



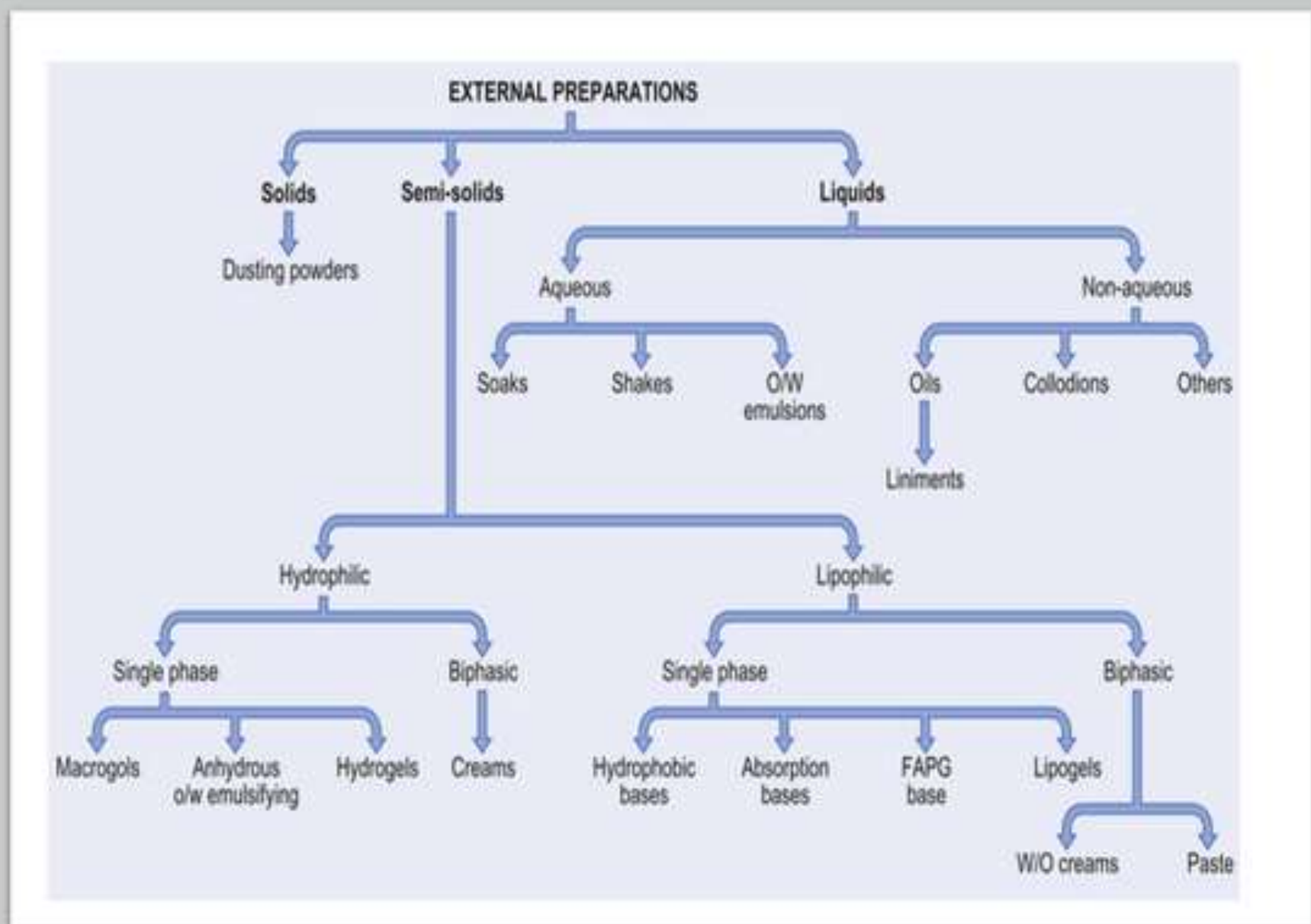
UNIVERSITY OF  
**PATRAS**  
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ



# Φυσικά Συστατικά και Προηγμένες Τεχνολογίες στα Σκευάσματα Τοπικής Εφαρμογής

**Sophia Hatziantoniou, Pharm B, PhD**  
Asst Professor of Pharmaceutical Technology  
President of Hellenic Society of Cosmetology  
Department of Pharmacy  
School of Health Sciences  
University of Patras, Greece

Σκευάσματα  
τοπικής  
εφαρμογής



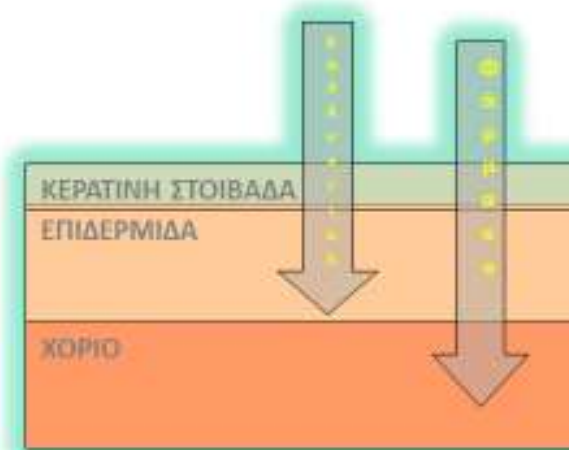
# Διάκριση Καλλυντικού - Φαρμάκου

## Καλλυντικό Προϊόν:

1. Παροδική δράση
2. Χρησιμοποιείται μόνο για την περιποίηση και τη βελτίωση της εμφάνισης του δέρματος.
3. Δεν προορίζεται αποκλειστικά για την θεραπεία ή την προστασία από ασθένειες.
4. Η ποιοτική και ποσοτική τους σύσταση πρέπει να είναι η επιτρεπόμενη (Παραρτήματα Κανονισμού)
5. Οι ισχυρισμοί δράσης να δείχνουν κοσμητολογική δράση (όχι θεραπευτική δράση)

## Κριτήριο κατάταξης: Διέλευση ουσιών

- ▶ - Δράση μέχρι το χόριο: **Καλλυντικό**
- ▶ - Δράση μετά το χόριο – αιματική κυκλοφορία: **Φάρμακο**



