

The Effect of Resveratrol Loaded Vitamin E Liposomes Against Breast Cancer Cells

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Director, Co-founder & Chief Scientist of GMPriority Pharma

▪ Researcher & Academic

- Founder and leader of the Pharmaceutical Research Group, part of MTRC
- Professor of Pharmaceutics & Nanomedicine
- Director of Director of the Medical Technology Research Centre
- Several managerial and educational roles

▪ National/International Roles

- Director, Academy of Pharmaceutical Sciences
- Nano TransMed Associate Editor

▪ Recognitions

- Corporate LiveWire award, Innovation and Excellence 2023
- ARU VC Award for Research and Innovation 2022, 2023
- HeMS Dean Award for Research 2022, 2023
- Fellow of the Royal Society of Chemistry and Chartered Chemist
- Innovate UK finalist for *Best of the Best* KTP, 2024, 2025
- Board member of the Academy of Pharmaceutical Sciences
- CRS award winner







Cancer Statistics in the UK

Cases

367,167



New cases of cancer, 2015-2017, UK.

Deaths

166,533



Deaths from cancer, 2016-2018, UK.

Survival

50%



Survive cancer for 10 or more years, 2010-11, England and Wales

The Burden of Cancer to the UK Economy

£5 BILLION

Cost of Cancer to NHS UK

£18 BILLION

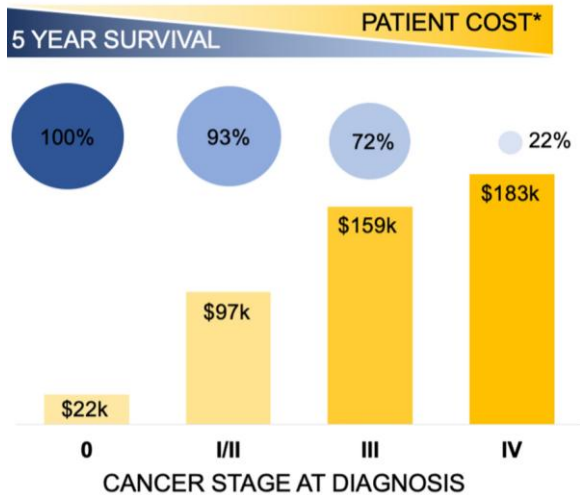
Cost of Cancer to UK Economy

£1.2 BILLION

NHS Spend on Anticancer Drugs

£340 MILLION

NHS Cancer Drugs Fund (CDF)



Cost of Drug (per patient per year)

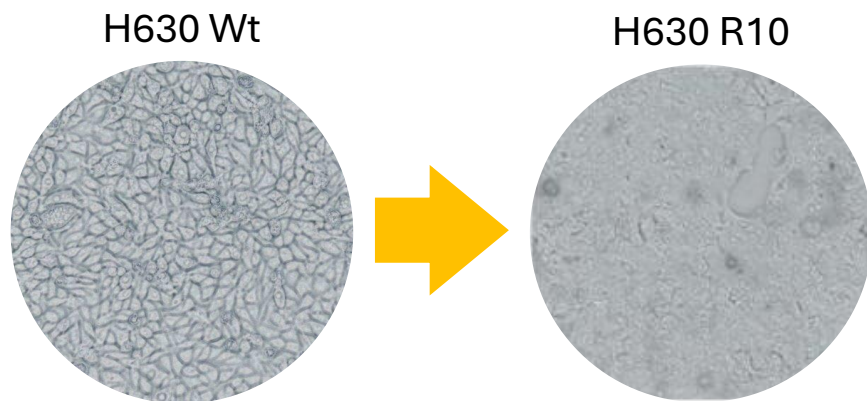
Sorafenib £39,000
Imatinib £21,000
Nilotinib £21,000
Dasatinib £31,000

Bosutinib £76,000
Synribo £100,000
Ponatinib £90,000
Lapatinib £24,000

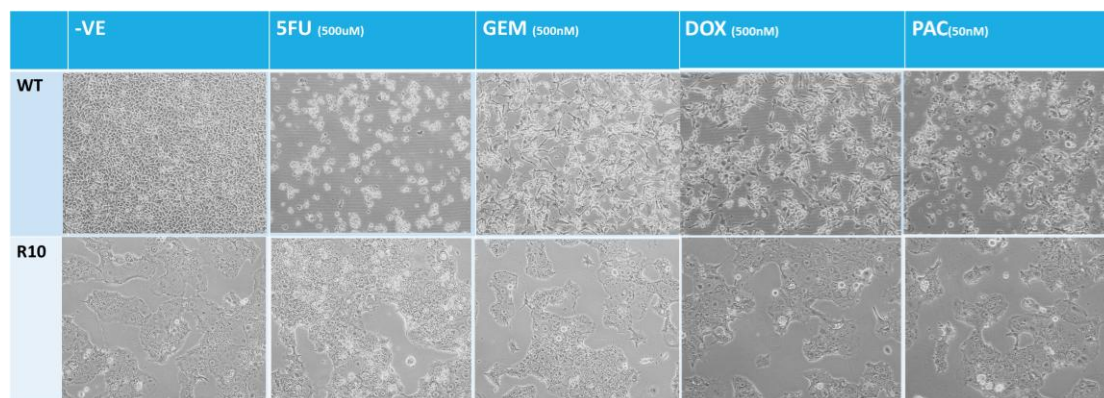
<https://www.gov.uk/government/publications/2010-to-2015-government-policy-cancer-research-and-treatment/2010-to-2015-government-policy-cancer-research-and-treatment>
cancerresearchuk.org

Acquired Resistance to Anticancer Drugs

The acquired resistance induced by repetitive exposure of cancer cells to anticancer drugs is one of the major limitations to successful chemotherapy



IC ₅₀ (uM)	5FU
H630 Wt	4.6 ± 1.6
H630 R10	462 ± 8



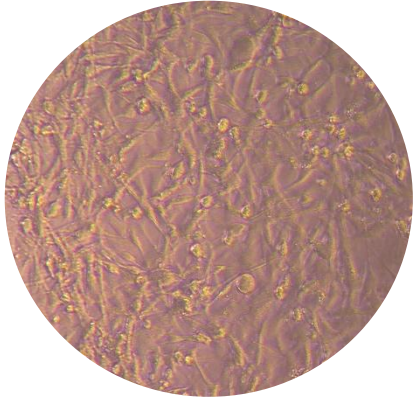
IC ₅₀ (nM)	GEM	DOX	PAC
H630 Wt	205 ± 118	135 ± 16	2.5 ± 1.7
H630 R10	>1000	>1000	>1000

The morphology (100 magnification) of H630 cell lines after 72 h drug exposure

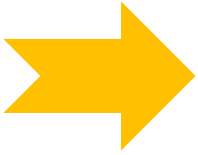
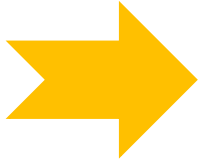
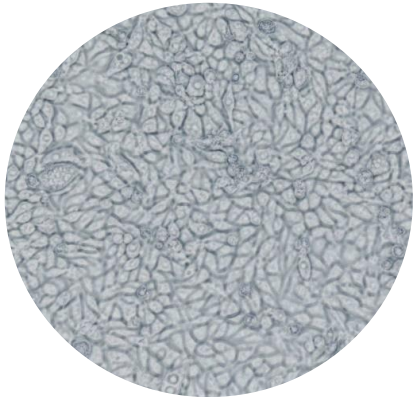
Unpublished data

Acquired Resistance to Anticancer Drugs

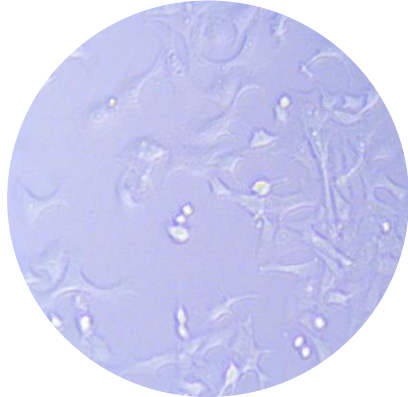
MDA-MB-231



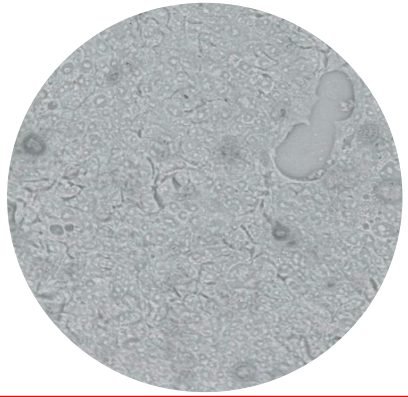
H630 Wt



MDA-MB-231_{PAC10}



H630 R10



Drug Repositioning – A new way for drug development



New tricks for old drugs

Faced with skyrocketing costs for developing new drugs, researchers are looking at ways to repurpose older ones – and even some that failed in initial trials.

