Karlsruhe Institute of Technology

Topic 3: Adaptive and Bioinstructive Materials Systems

MSE Day 18.11.2022

From bioinspired materials to personalized biomedical technologies

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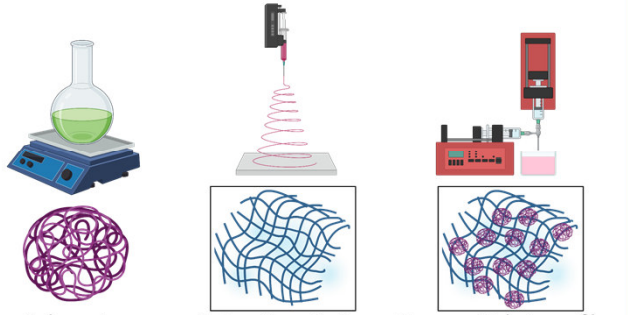
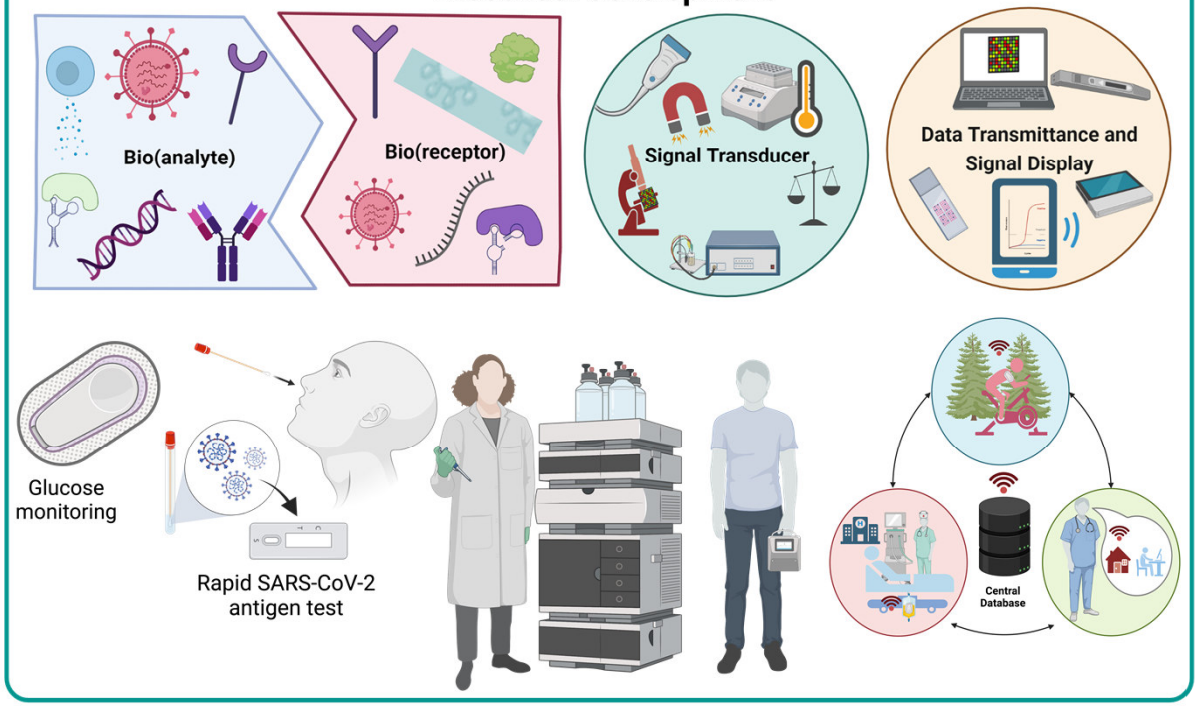
OUTLINE

Natural/synthetic polymeric materials for drug delivery, wound healing and photodynamic cancer therapy