# Nanoparticles / Nanocarriers

main uses:

as UV filters

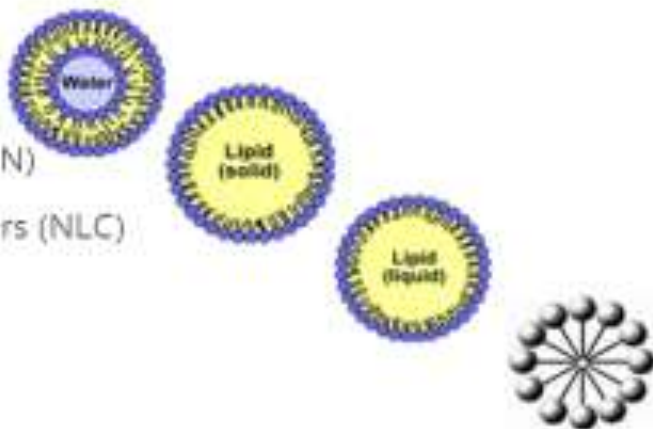
as Carriers

soluble – biodegradable:  
disintegration upon application to  
skin into molecular species  
(liposomes, SLN, nanoemulsions)  
(Nanocarriers)

insoluble – biopersistent: Metal  
oxide nanoparticles ( $\text{TiO}_2$ ,  $\text{ZnO}$ ),  
fullerenes etc

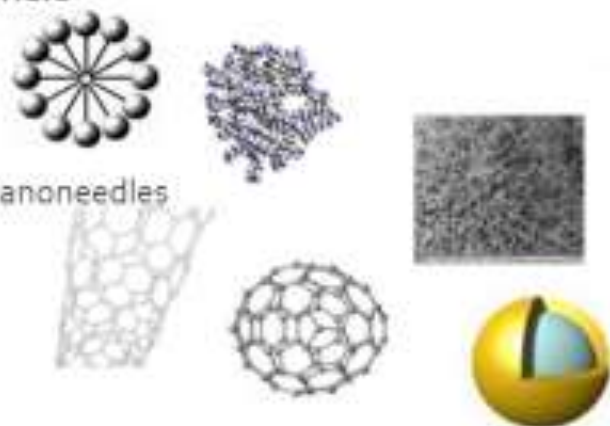
## Lipidic nanocarriers

- Liposomes
- Solid Lipid Nanoparticles (SLN)
- Nanostructures Lipidic Carriers (NLC)
- Nanoemulsions
- Micelles



## Polymeric nanocarriers

- Micelles
- Dendrimers
- nanopores and nanoneedles
- Nanotubes
- Fullerenes
- Nanoshells

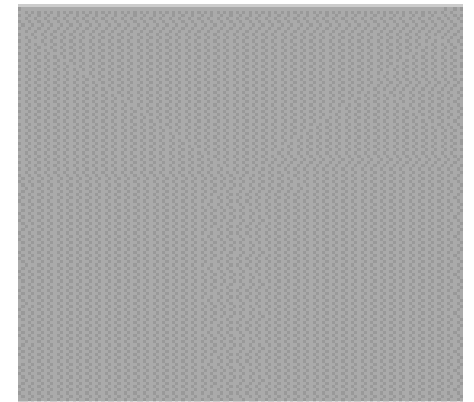


## Inorganic nanoparticles

- NanoZnO
- NanoTiO<sub>2</sub>
- Nano Si
- Nano Ag
- NanoAu



# Aqueous dispersions of lipophilic molecules and Physicochemical stability



SCANNING ELECTRON MICROSCOPY  
STUDY ON NANOEMULSIONS AND  
SOLID LIPID NANOPARTICLES  
CONTAINING HIGH AMOUNTS OF  
CERAMIDES

- SOPHIA HATZIANTONIOU,  
GEORGIA DELI, YORGOS NIKAS,  
COSTAS DEMETZOS, GEORGIOS  
Th. PAPAIOANNOU, *Micron*.  
2007, 38, 819-823

Table 1  
The lipid content of the nanoemulsions and solid lipid nanoparticles

|  | Granules/<br>Nanoparticles <sup>a</sup> | Granules<br>(% of lipid content) | ph-values<br>(near 100%) | PI <sup>b</sup> |
|--|---|----------------------------------|--------------------------|-----------------|
| <b>Nanoemulsions (NE)</b>              |   |                                  |                          |                 |
| NE 1                                   | 101                                     | 0                                | 187.7 ± 0.7              | 0.2             |
| NE 2                                   | 108                                     | 4.8                              | 188.6 ± 0.4              | 0.3             |
| NE 3                                   | 111                                     | 23.2                             | 192.8 ± 0.8              | 0.3             |
| NE 4                                   | 240                                     | 29.3                             | 202.1 ± 0.8              | 0.2             |
| NE 5                                   | 110                                     | 41                               | -                        | -               |
| <b>Solid lipid nanoparticles (SLN)</b> |   |                                  |                          |                 |
| SLN 1                                  | 101                                     | 0                                | 227.6 ± 5.5              | 0.2             |
| SLN 2                                  | 108                                     | 5.0                              | 203.7 ± 0.3              | 0.3             |
| SLN 3                                  | 111                                     | 13.0                             | 219.4 ± 1.5              | 0.5             |
| SLN 4                                  | 111                                     | 25.0                             | 303.8 ± 0.9              | 0.7             |
| SLN 5                                  | 110                                     | 51.0                             | -                        | -               |

