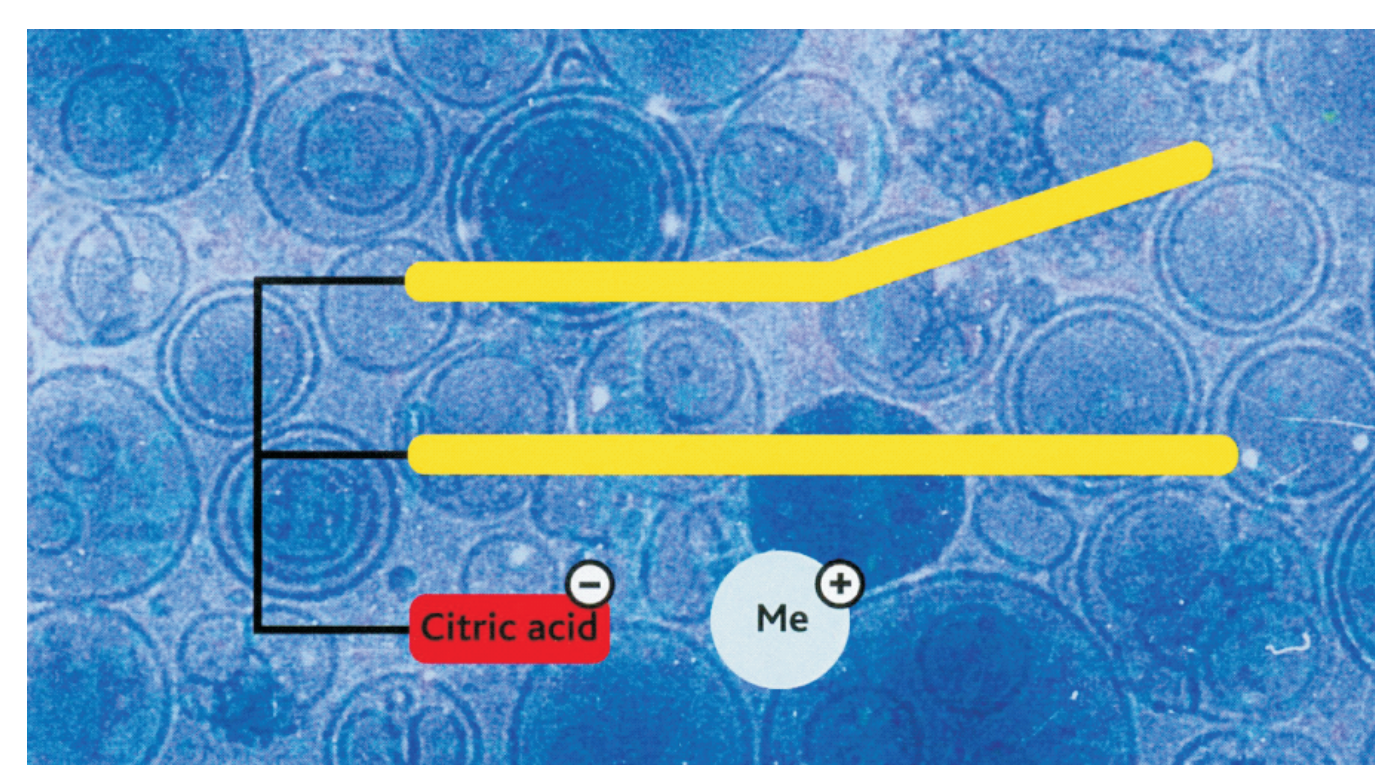


## Introduction

Oil-in-water nanoemulsions (O/W emulsion) become more and more important as potential vehicles for controlled delivery of lipophilic components in the skin. In contrast to thermodynamically stable transparent low viscous microemulsions (sizes <100nm), the Lipo-Tops are a milky formulation based on low concentrations of emulsifiers. They were developed to achieve vesicles with high encapsulation efficacy of lipophilic components or oils (up to 20%). The stability of sensitive as well of poorly soluble substances could be enhanced by the incorporation into this carrier system.

The Lipo-Tops are based on a skin friendly membrane building emulsifier coming from the food industry which contains a high amount of unsaturated fatty acids (vitamin F) and a coemulsifier.