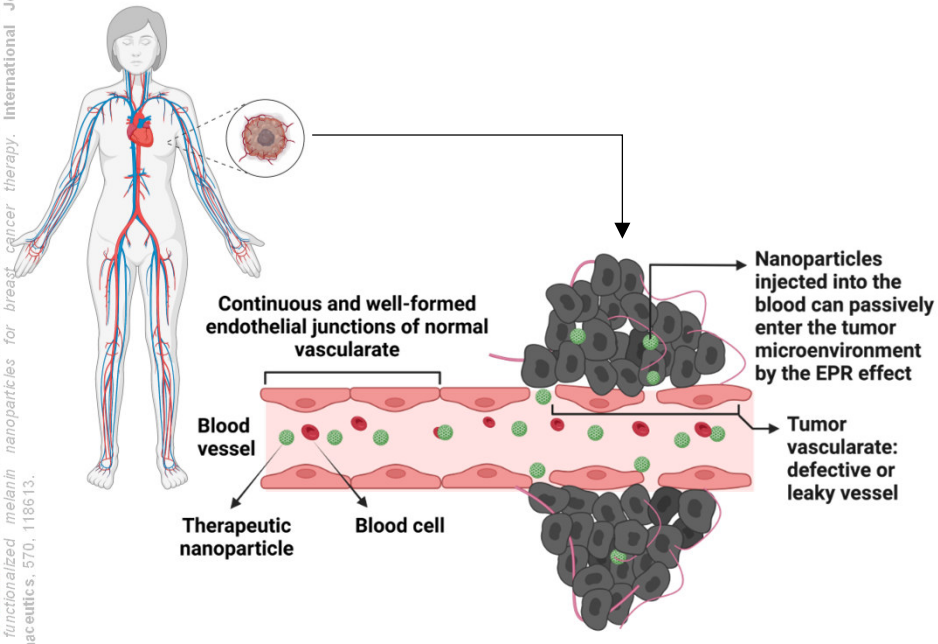
Plasma surface treatment for biosensor development and modification of blood-contacting implants

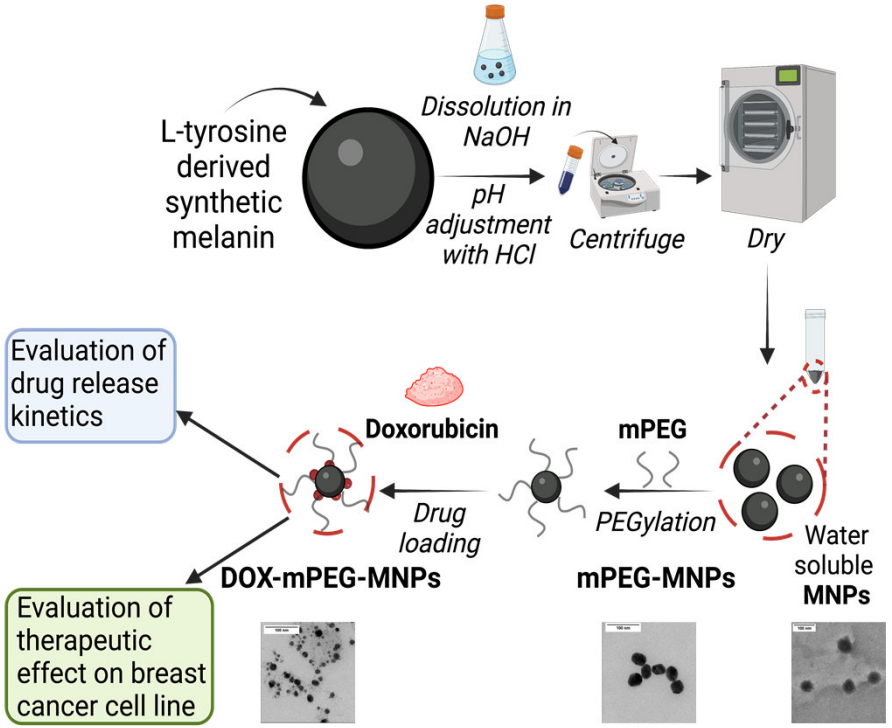
Biosensor development



Bio(inspired) materials – Synthetic melanin
Drug delivery and cancer therapy

- **Controlled release of doxorubicin from polyethylene glycol functionalized synthetic melanin nanoparticles for breast cancer therapy**