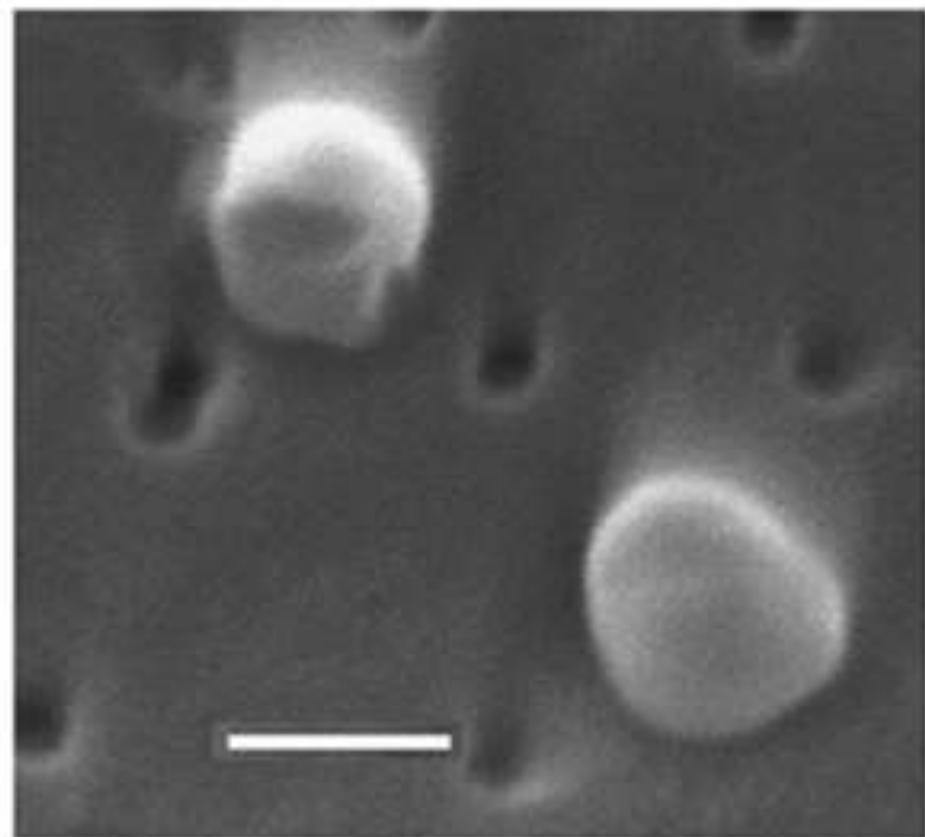
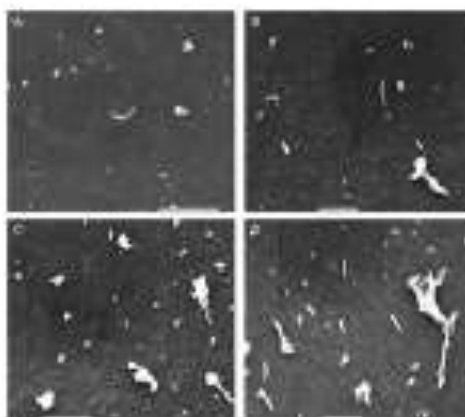
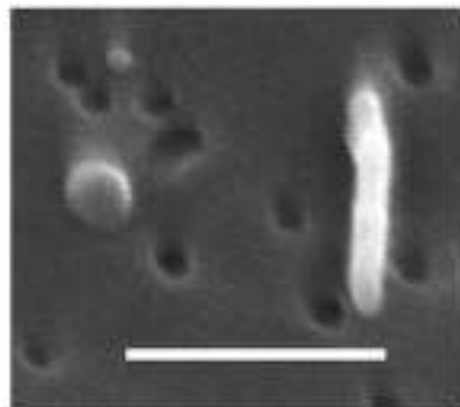
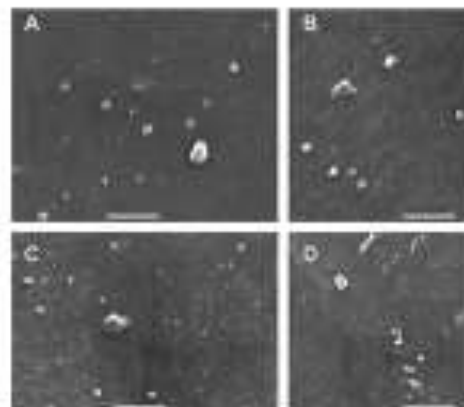
<sup>a</sup> n=100.

<sup>b</sup> PI: Polydispersity Index.

<sup>c</sup> The lipid content is calculated about first and fifth of triglyceride (taglycerol 10) and ceramide (24) for nanoemulsions and solid lipid nanoparticles, respectively.




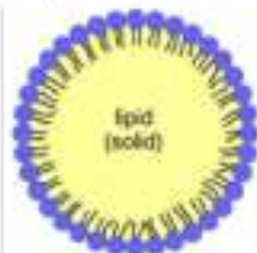



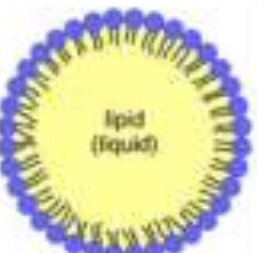


Fig. 1. Molecular structure of a ceramide.

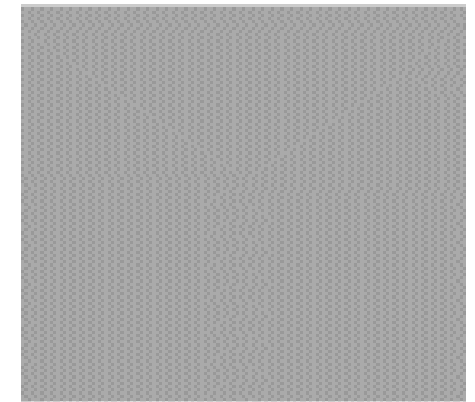


# Influence of the ingredients on the chemical stability of the incorporated molecule

ΑΝΑΠΤΥΞΗ ΚΑΛΛΥΝΤΙΚΩΝ  
ΝΑΝΟΓΑΛΑΚΤΩΜΑΤΩΝ ΓΙΑ ΤΗΝ  
ΣΤΑΘΕΡΟΠΟΙΗΣΗ  
ΑΝΤΙΟΞΕΙΔΩΤΙΚΩΝ ΒΙΤΑΜΙΝΩΝ  
ΜΑΡΙΑ ΠΑΠΑΚΩΝΣΤΑΝΤΙΝΟΥ,  
Μεταπτυχιακή Εργασία, Πάτρα  
2016

|     | Carrier  | Tocopheryl acetate   | $\beta$ -carotene  |  |
|-----|--|--|--|--|
| SLN |   |   |   |   |
| NE  |  |  |  |  |

