Near-Infrared Light-Mediated Multifunctional Hydrogel for Cancer Photo-Chemo-Immunotherapy

Samin Abbaszadeh, Vahideh Nosrati Siahmazgi, Kiyan Musaie, Hélder A. Santos*, and M.-Ali Shahbazi*

Department of Biomedical Engineering, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands

W.J. Kolff Institute for Biomedical Engineering and Materials Science, University of Groningen, Groningen, The Netherlands

m.a.shahbazi@umcg.nl

Cancer Mortality and Therapeutic Approaches

GLOBALLY

1 OUT OF 6

DEATHS

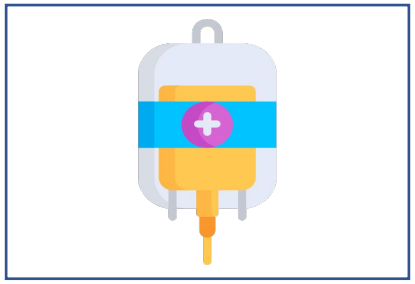
is due to **Cancer**

Surgery

- Inability to remove all cancer cells in the edges of the tumor tissue.
- Aggressive

Radiation

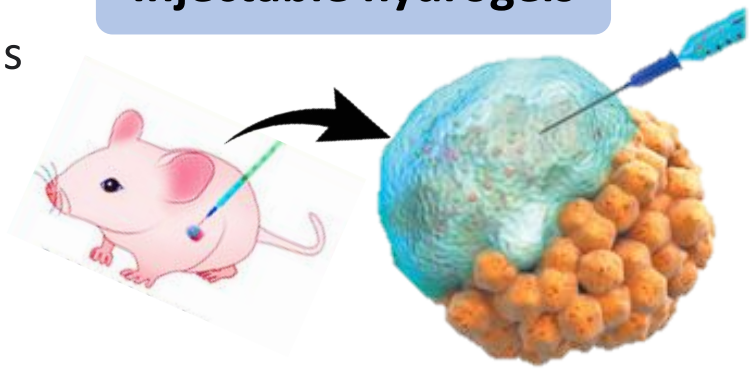
- Damage to surrounding tissues.
- Lack of complete tumor ablation.



Chemotherapy

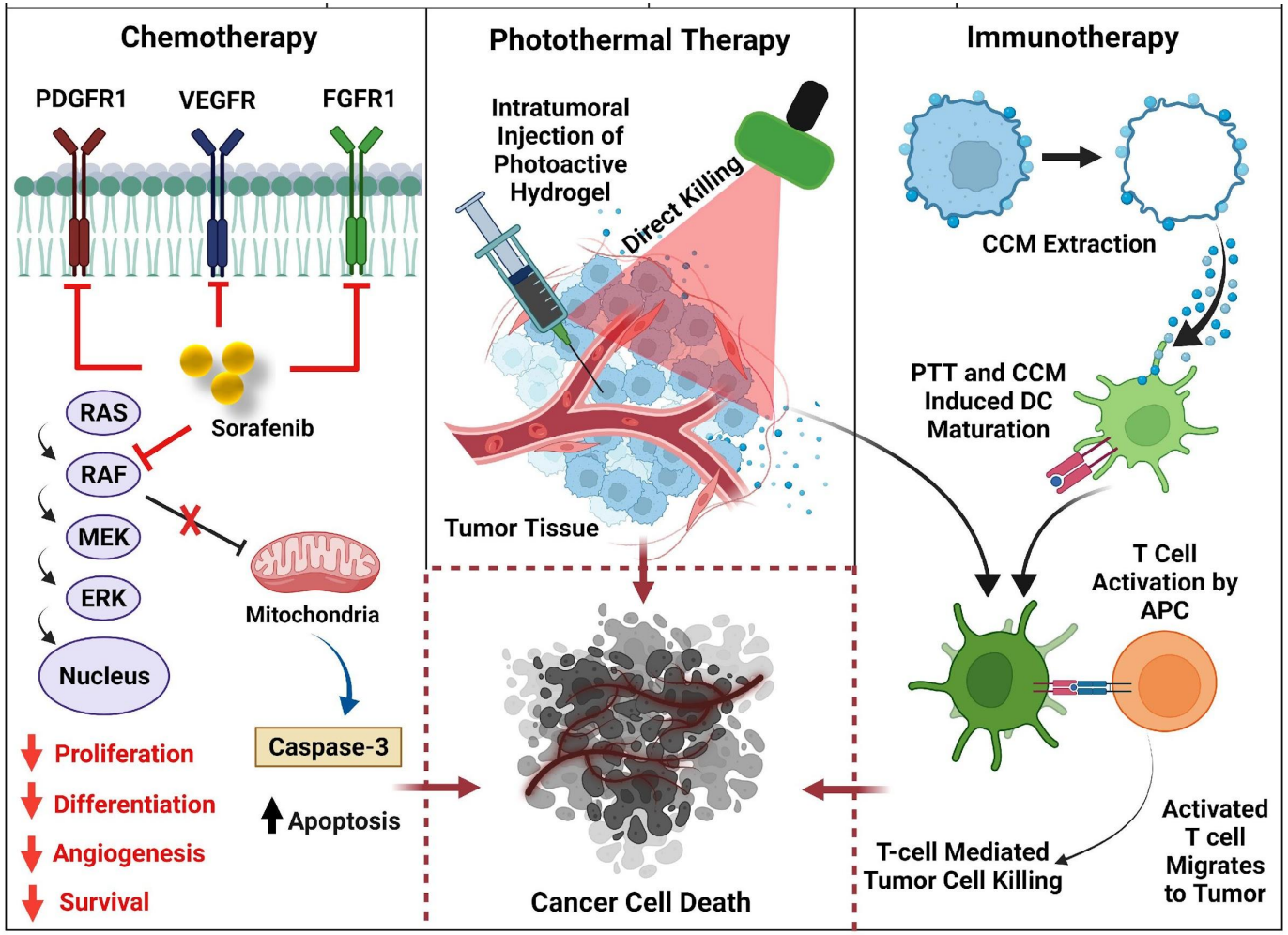
- High toxicity and severe side effects in normal tissues.
- Drug resistance

