Nanomedicine

Paper selection

Paper 1:

Article | Open access | Published: 05 April 2025

Redox disruption using electroactive liposome coated gold nanoparticles for cancer therapy

Ying-Chi Chen, Li-Chan Chang, Yan-Ling Liu, Ming-Che Chang, Yin-Fen Liu, Po-Ya Chang, Divinah Manoharan, Wen-Jyun Wang, Jia-Sin Chen, Hsueh-Chun Wang, Wen-Tai Chiu, Wei-Peng Li, Hwo-Shuenn Sheu, Wen-Pin Su & Chen-Sheng Yeh

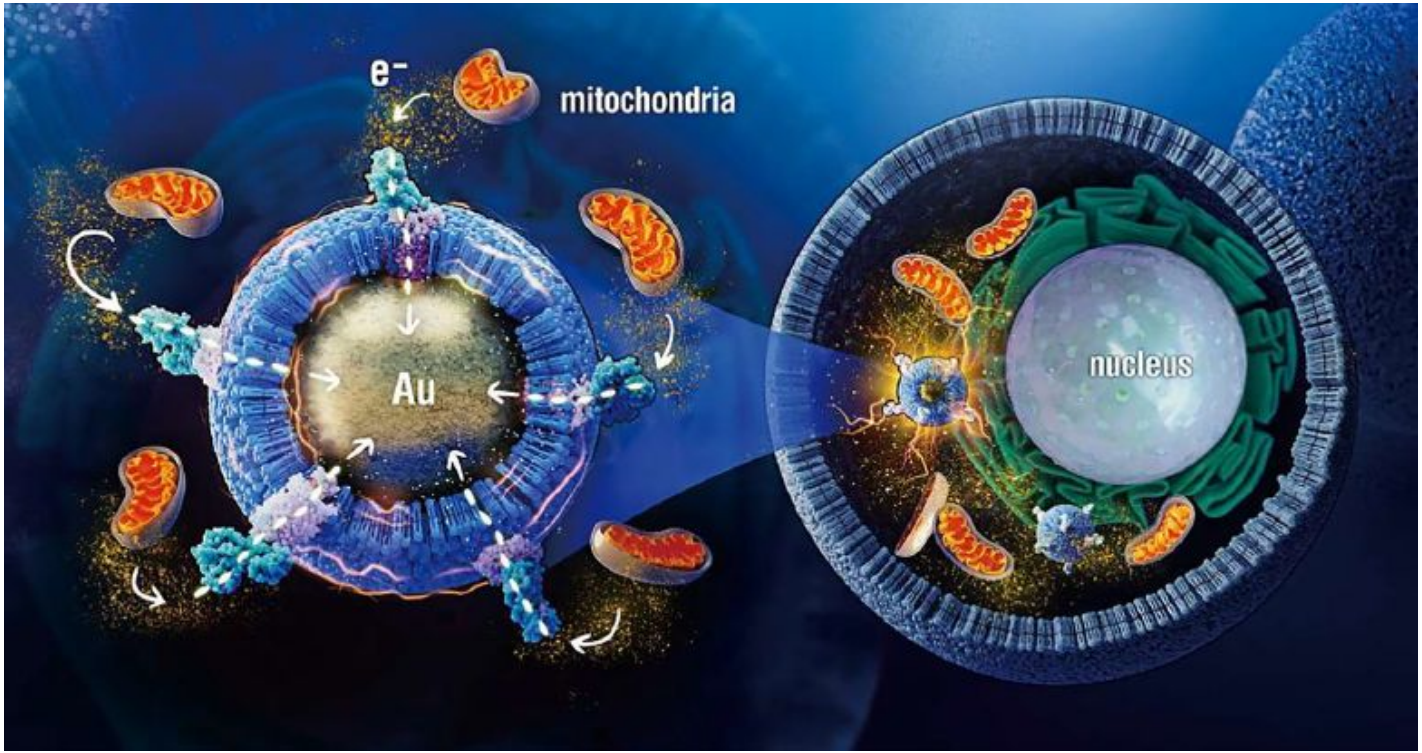
Paper 2:

A dissolving and glucose-responsive insulin-releasing microneedle patch for type 1 diabetes therapy†

Yujie Zhang,[a] Mingxin Wu,[a] Di Tan,[a] Quan Liu,[a] Re Xia,[a] Min Chen,[b] Yuangang Liu,[c] Longjian Xue[a] and Yifeng Lei*[a]

November 2020

Paper 1



Source : *Chen, YC., Chang, LC., Liu, YL. et al. Redox disruption using electroactive liposome coated gold nanoparticles for cancer therapy. Nat Commun 16, 3253 (2025).*

Results

- Use of Gold Nanoparticles to pull electrons from cancer cells
- Disrupts Redox balance, triggers cell death
- Effective against multiple cancer cells (selective), spares normal cells
- Induces lipid peroxidation in mitochondria and ER.
- No ROS (Reactive Oxygen Species), electron withdrawal is what causes damage → good for cases where ROS production is undesirable
- Works in hypoxic tumors
- Larger nanoparticles (100nm) are more effective due to larger surface contact area and number of cytochromes on surface
- Mouse models : significant tumor regression, prolonged survival without observed toxicity

Key takeaway message and novelty

Use electroactive nanoparticles (Au@MIL) to withdraw electrons from cancer cells, disrupting their redox balance and inducing death without ROS generation.