# Physicochemical stability of the carrier



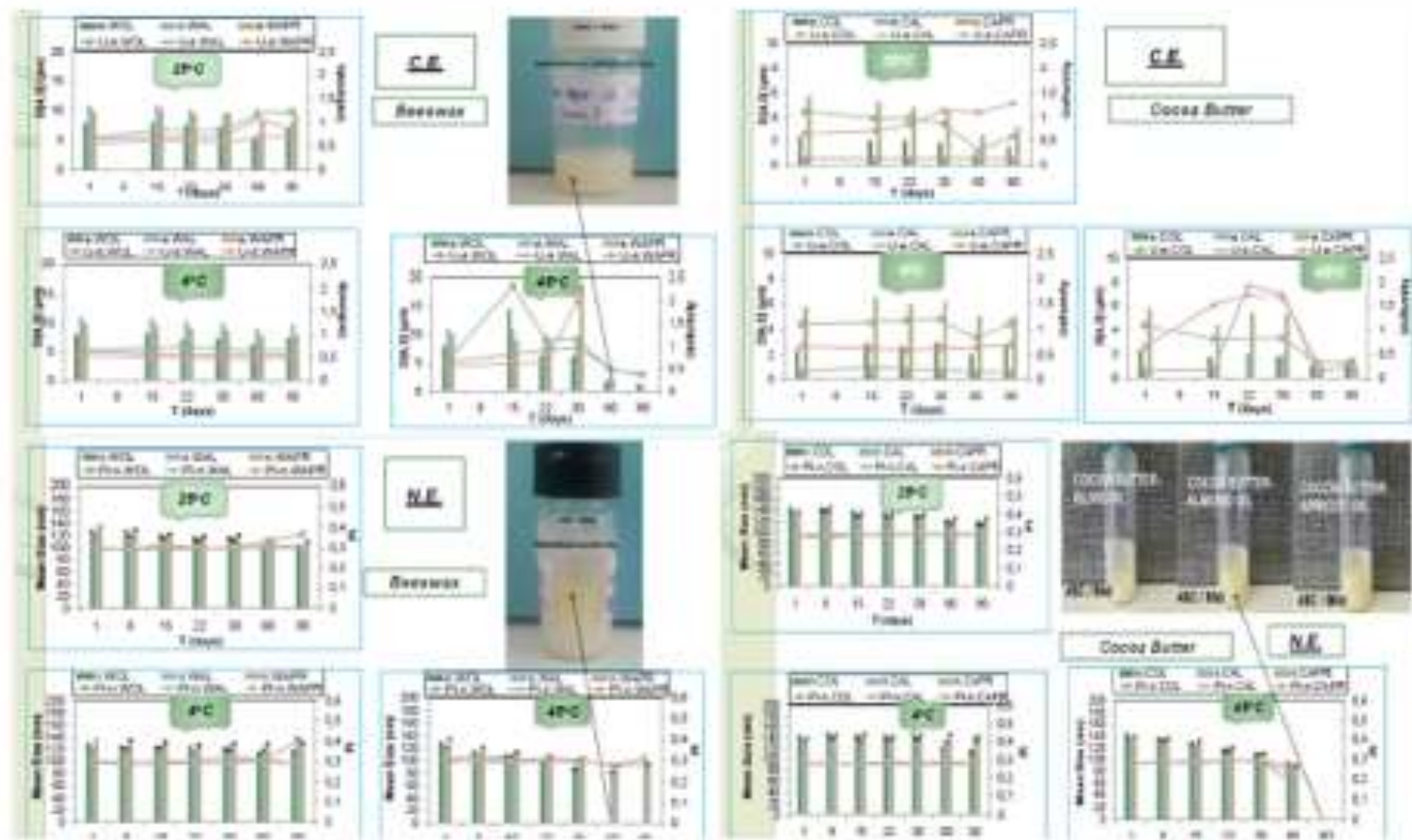


# Preparations of plant oil nanoemulsions and evaluation of their stability and their occlusive and hydration effects on skin



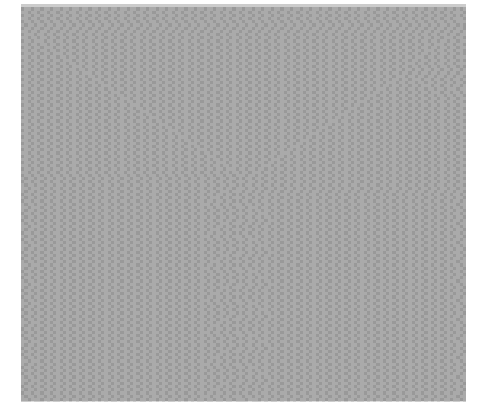
Aggeliki Liakopoulou, Pavlos Klepetsanis, Konstantinos Avgoustakis and Sophia Hatziantoniou\*  
IPC 2016, Antigua, Guatemala

# Results - Stability



- Nanoemulsions containing plant origin oils have shown better physicochemical stability compared to their corresponding conventional emulsions.

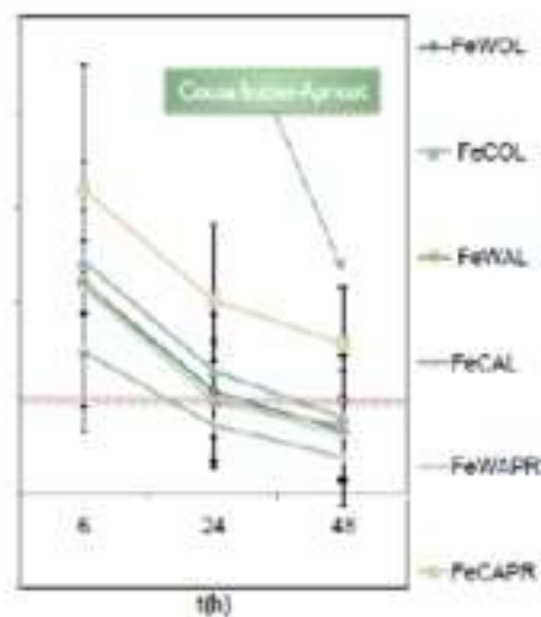
# Enhancement of Skin Barrier (occlusive index)



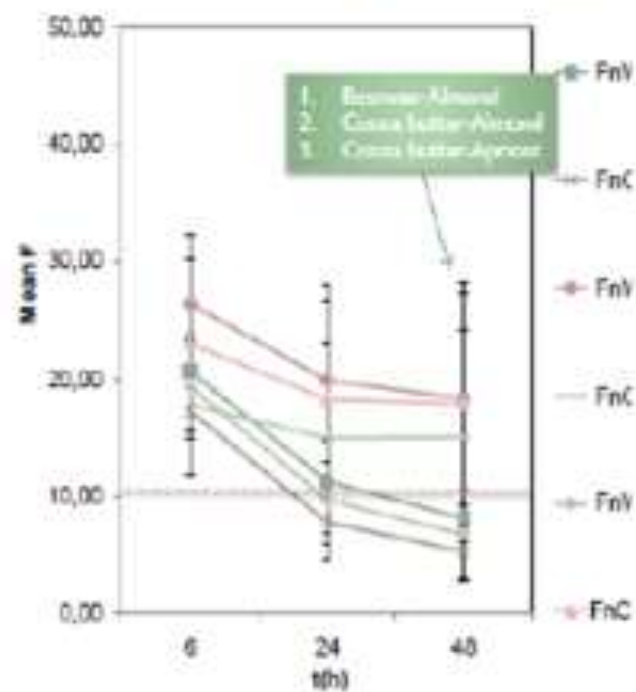
# Occlusive Index and Film Forming capacity

Compare of the occlusive index F in N.E.