BY NICOLA NOSENGO

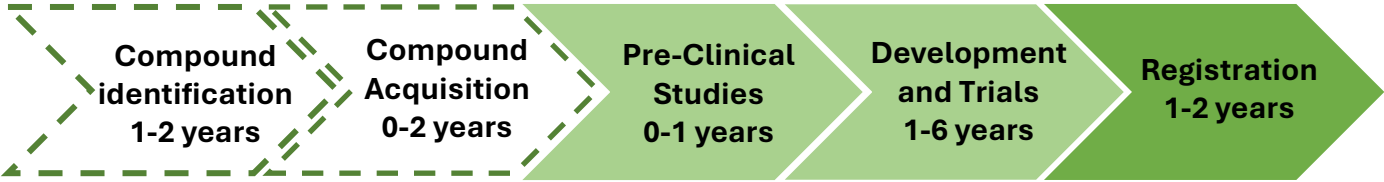
Drug development process 10-17 years

\$1.2 - \$2.5 billion



Drug repositioning 3-8 years

\$8.4 - \$40 million



Resveratrol



Tangerine

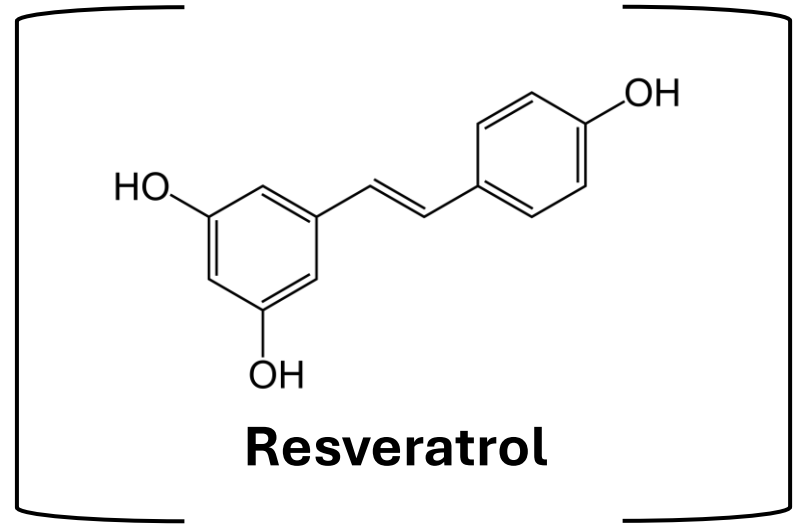


Peach

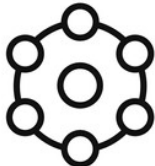


Peanut

Sources



Health benefits



Antioxidant



Cardiovascular Protection

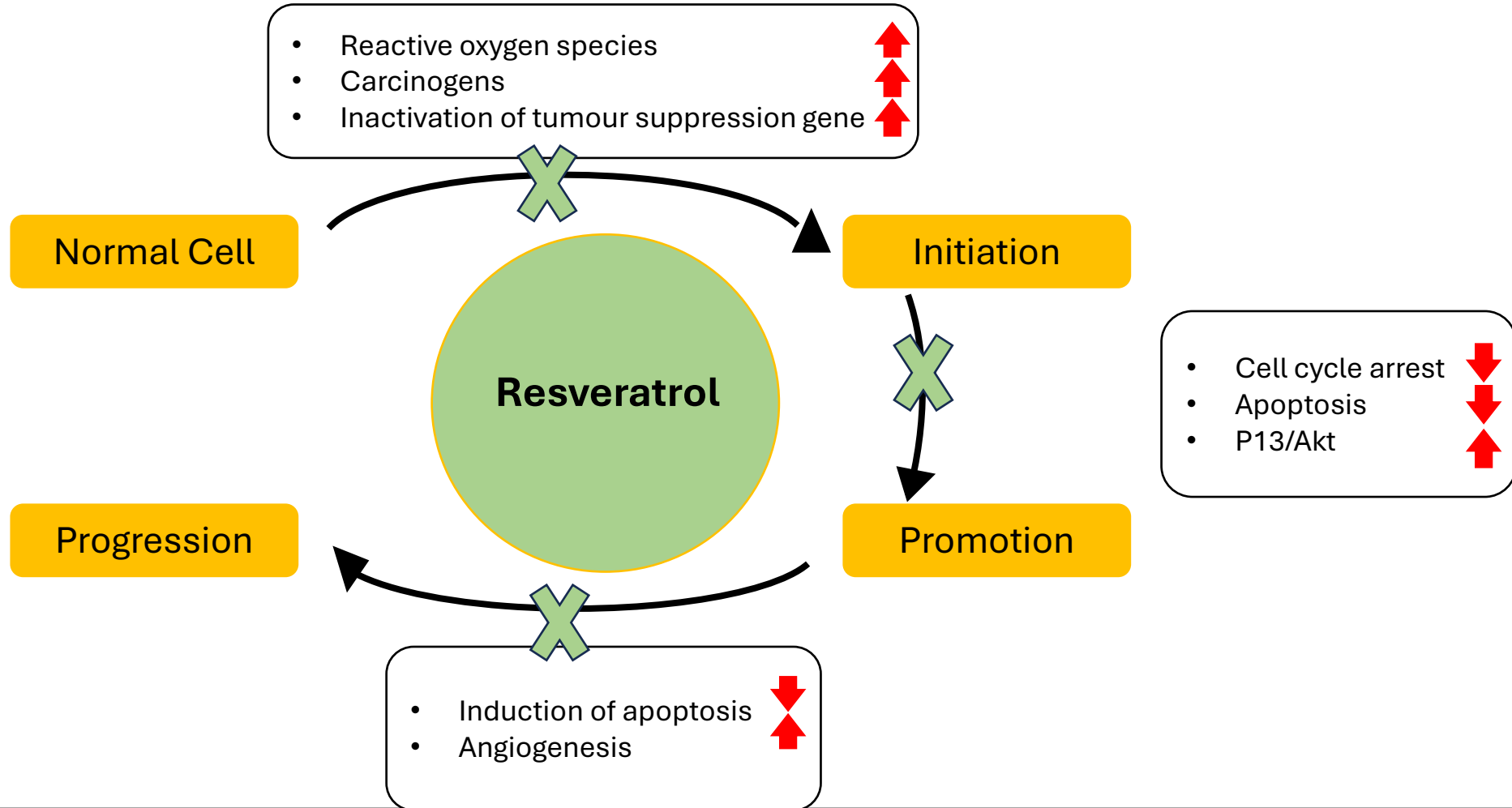


Anticancer



Anti-inflammatory

Resveratrol – Anti-Cancer



The Challenges of using Resveratrol

Formulation difficulties

“Its hydrophobic nature and instability make it difficult to formulate into clinically viable dosage forms.