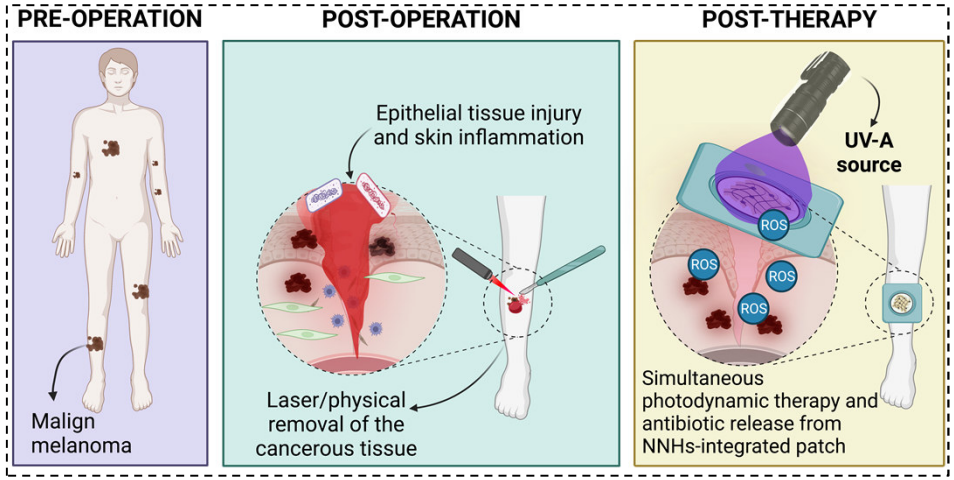


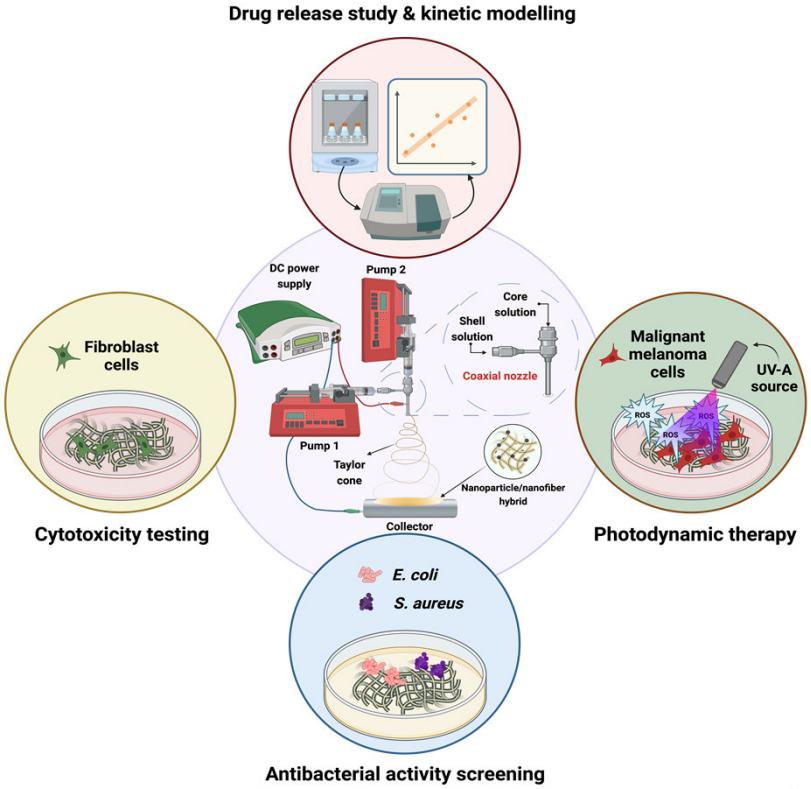


B Ozlu, **G Kabay**, BS Shim, AK Piskin, M Mutlu. (2019). *Controlled release of doxorubicin from polyethylene glycol functionalized melanin nanoparticles for breast cancer therapy*. **International Journal of Pharmaceutics**, 570, 118613.