Injectable hydrogels

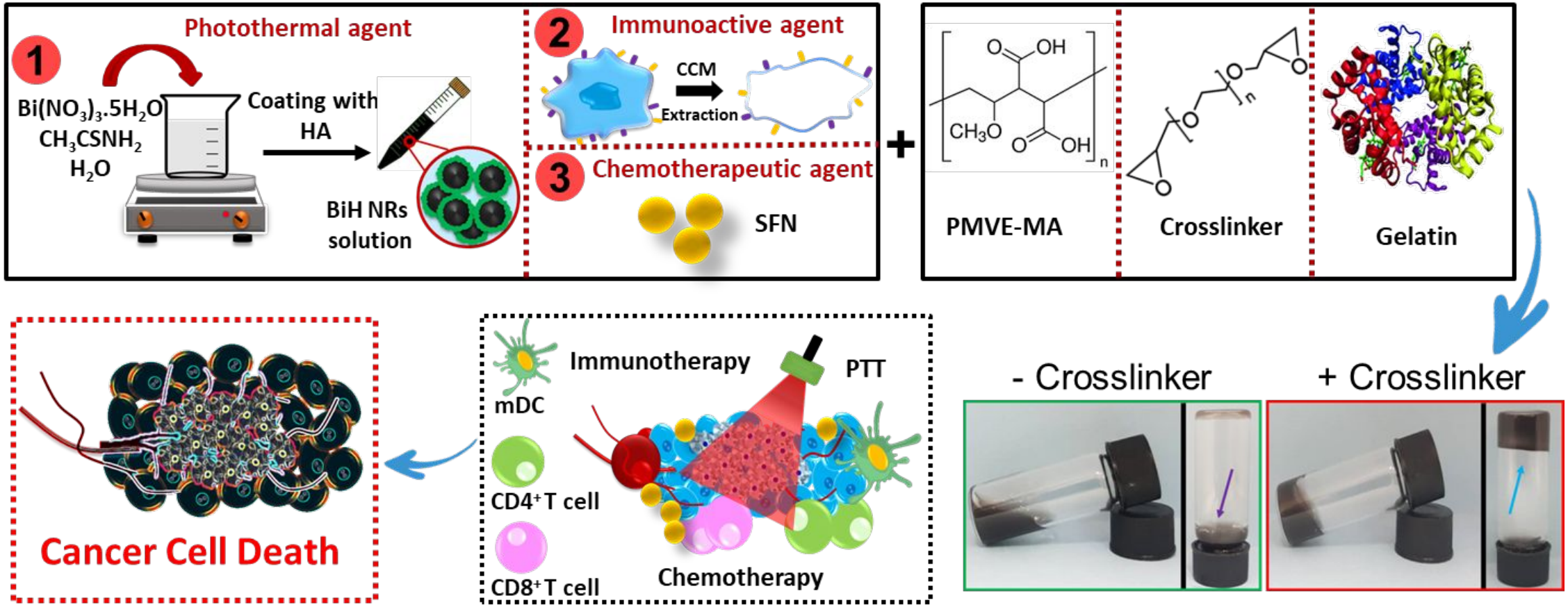


Combined Therapy

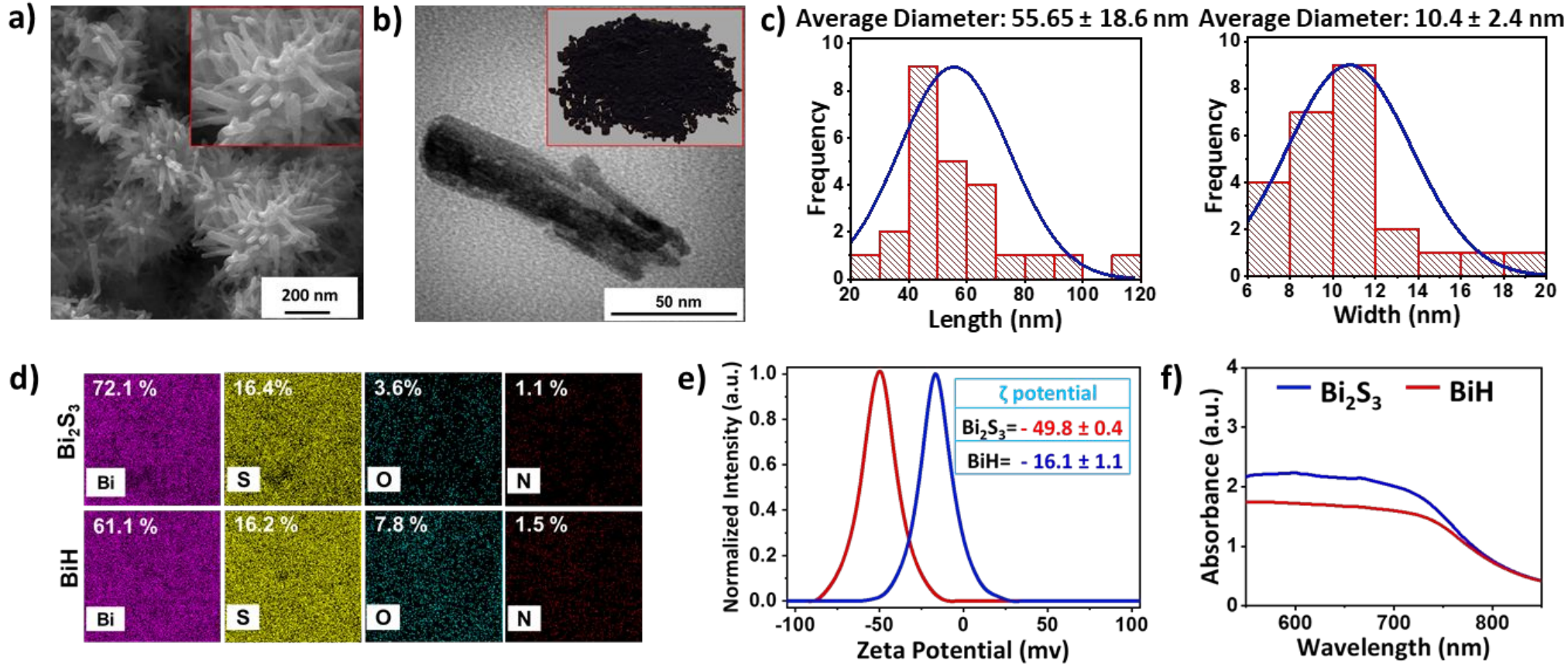