Advanced delivery systems (**e.g., liposomes** ..) are being explored but face **scalability hurdles.**”



Low bioavailability



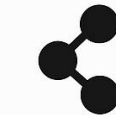
Short half-life



Dose-dependent effects



Instability

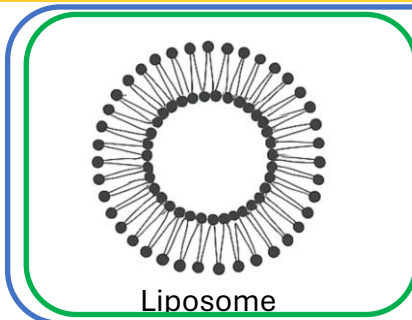


Non-specific targets

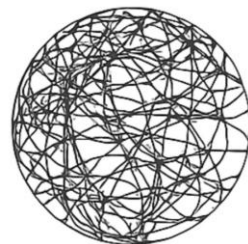


Formulation difficulties

Nano-encapsulation may bridge the gap between “bench” and “bed”



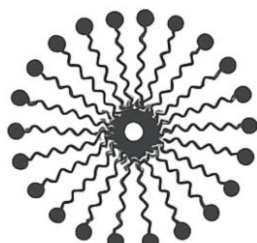
Liposome



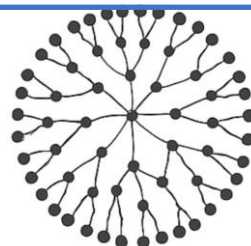
Polymeric Nanoparticles



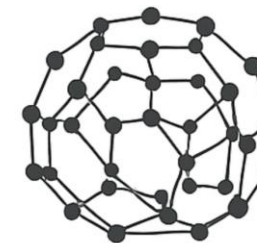
Solid Lipid Carrier



Micelle



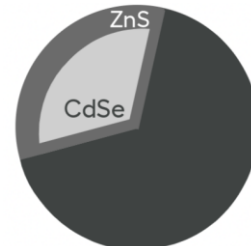
Dendrimer



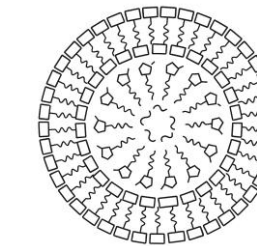
Gold Nanoparticles



Nanocage



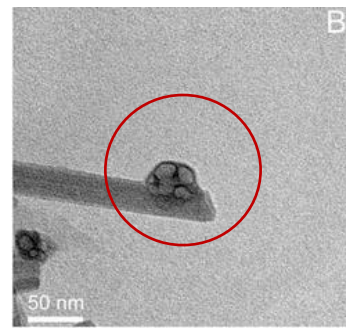
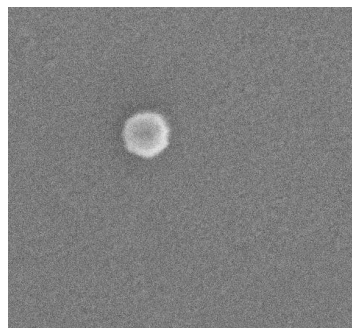
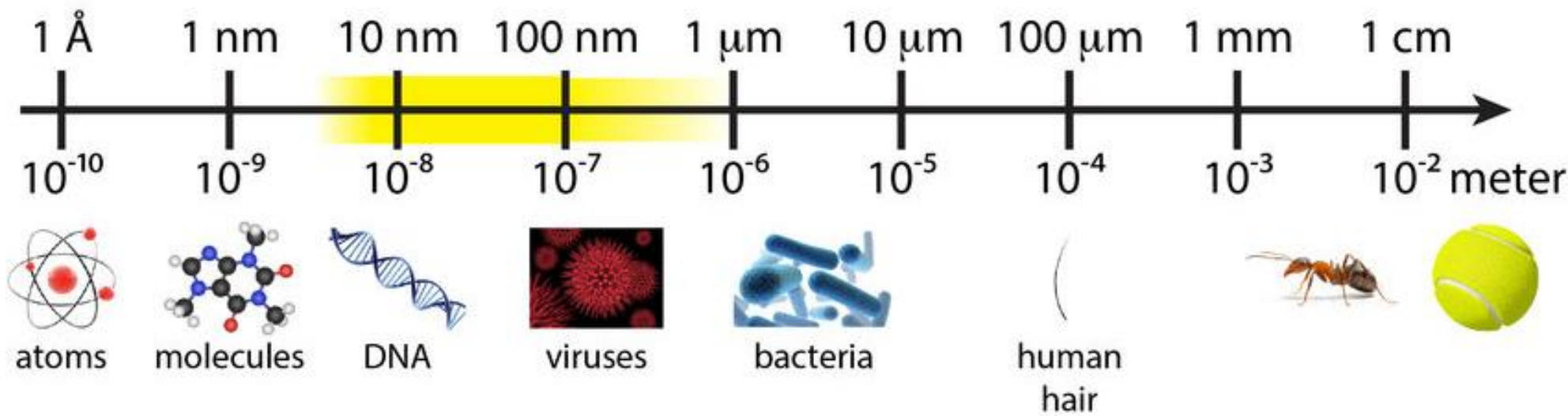
Quantum Dots



Amphiphilic Cyclodextrins

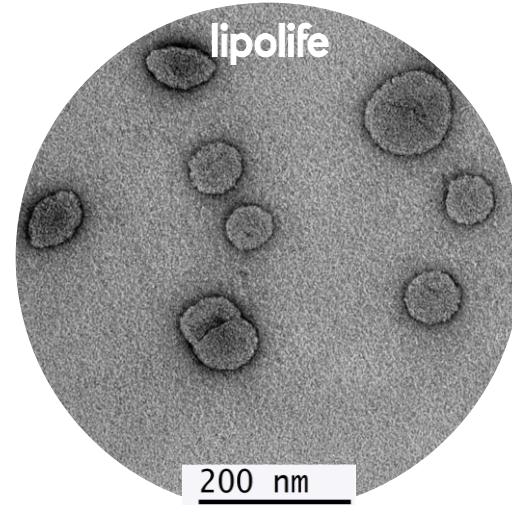
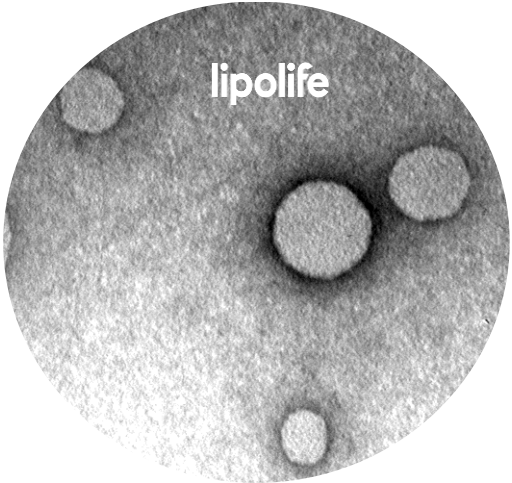
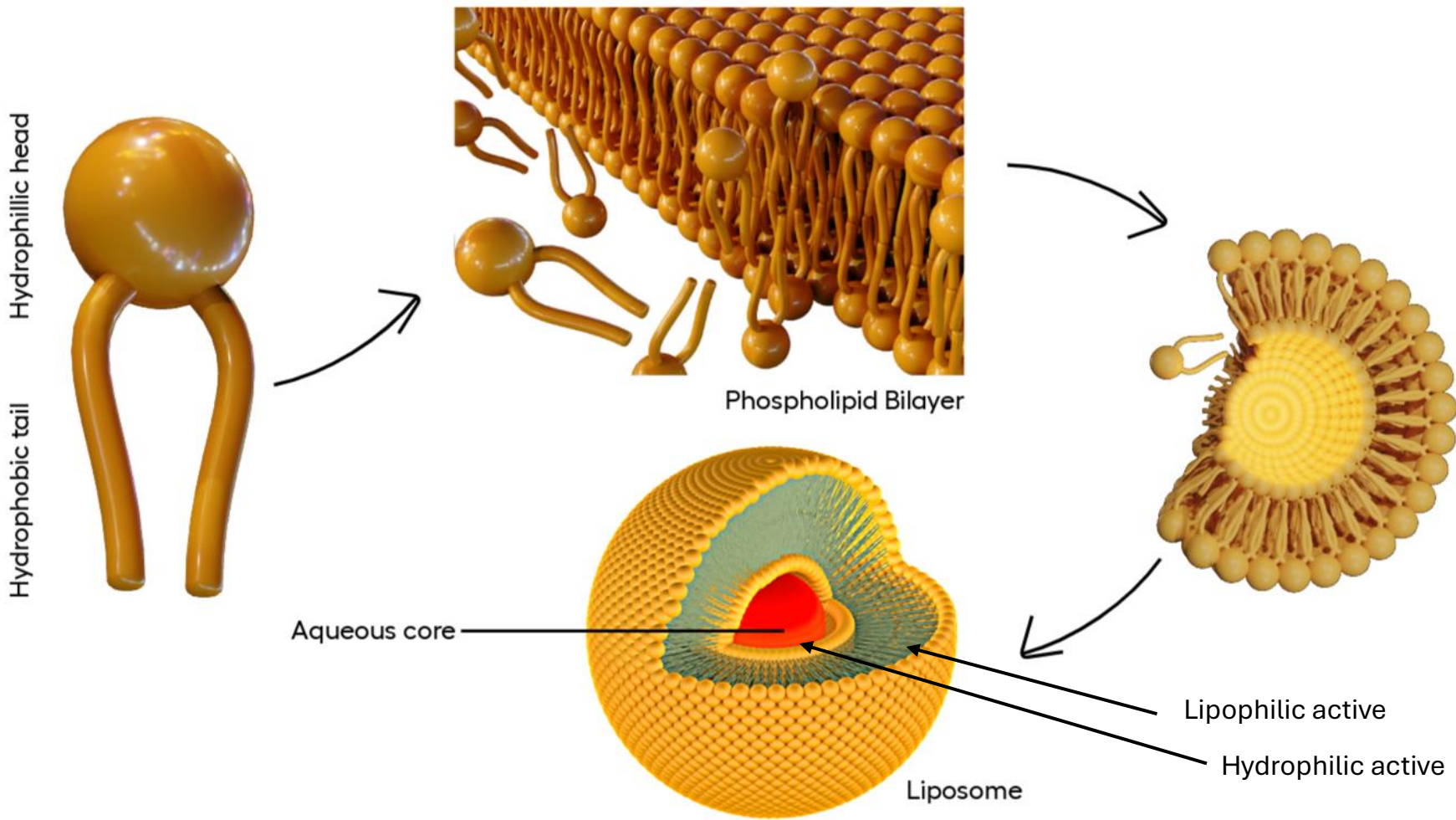
Najlah, M., 2021. <https://doi.org/10.4155/tde-2021-0009>