Bio(inspired) materials – Natural melanin (eumelanin)
Drug delivery and photodynamic cancer therapy

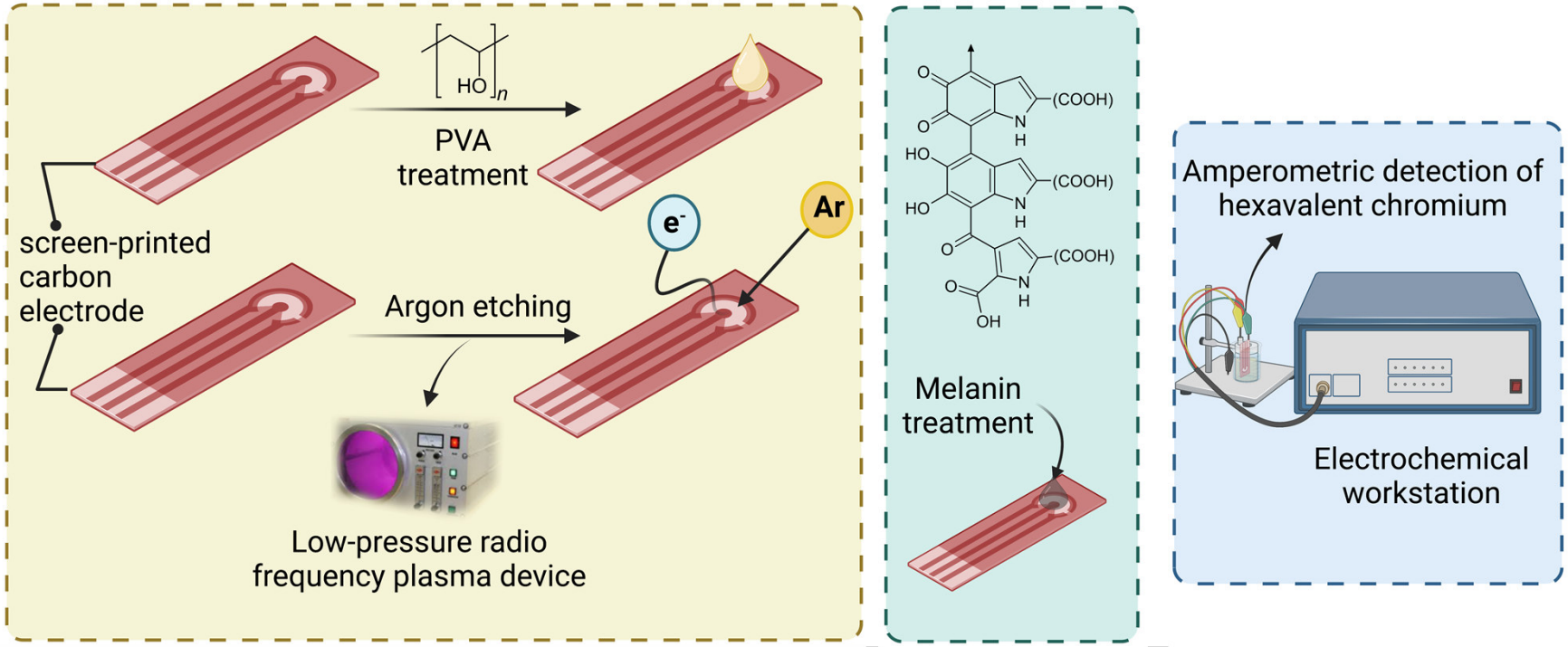
- **Multifunctional natural melanin nanoparticle-nanofiber hybrid electrospun meshes for photodynamic malign melanoma therapy**