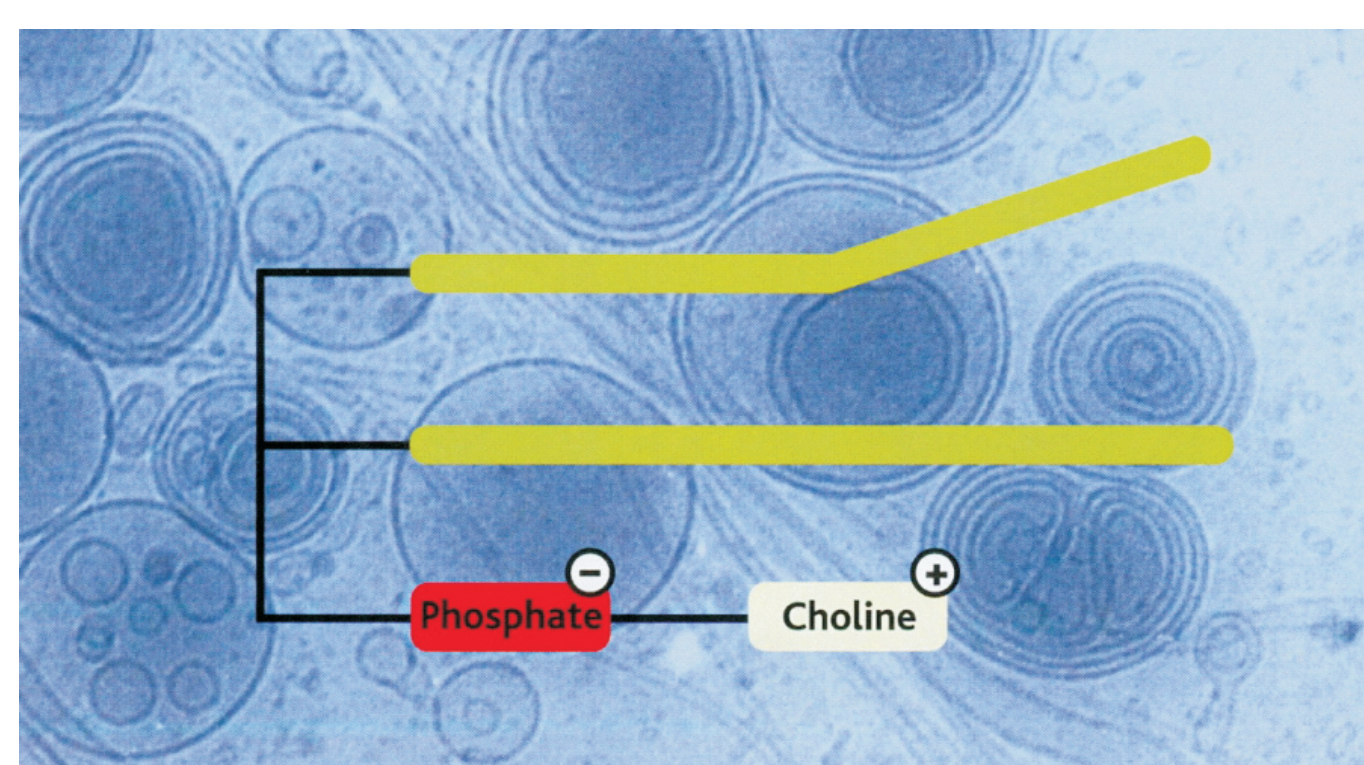
### Lipo-Tops



**Sunflower**

Glyceryl Citrate / Lactate / Linoleate / Oleate

### Nanosomes



**Soy Bean**

Phosphatidylcholine

## High Penetration Efficiency

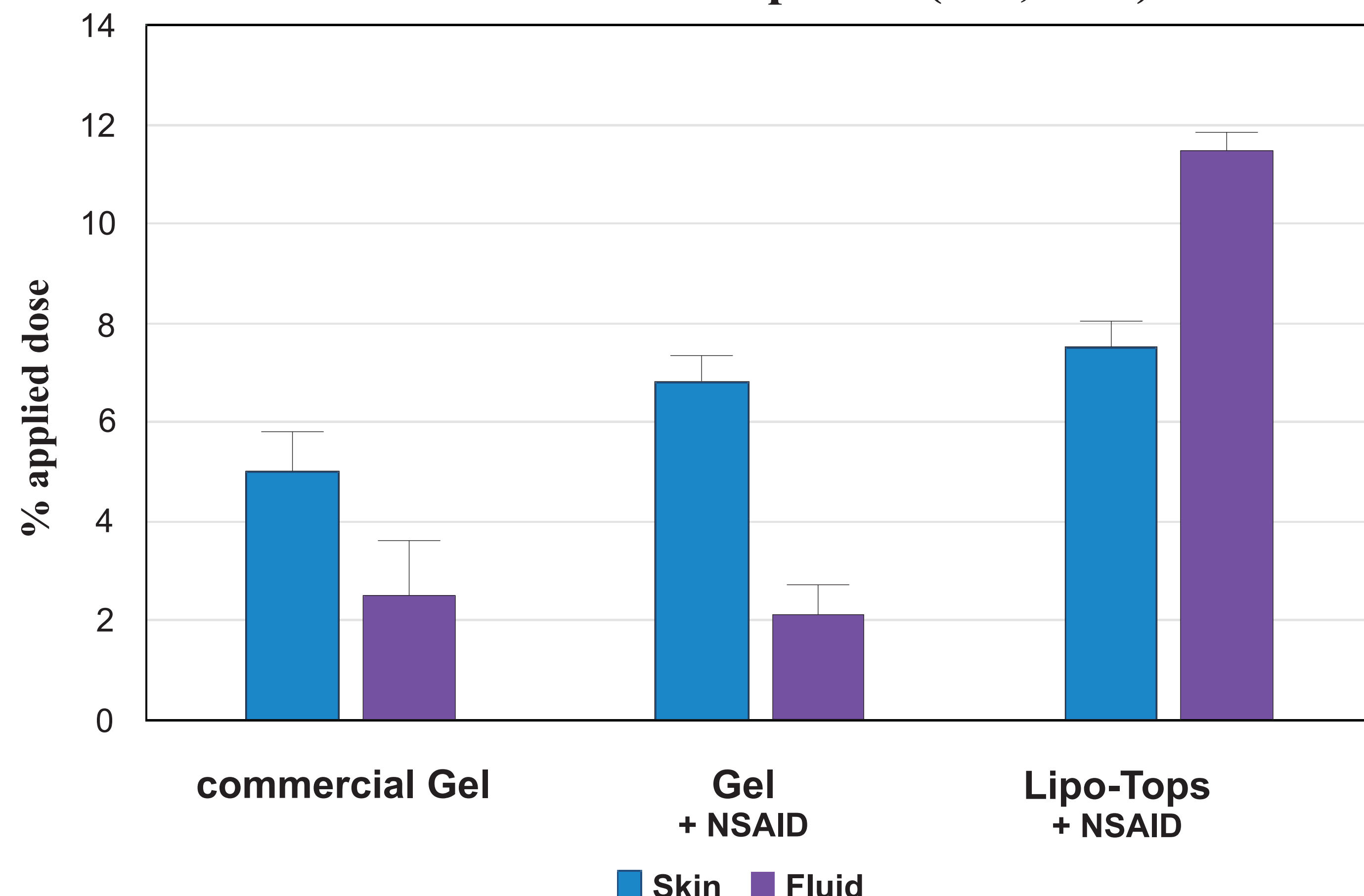
Ibuprofen belongs to the NSAIDs (nonsteroidal anti-inflammatory drugs) and provides pain-killing and anti-inflammatory effects. The oral usage of NSAIDs increases the risk of gastrointestinal problems – but the dermal application demands a good penetration behavior of ibuprofen into skin and muscles to suppress painful symptoms.