The Nanoscale

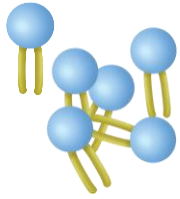


Detail of a single viral particle supported on a xanthan-modified sepiolite fibre (Reproduced with permission.)
(Copyright 2009, Wiley Co.).

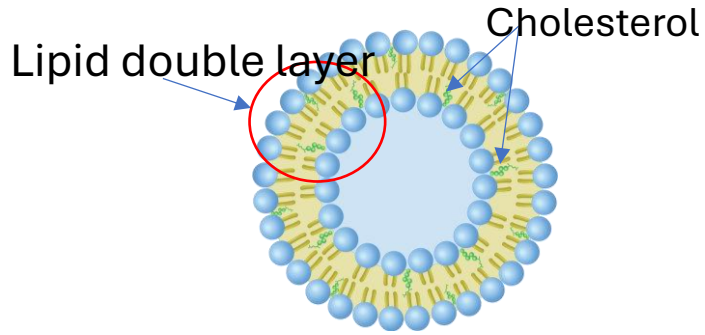
Liposomes



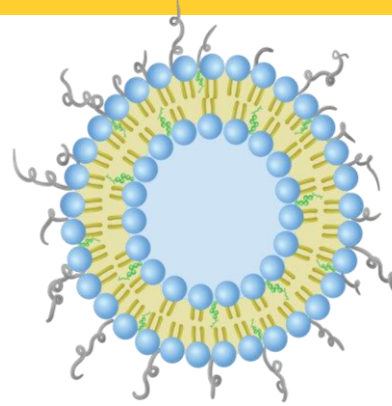
Liposomes



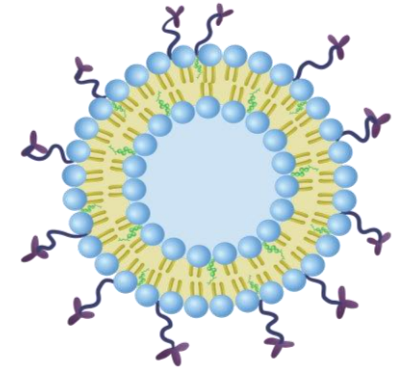
Phospholipids



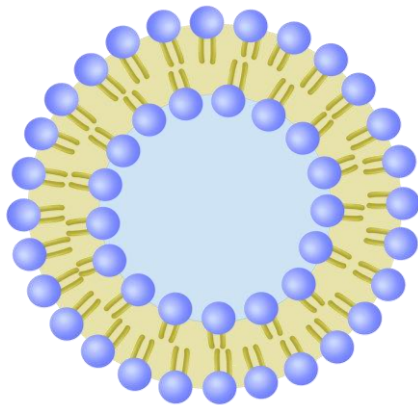
Conventional liposomes



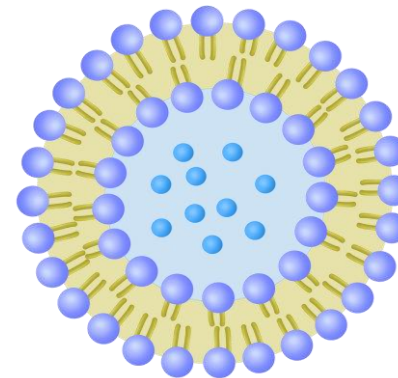
Long circulating liposomes



Targeting liposomes



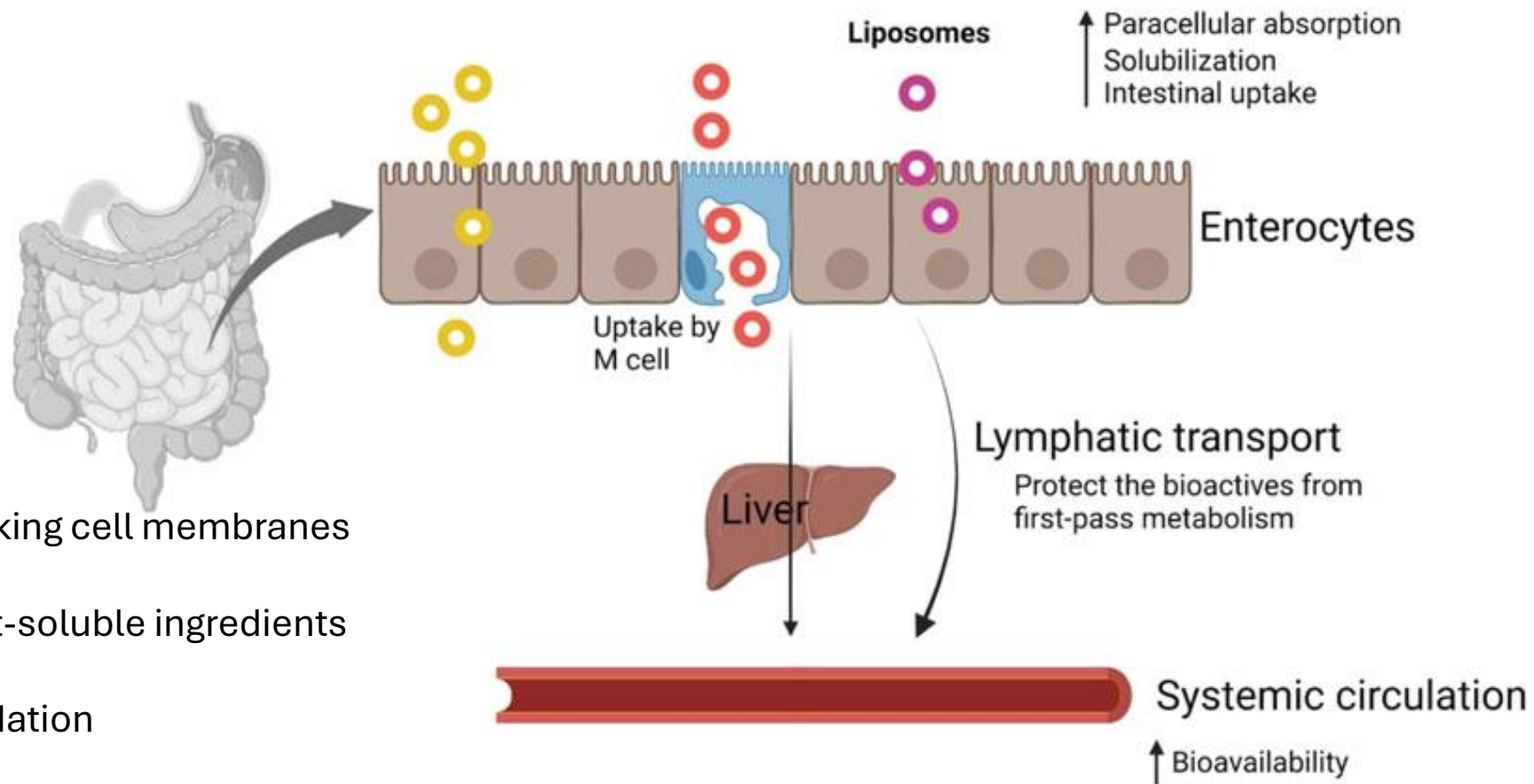
Food supplement liposome (empty)