Localized Combination Therapy of Cancer



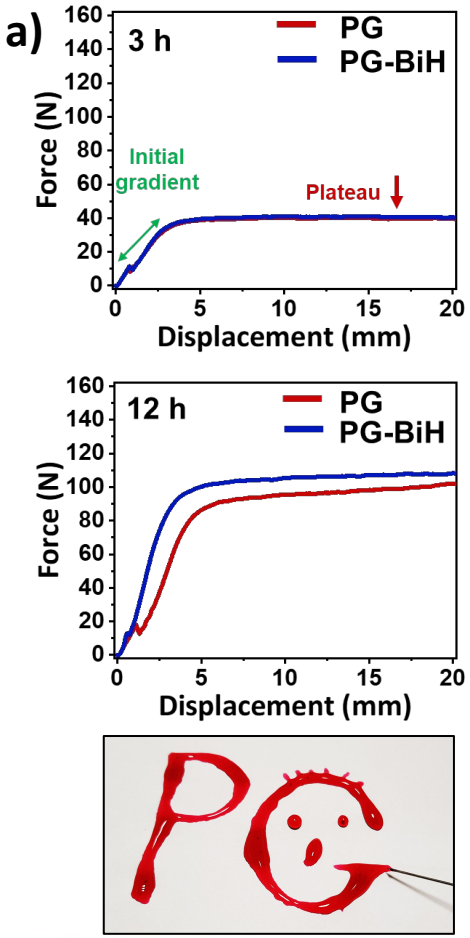
Fabrication of the Photoactive Injectable Hydrogel