The distribution of ibuprofen in human skin was tested ex vivo by using different formulations containing 5% ibuprofen.

When ibuprofen is encapsulated in the lipid based carrier system Lipo-Tops, the drug overcomes the skin barrier in the stratum corneum and is distributed even in the deeper skin.

This behavior is depending on used oil. Lipo-Tops formulation with ibuprofen and evening primrose oil leads to a high concentration of API in the very deep skin area (>20% in fluid).

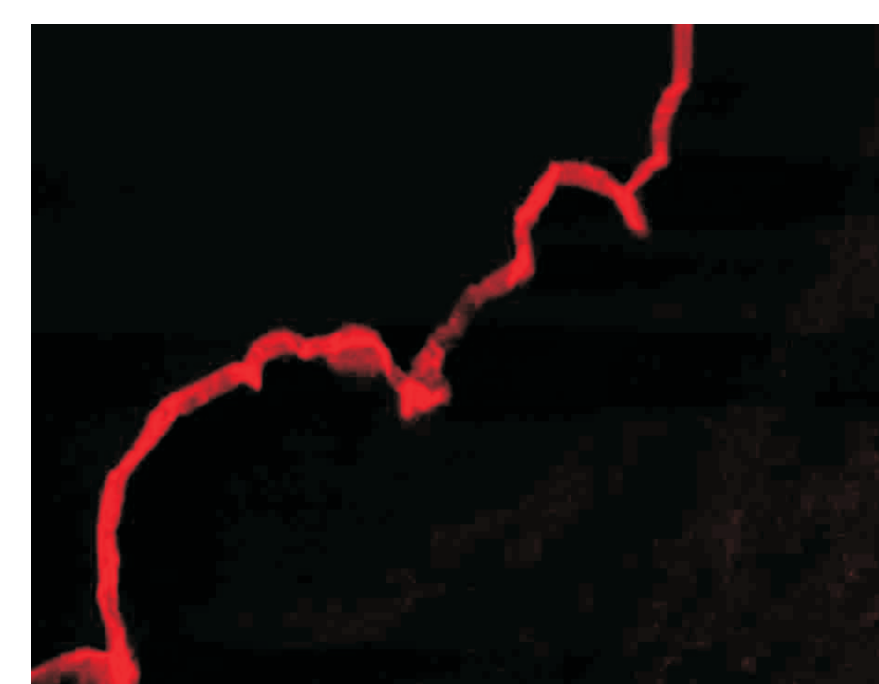
### Penetration of Ibuprofen (5%, 24 h)