Food supplement liposome (loaded)

Why Liposomes?

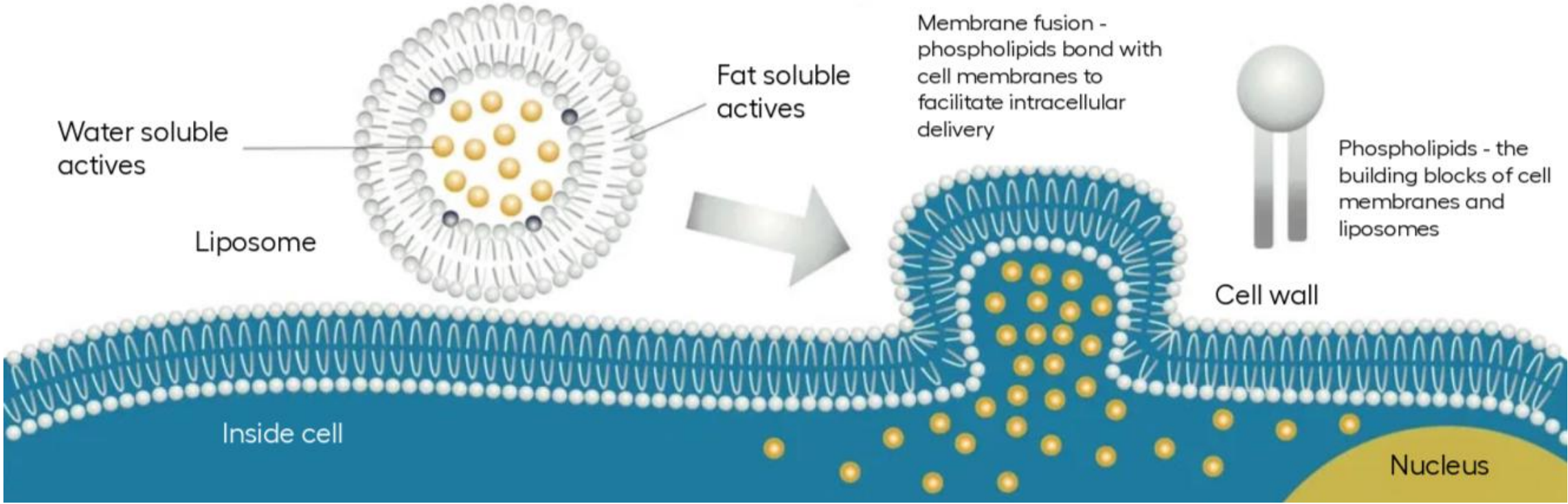
- Nano-sized lipid vesicles mimicking cell membranes
- Encapsulates both water and fat-soluble ingredients
- Protect compounds from degradation
- Enhance bioavailability and absorption in the gut



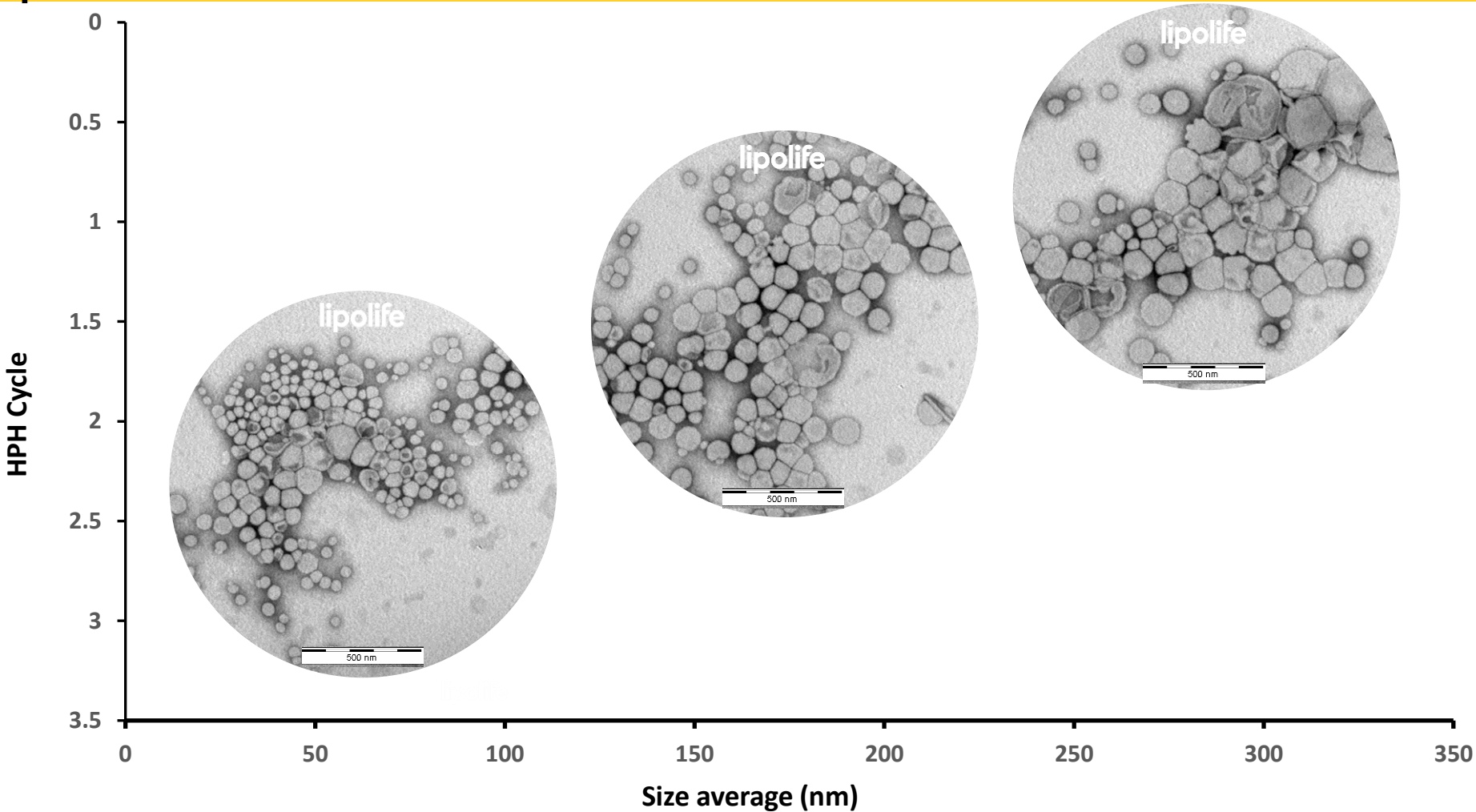
<https://www.frontiersin.org/journals/drug-delivery/articles/10.3389/fddev.2023.1232012/full>

Why Liposomes?