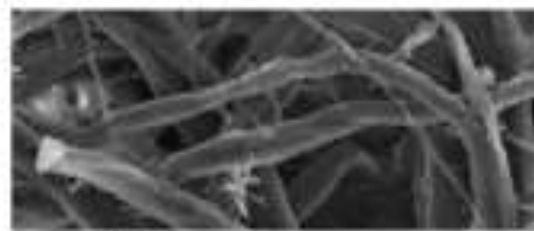
Comparison of the occlusive index F



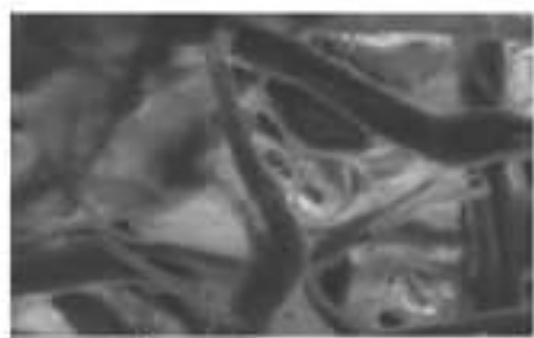
*the lower acceptable occlusion limit*



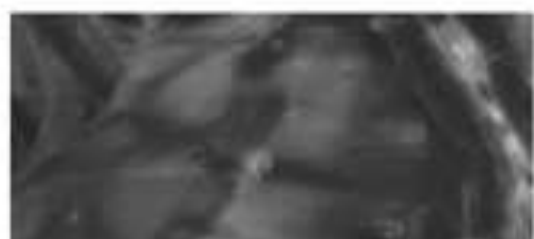
Plain filter paper



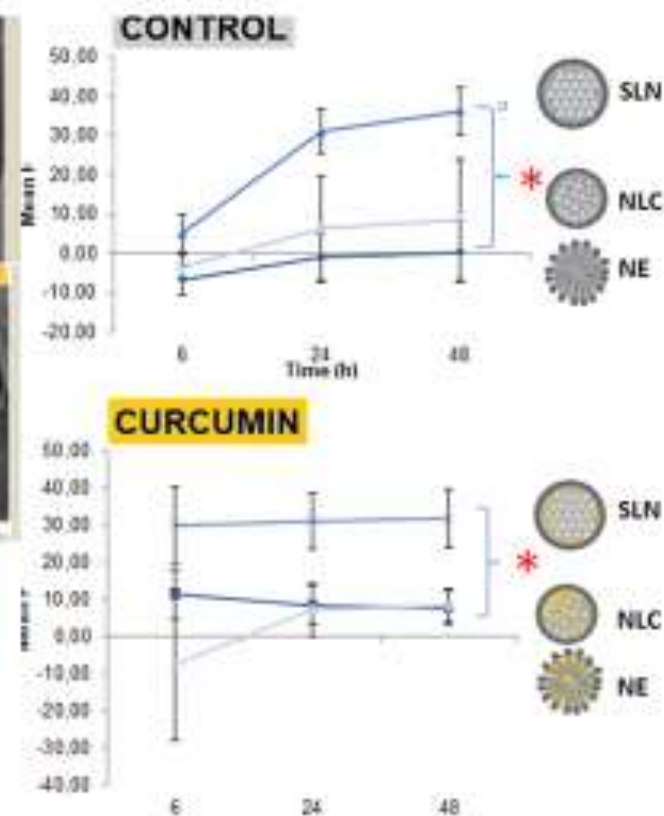
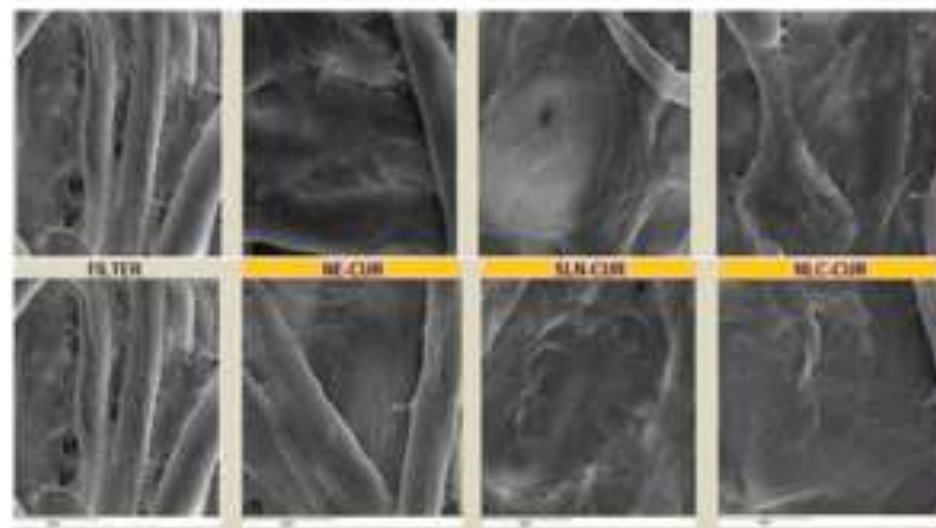
filter paper with conventional emulsion



filter paper with nanoemulsion

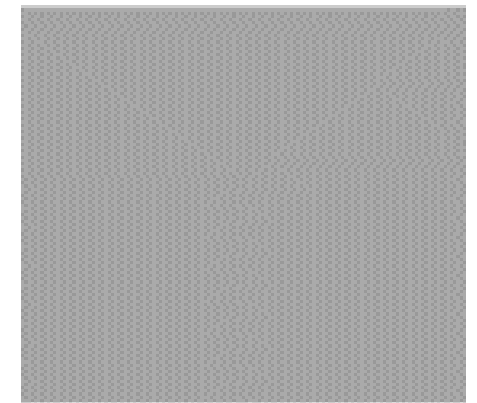


# Nanolipidic Carriers Containing Curcumin: Preparation and Physicochemical Characterization

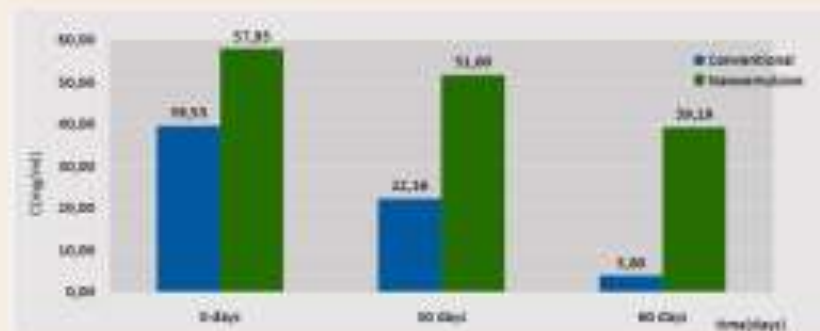


Aggeliki Liakopoulou, Konstantinos Avgoustakis and Sophia Hatziantoniou\*  
NanoMed, Rome, July 2017