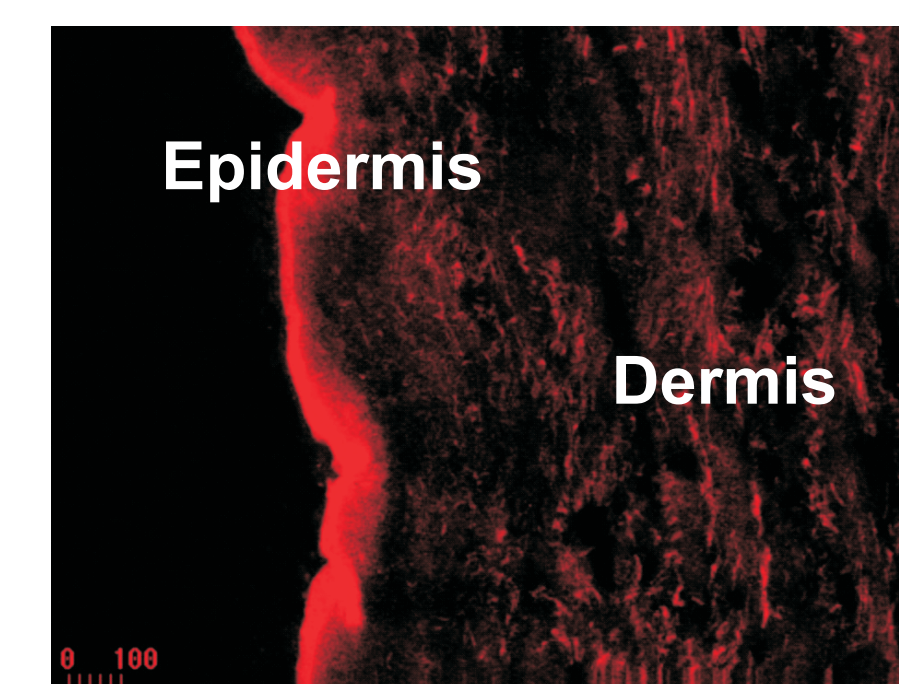
## ... even poorly soluble APIs

The poorly soluble lipophilic fluorescent dye Dil (1,1'-Diocetyl-3,3,3',3'-Tetramethylindocarbocyanine Perchlorate) was encapsulated into flexible nanosomes as well into Lipo-Tops. In contrast to the nanosomes the new carrier system is characterized by smaller vesicles and very homogenous size distribution. The penetration of Dil into human skin was determined by confocal laser scan microscopy (0.5% Dil / 5 h).