Bio(inspired) materials – Natural melanin (eumelanin)
Sensor application

- **Natural melanin nanoparticle-decorated screen-printed carbon electrode: Performance test for amperometric determination of hexavalent chromium as model trace**



Bio(inspired) materials – Amyloid-like BSA
Drug delivery and biosensor application

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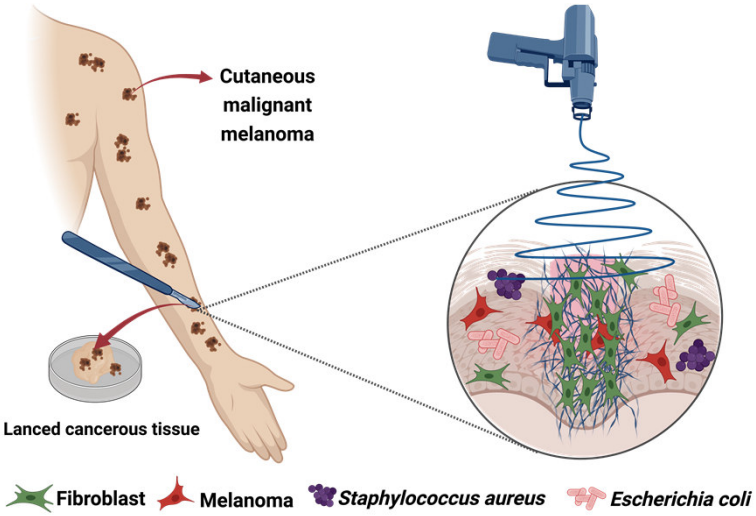
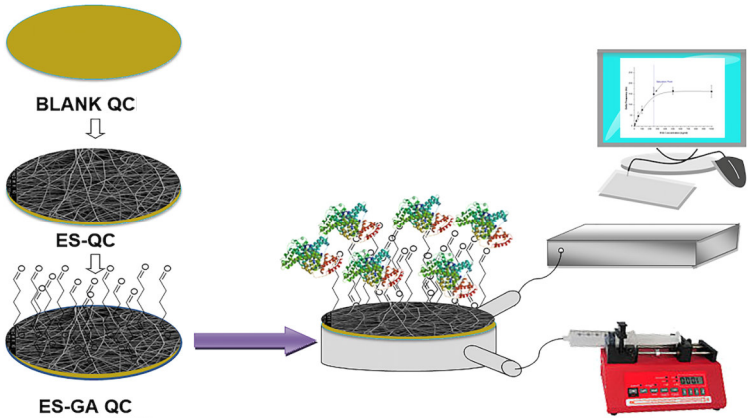
- **Pyrrole-doped amyloid-like bovine serum albumin nanofibrous scaffold for skin cancer therapy**



AE Meydan, **G Kabay**, F Buyukserin. (2022). Pyrrole-doped amyloid-like bovine serum albumin nanofibrous scaffold for skin cancer therapy. (Under Preparation)

- **Single-step biorecognition layer formation onto quartz crystal electrode for biosensor applications**



Kabay, G., Can, G. K., & Mutlu, M. (2017). Amyloid-like protein nanofibrous membranes as a sensing layer infrastructure for the design of mass-sensitive biosensors. Biosensors and Bioelectronics, 97, 285-291.