# Alterations on the pharmacokinetic profile of incorporated molecule



# STUDY OF THE CONTRIBUTION OF INCORPORATION IN NANOEMULSIONS ON STABILITY AND RETENTION OF LAVENDER ESSENTIAL OIL



The concentration of lavender essential oil incorporated in both CE and NE at 30 and 60 days.

Konstantina Flekka, Virginia Dimaki, Pavlos Klepetsanis, Konstantinos Avgoustakis, Fotini Lamari, Sophia Hatziantoniou

**IPPC2017 Patras, Greece**



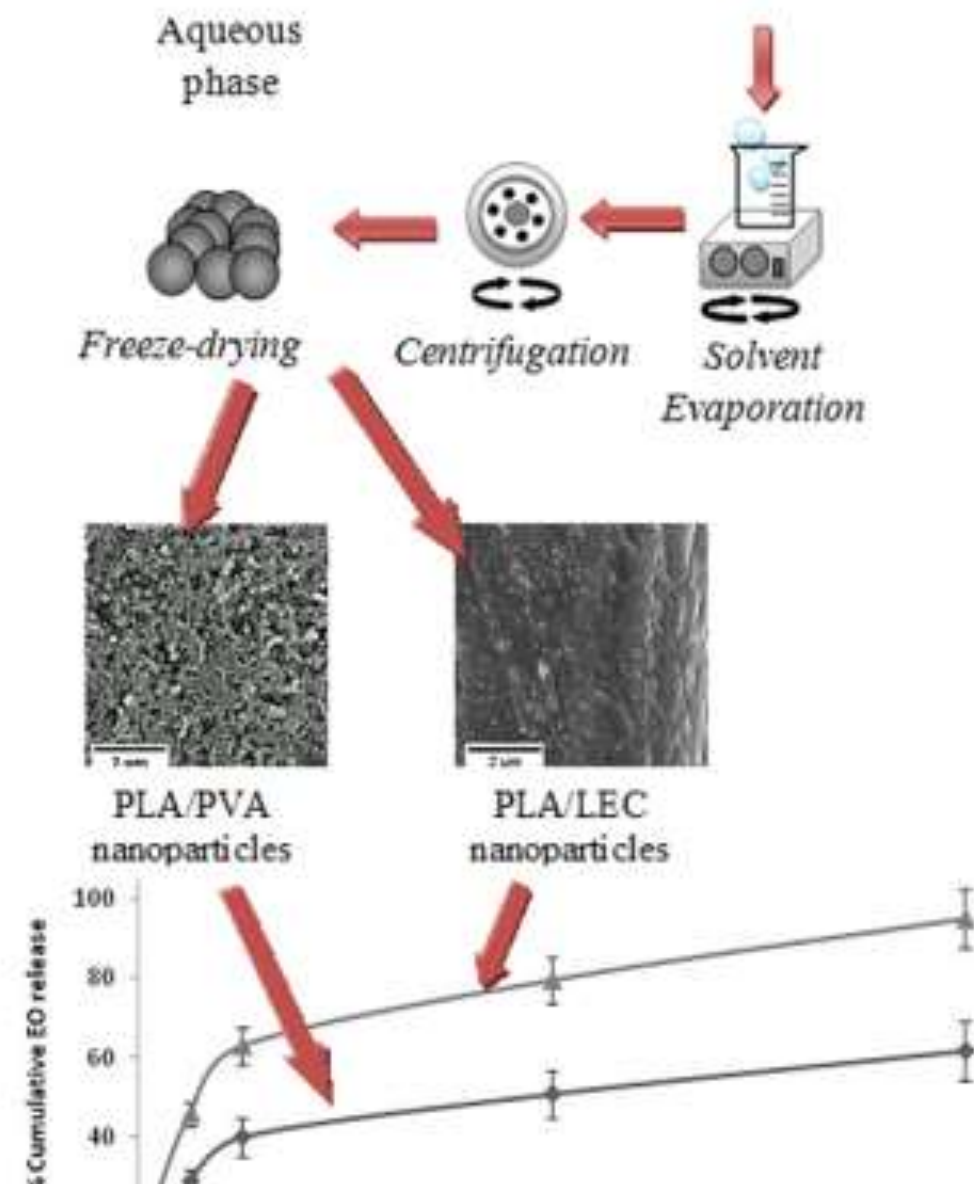
# Release modification of Pistacia lentiscus var. chia essential oil by incorporation in polymeric nanoparticles for topical application

Vrouvaki, E. Koutra, M. Kornaros, K. Avgoustakis, F. N. Lamari, and S. Hatziantoniou

Pharmaceutics. 2020 Apr  
14;12(4):353.

doi:

10.3390/pharmaceutics12040353.