Boosts cellular permeability

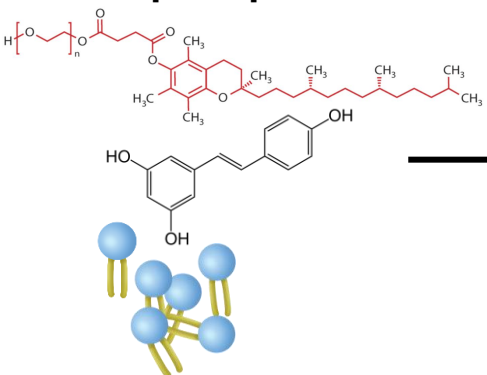


Nano – up close



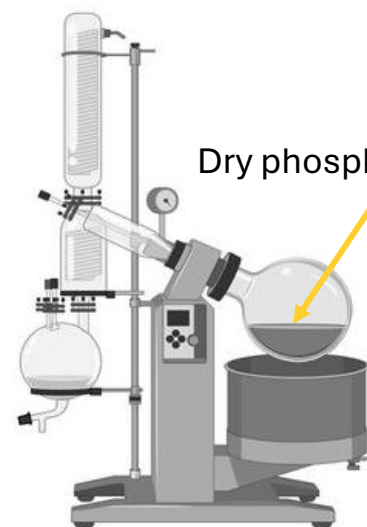
The Preparation of Resveratrol-loaded Liposomes

TPGS
Resveratrol
Phospholipids



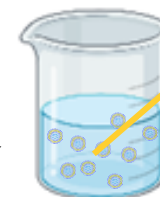
Lipid and actives dissolved in polar solvent

Solvent evaporation



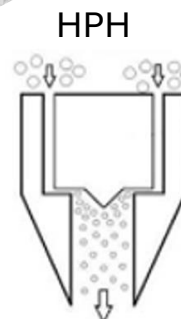
Dry phospholipid film

Hydration

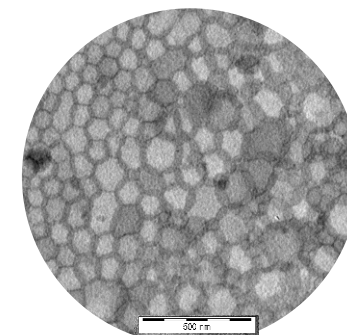
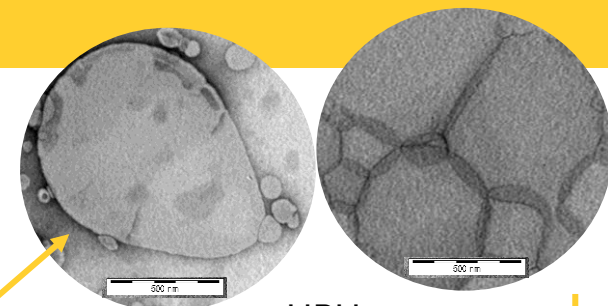


Suspended liposomal vesicles

Reduce the PZ (nm)



Resveratrol loaded TPGS liposomes



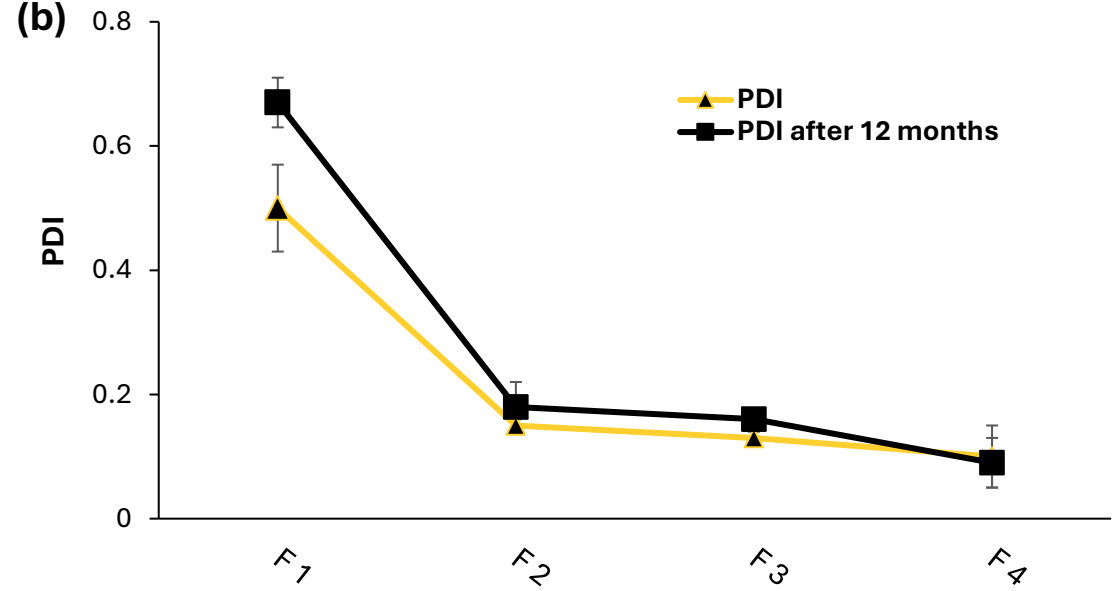
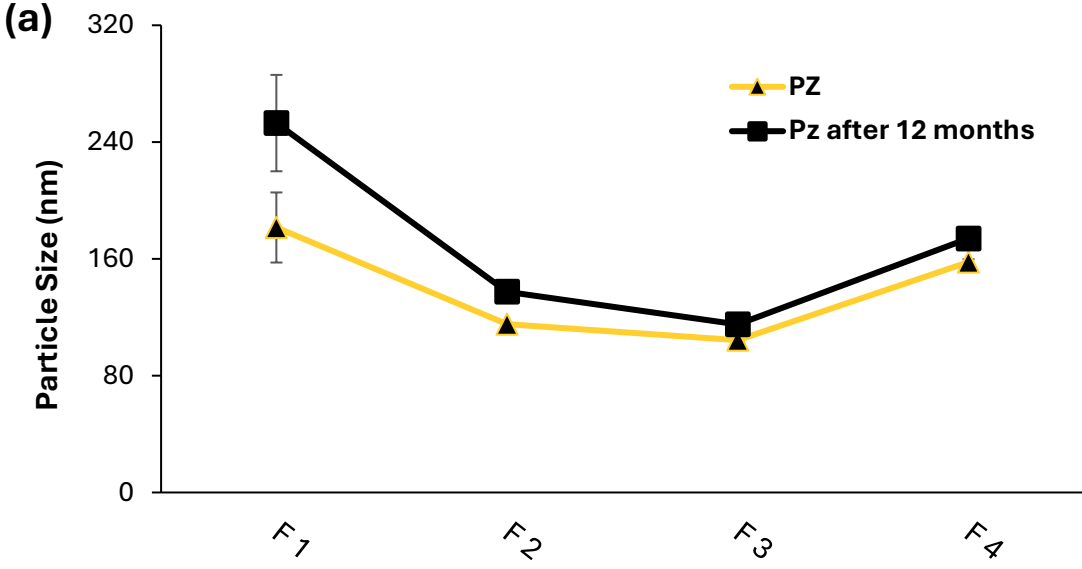
Molar Ratio