Plasma-aided material surface treatment
Blood-contacting materials and biosensors

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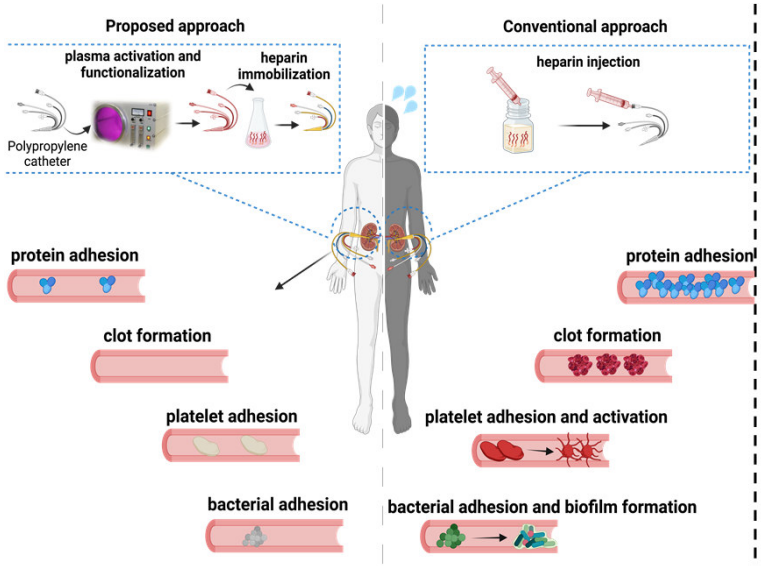
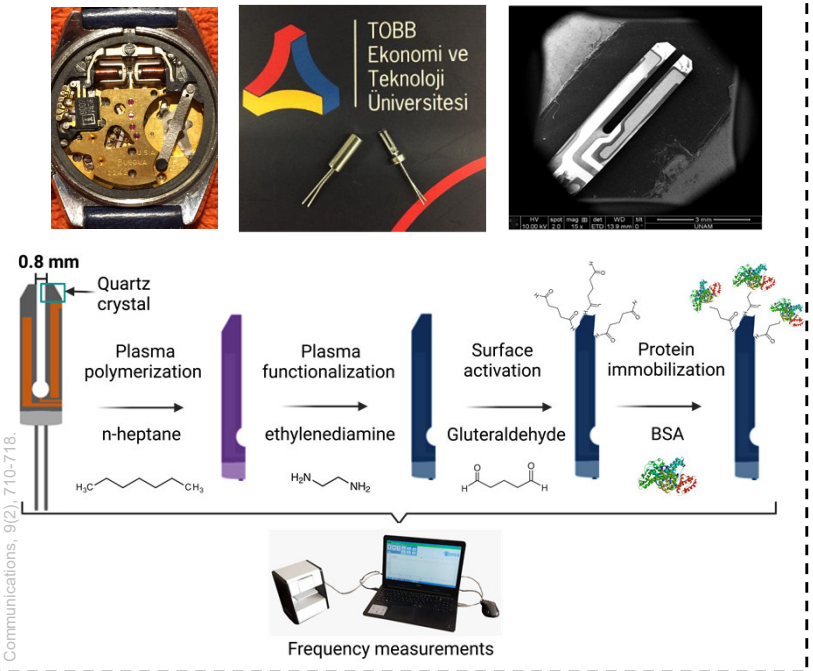
- **Dual-functionalized blood-contacting biomaterials with improved hemocompatibility and antibacterial features**



HF Ozguzar*, E Evren, AE Meydan, **G Kabay**, JS Gocmen, F Buyukserin, O Erogul, (2022). Plasma-assisted surface modification and heparin immobilization: Dual-functionalized blood-contacting biomaterials with improved hemocompatibility and antibacterial features. Advanced Materials Interfaces. 10.1002/admi.202202009.