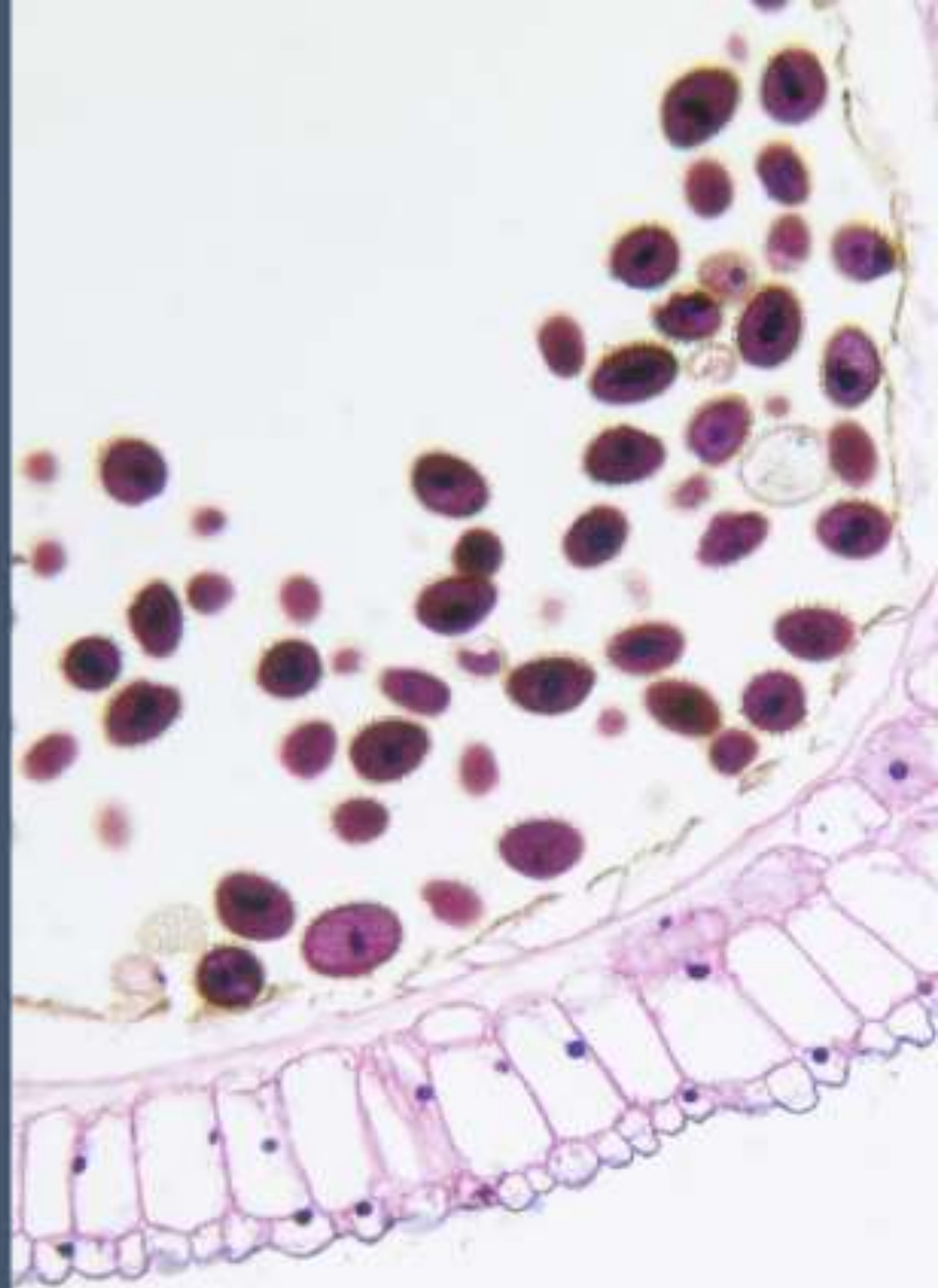




# Skin / nanoparticles interactions

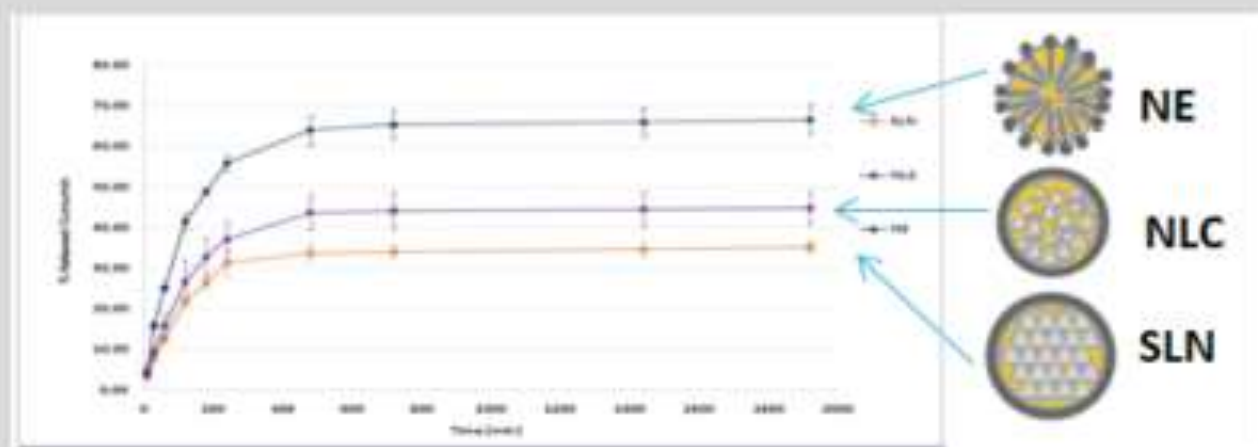
## Steps:

1. Translocation across the skin barrier
2. cellular uptake
3. biological effects.
  - 3.a on the cellular level,
  - 3.b interactions with the skin microenvironment.