Formulations	HSPC	Ch	TPGS
F1	45	45	0
F2	42.5	42.5	5
F3	40	40	10
F4	35	35	20



Dr. Hanan Abdalmaula

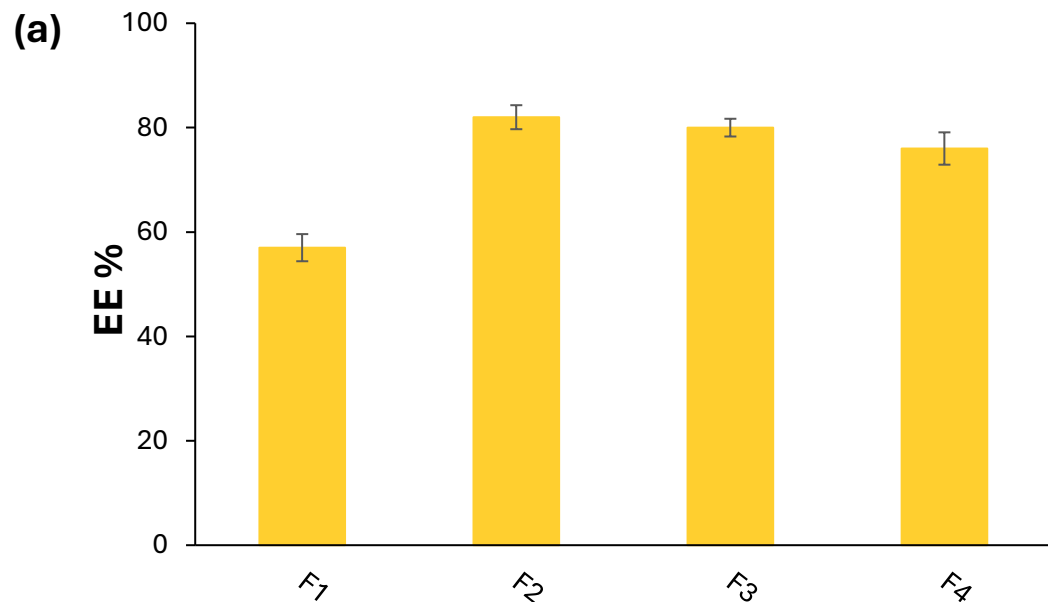
Characterisation



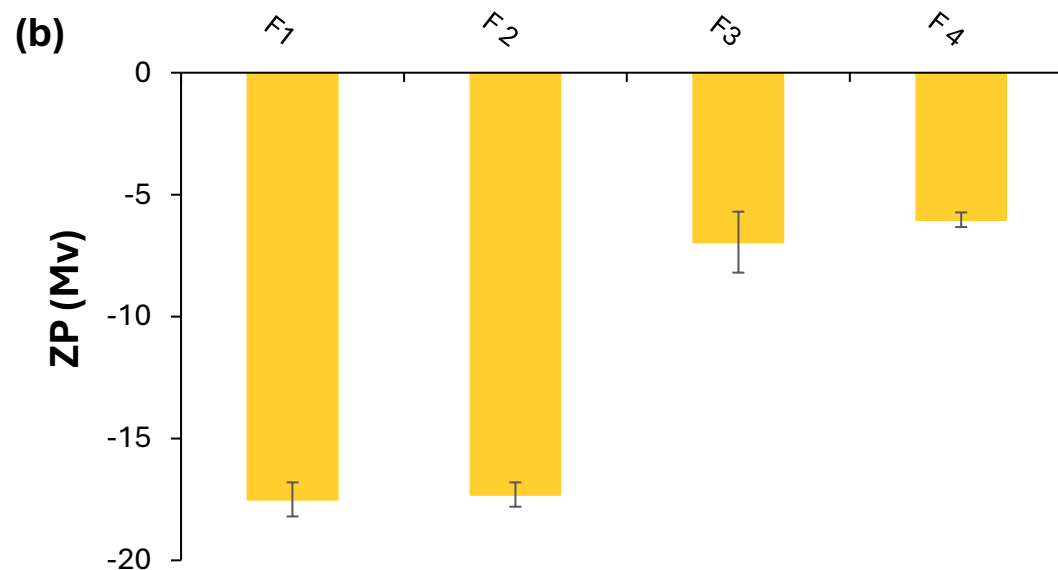
(a, b) PZ and PDI of RESV loaded TPGS liposome formulas and stability of formulations for 180 days regarding particle size (a), PDI (b)

Characterisation

TPGS showed effect on physicochemical properties of resveratrol-loaded liposomes, resulting in higher EE% and uniform, smaller particle size.

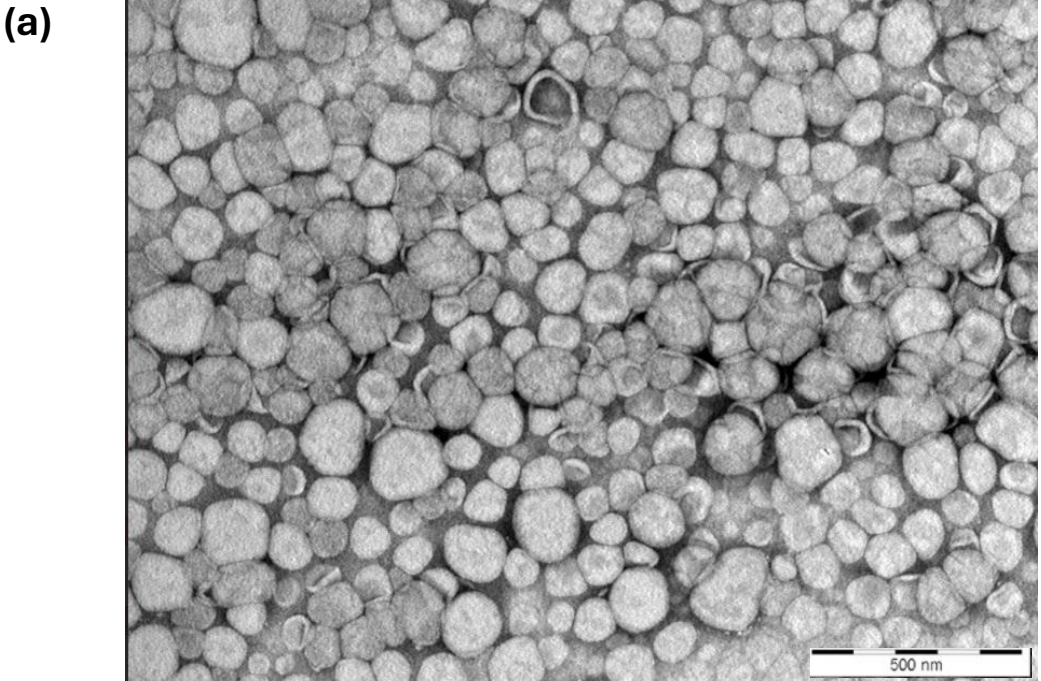


(a) Encapsulation efficiency (EE)