- Induce oxidative stress and apoptosis without generating ROS! (unlike classical ferroptosis)
- electron sink nanomedicine → disrupt redox balance by pulling electrons from cells → quite original
- First time bacterial cytochrome-rich membranes are used to create electroactive liposomes for medical treatment

Why it’s cool

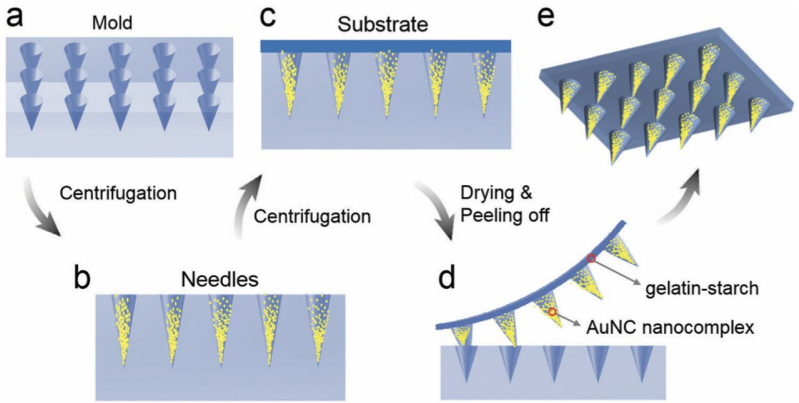
- Elegant approach, using bacteria’s natural electron transfer machinery.
- Cool comparisons across different cancer cells and non cancer cells (**Hep G2, HA22T, MDA-MB-231**, NeHepLxHT, M10)
- They tested many different conditions and scenarios to gain a better understanding of underlying mechanisms
- Multidisciplinary (bio,nano,electrochemical)
- Cool that just one injection causes tumor regression in mice.

Paper 2:

A dissolving and glucose-responsive insulin-releasing microneedle patch for type 1 diabetes therapy†

Yujie Zhang,[a] Mingxin Wu,[a] Di Tan,[a] Quan Liu,[a] Re Xia,[a] Min Chen,[b] Yuangang Liu,[c] Longjian Xue[a] and Yifeng Lei*[a]

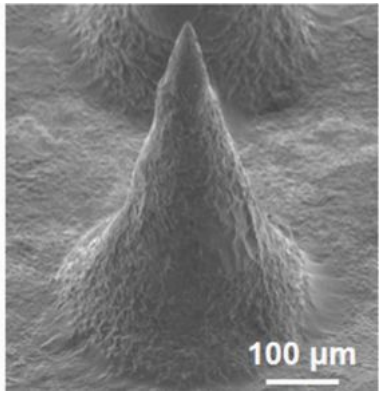
- Glucose-response insulin-releasing Micro-Needle (MN) patch
- MN made of dissolving and biodegradable starch and gelatin.
- Encapsulated in the MN are insulin responsive gold nano-clusters.
- Investigated two patches with different Nano-clusters. (BSA or CR9 peptide)

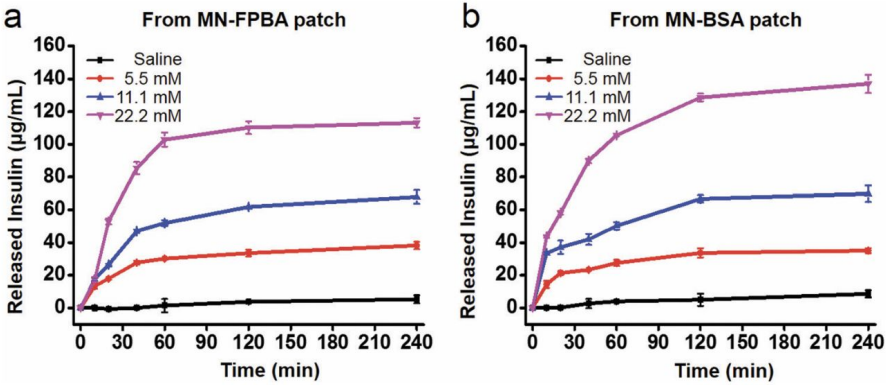


(Zhang *et al*, 2019)

Paper 2: Takeaways

- Patches dissolved during application (~hours)
- Insulin was successfully released into the bloodstream
- Insulin release is tuned to glucose presence through nano-cluster engineering.
- Demonstrated in type-1 diabetic mice (in vivo)





Paper 2: Interest and Critique

- Highly biocompatible and biodegradable materials were used.
- Feedback loop for insulin dosage.

- Insulin release times were attributed to micro-needle dissolvement and gold nano-clusters engineering. Dissolvement and release of insulin by the gold nano-cluster was not investigated separately.
- Nanoclusters were not located after microneedle application

Questions?

Paper 1:

Article | Open access | Published: 05 April 2025

Redox disruption using electroactive liposome coated gold nanoparticles for cancer therapy

Ying-Chi Chen, Li-Chan Chang, Yan-Ling Liu, Ming-Che Chang, Yin-Fen Liu, Po-Ya Chang, Divinah Manoharan, Wen-Jyun Wang, Jia-Sin Chen, Hsueh-Chun Wang, Wen-Tai Chiu, Wei-Peng Li, Hwo-Shuenn Sheu, Wen-Pin Su & Chen-Sheng Yeh

Paper 2:

A dissolving and glucose-responsive insulin-releasing microneedle patch for type 1 diabetes therapy†

Yujie Zhang,[a] Mingxin Wu,[a] Di Tan,[a] Quan Liu,[a] Re Xia,[a] Min Chen,[b] Yuangang Liu,[c] Longjian Xue[a] and Yifeng Lei*[a]

November 2020