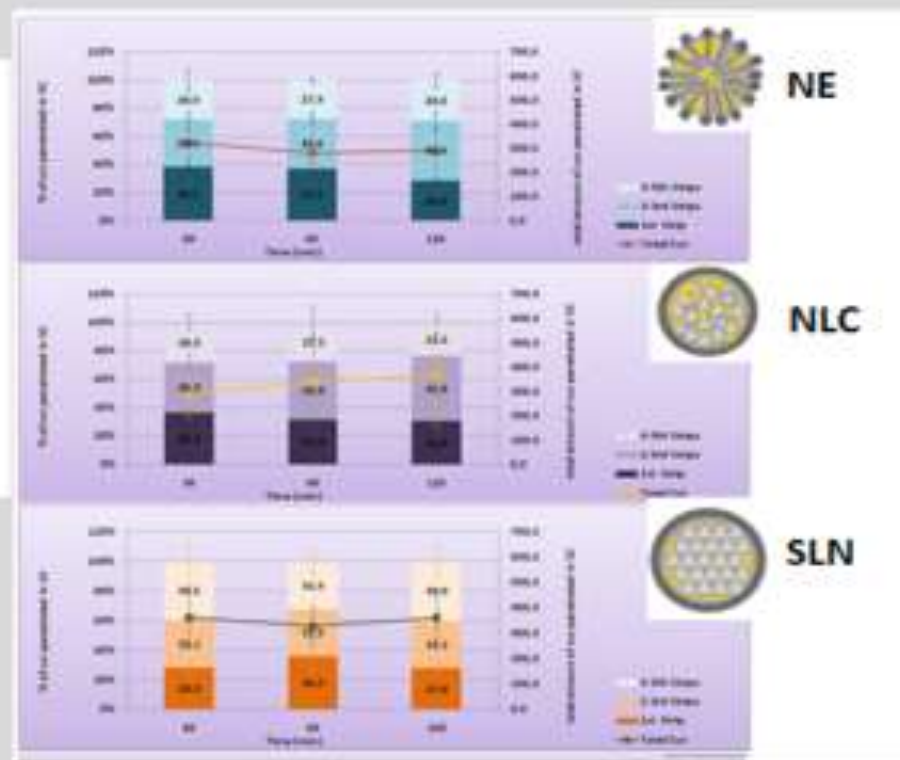


# Effect of Different Lipid Nanocarriers on Percutaneous Absorption of Curcumin

The rate of % release of curcumin incorporated in SLN, NLC or NE, over time



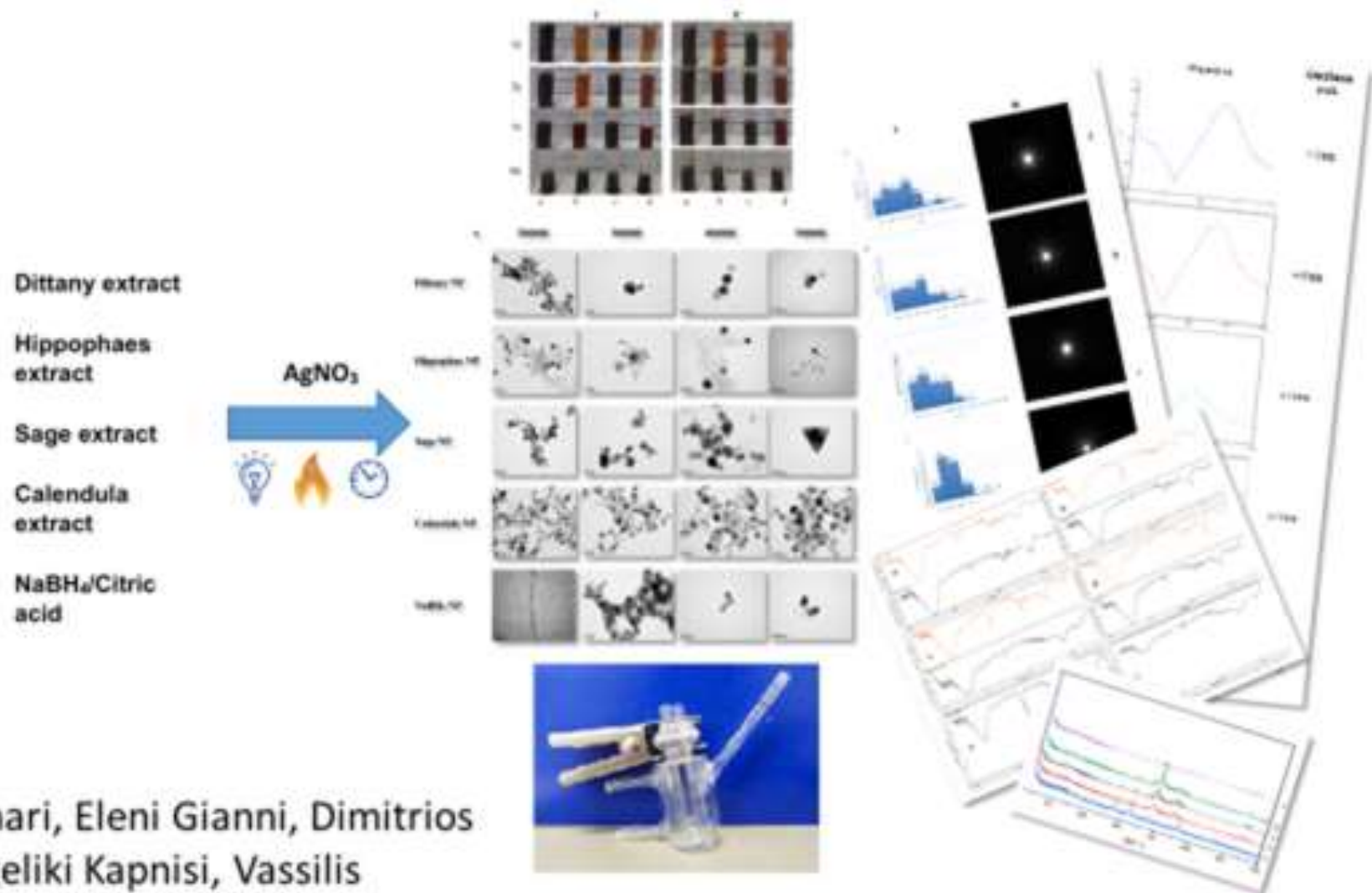
The rate (%) and depth of curcumin penetration in Stratum Corneum after application of SLN, NLC or NE



A. Liakopoulou, E. Mourelatou, K. Avgoustakis, S. Hatziantoniou\*  
Nanotextology, Thessaloniki 2019

# Green synthesis and characterization of silver nanoparticles (AgNPs) using plant extracts

Ioanna K. Siakavella, Fotini Lamari, Eleni Gianni, Dimitrios Papoulis, Malvina Orkoula, Aggeliki Kapnisi, Vassilis Tangoulis, Konstantinos Avgoustakis, Sophia Hatziantoniou  
Nanotechnology, Thessaloniki 2019



# Conclusions

Application of Nanotechnology on natural ingredients may facilitate:

- The aqueous dispersions of lipophilic molecules
- The physicochemical stability Physicochemical stability of the carrier
- The enhancement of Skin Barrier (occlusive index and film forming capacity)
- The alterations on the pharmacokinetic profile of incorporated molecule



# Acknowledgments

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- Dr. Vachliotis D. and Dr. Andreopoulou

MSc course on  
Pharmaceutical Sciences and Technology  
Specialization  
Industrial Pharmacy- Cosmetics Technology  
2014-2018



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# 2018-up to date MSc course on Cosmetology Development and Evaluation of Cosmetic Products



# Ευχαριστώ

sohatzi@upatras.gr