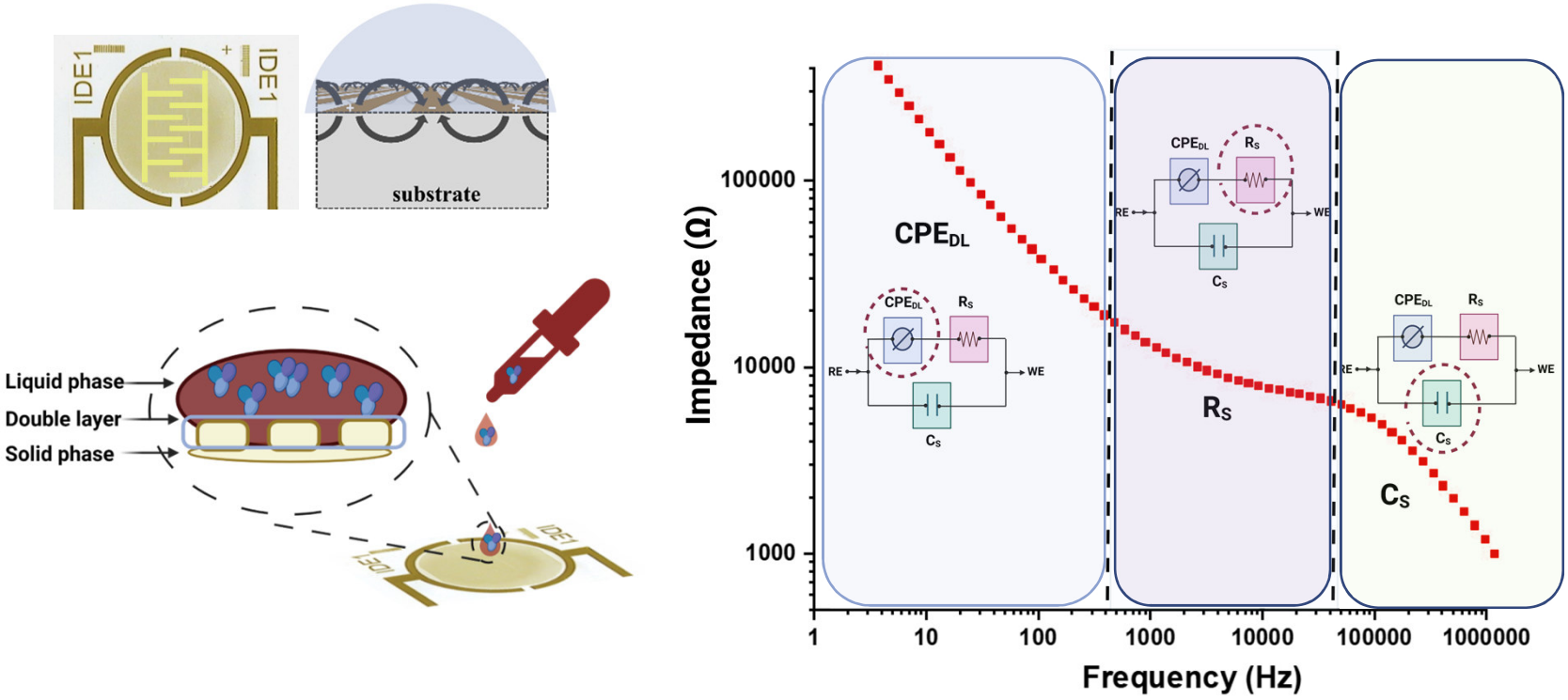
- **Quartz tuning fork as a mass-sensitive biosensor platform with a bi-layer film modification via plasma polymerization**



Özgüzar, H., Kaleli Can, **Kabay, G**., & Mutlu, M. (2019). Quartz tuning fork mass-sensitive biosensor platform with a bi-layer film modification via plasma polymerization. MRS Communications, 9(2), 710-718.

YIG Prep Pro Project and Research at the IFG

- **Development of a magnetically enhanced rheology-based interdigitated electrode biosensor – *RheoIDEA***



Call for Collaboration

- Computational modeling of artificial receptors and simulating the bioreceptor-analyte interactions
- 3-D printing of artificial receptors onto an electrode surface
- User-friendly interface for health data acquisition and monitoring