### Penetration of lipophilic Dil



**Nanosomes**

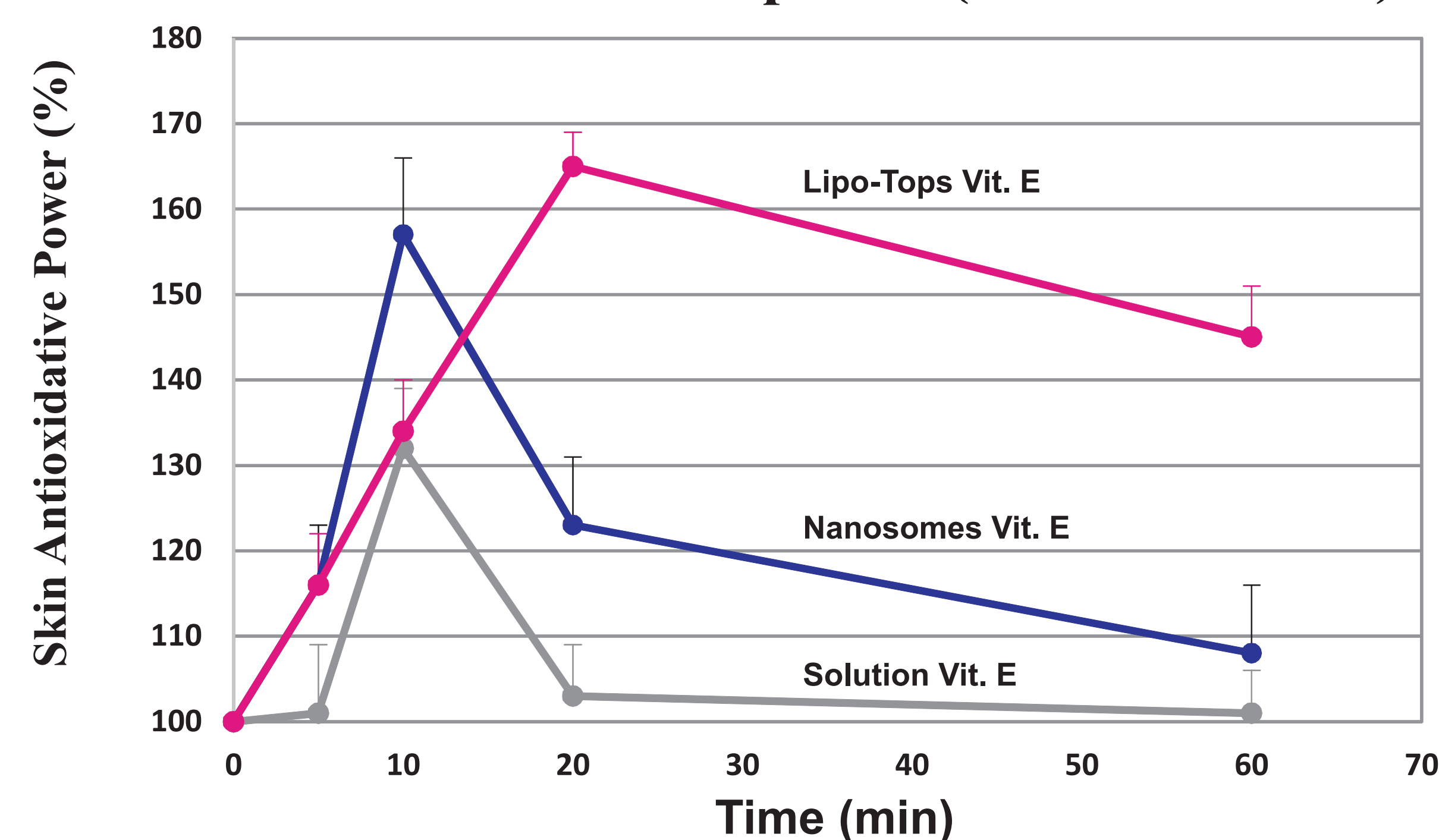


**Lipo-Tops**

## Strong biological Effects

Tocopherol is a widely used lipophilic active ingredient with high radical scavenging properties. By encapsulation of 10% of this vitamin E into Lipo-Tops the antioxidative potential in human skin could be clearly increased which was measured by electron spin resonance spectroscopy. Also the activity of encapsulated vitamin E is retained at 100% over 12 months at 4° C storage [K. Jung et al (2006); SÖFW Journal 132 38-44].

### Penetration of Tocopherol (10% Vitamin E)



## Stability of Vesicles

The integrity and stability of the lipidic carrier systems inside a final dermatological formulation were tested by ESR (electron spin resonance spectroscopy) (Gematria Test Lab, Berlin).

It was proven that Tops are stable (no degradation) in the cream and able to penetrate out of this formulation after dermal application too.

### Stability (%)

Vesicles	t = 0h	t = 24h	t = 48
Liposomes	100	100	95
Hydro-Tops	100	100	100
Lipo-Tops	95	95	95

Water, Petrolatum, Propylene Glycol, PEG-20 Glyceryl Stearate, Caprylic/Capric Triglyceride, Cetyl Alcohol, Polysorbate 60 + 5% Vesicles

## Conclusion

The Sopharcos technology opens the chance to encapsulate a huge variety of different lipophilic components & oils and to enhance their solubility, their stability and their penetration depth into the skin or hair follicles.

In comparison to conventional “Nanosomes” based on phospholipids, this novel nanoemulsion (80-200nm) exhibits unique homogenous size distribution, higher encapsulation efficiency and better bioavailability of APIs in the skin.

Lipo-Tops are patented in Europe and the USA.