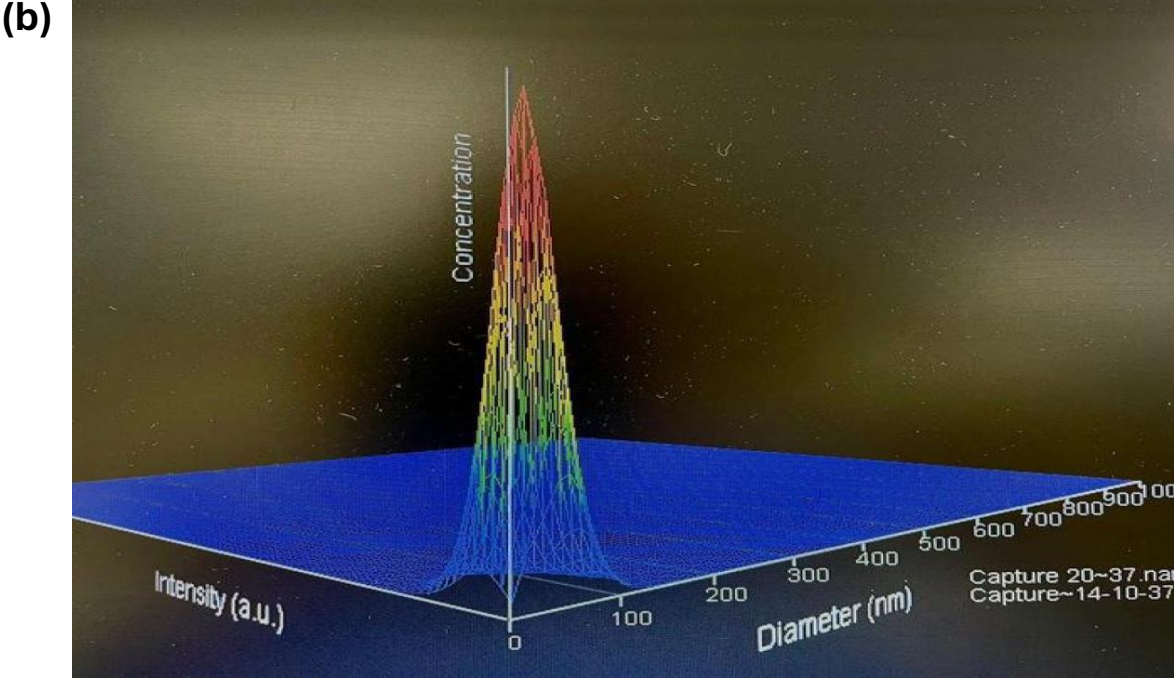


(b) Zeta potential of Resveratrol loaded-liposomes with TPGS formulations

Characterisation

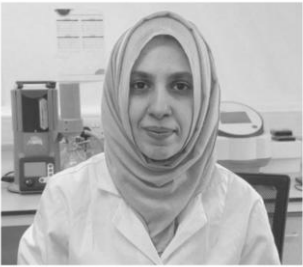


(a) TEM image showing spheric nanoparticles

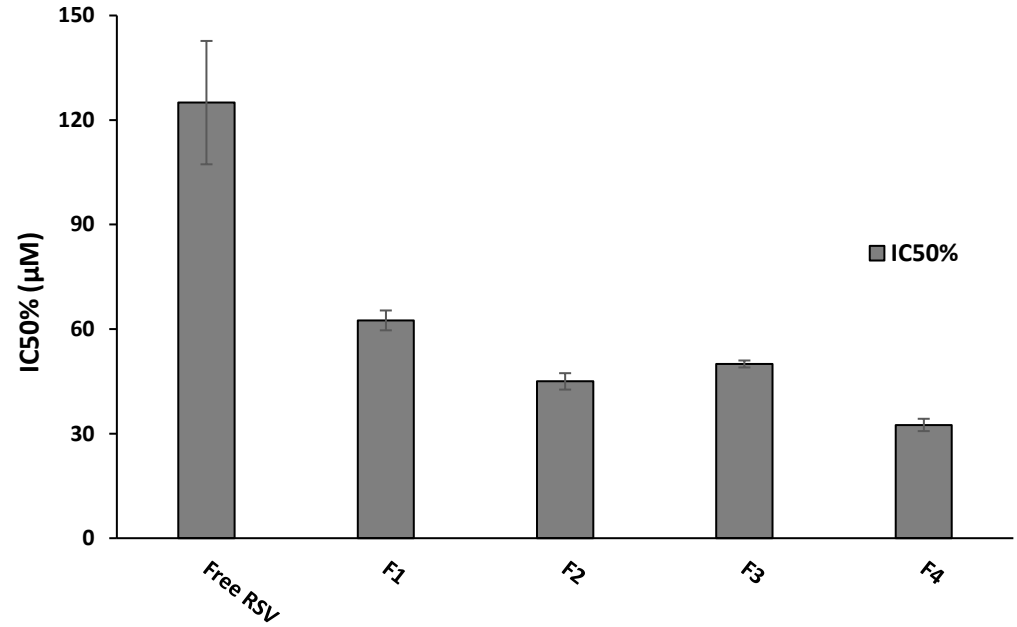
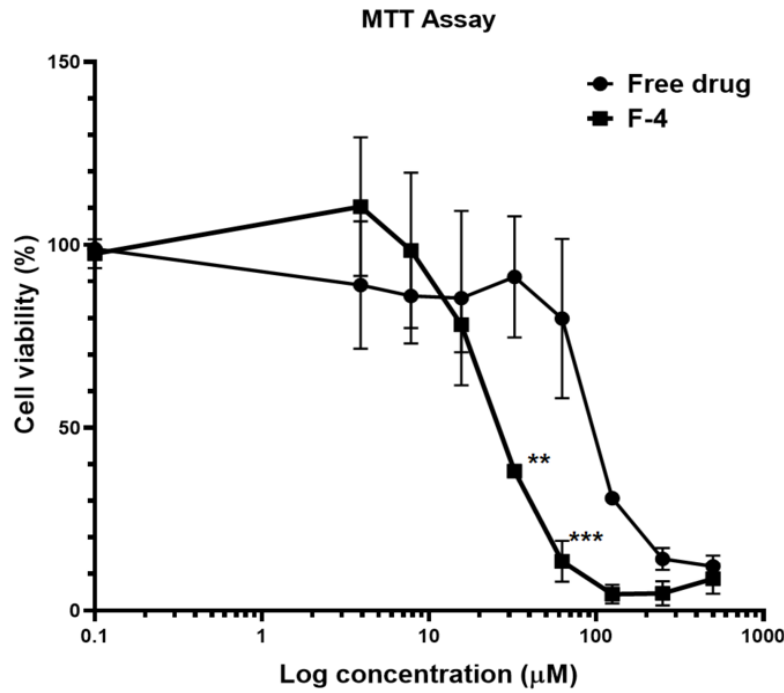


(b) Size dispersion plots using Nanosight.

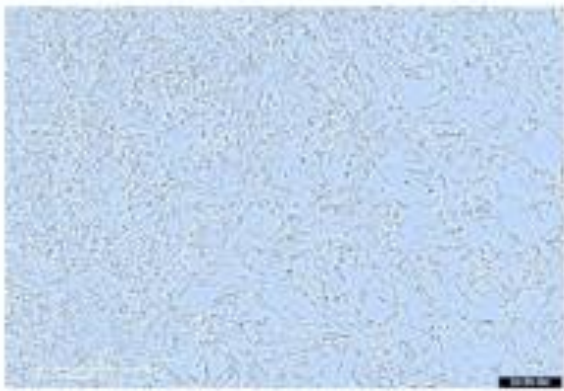
Anti-Cancer Activity



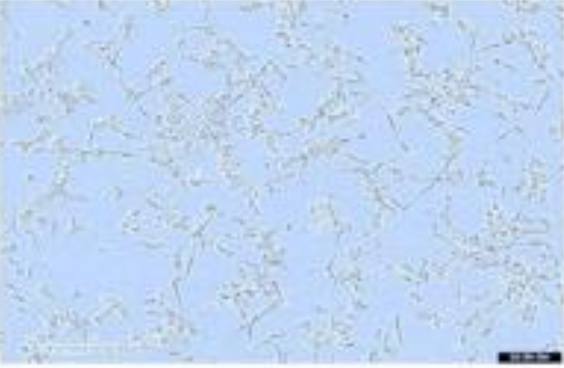
Dr. Sahrish Fehmani



Anti-Cancer Activity



Control



RSV-loaded TPGS liposomal
IC50% at 32.5 μ M (2 Day)

Scaling up?

lipolife
Stand: F46



- First UK Facility to produce Liposomal nutraceuticals under GMP Standards
- Exporting worldwide



What you did/are doing

lipolife
Stand: F46



GMPriority Pharma



Selected twice top three in “Best of the Best” 2024 and 2025 by Innovate UK

R&D focus on effective bioavailability



Thank you

Students

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Dr Ibrahim Dumbuya
Dr Barbara Machado
Dr Ayse Kaya
Dr Niusha Ansari
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lipolife

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Dr. Mouhamd Khoder
Prof. Waqar Ahmed
Dr. Chris McConville
Prof Raed Alani
Prof Wei Chen



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