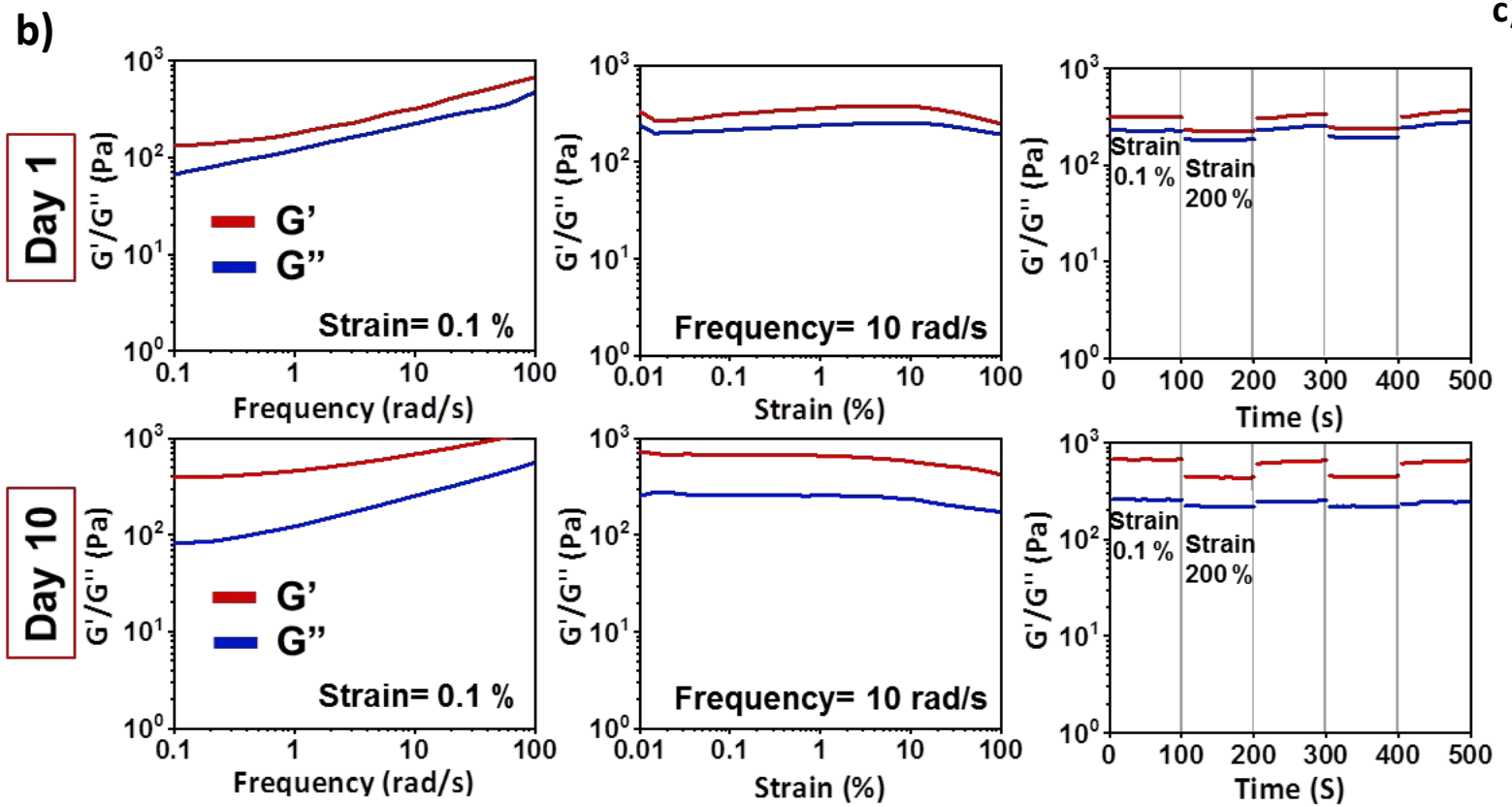


Characterization of Bi_2S_3 and BiH Nanoparticles

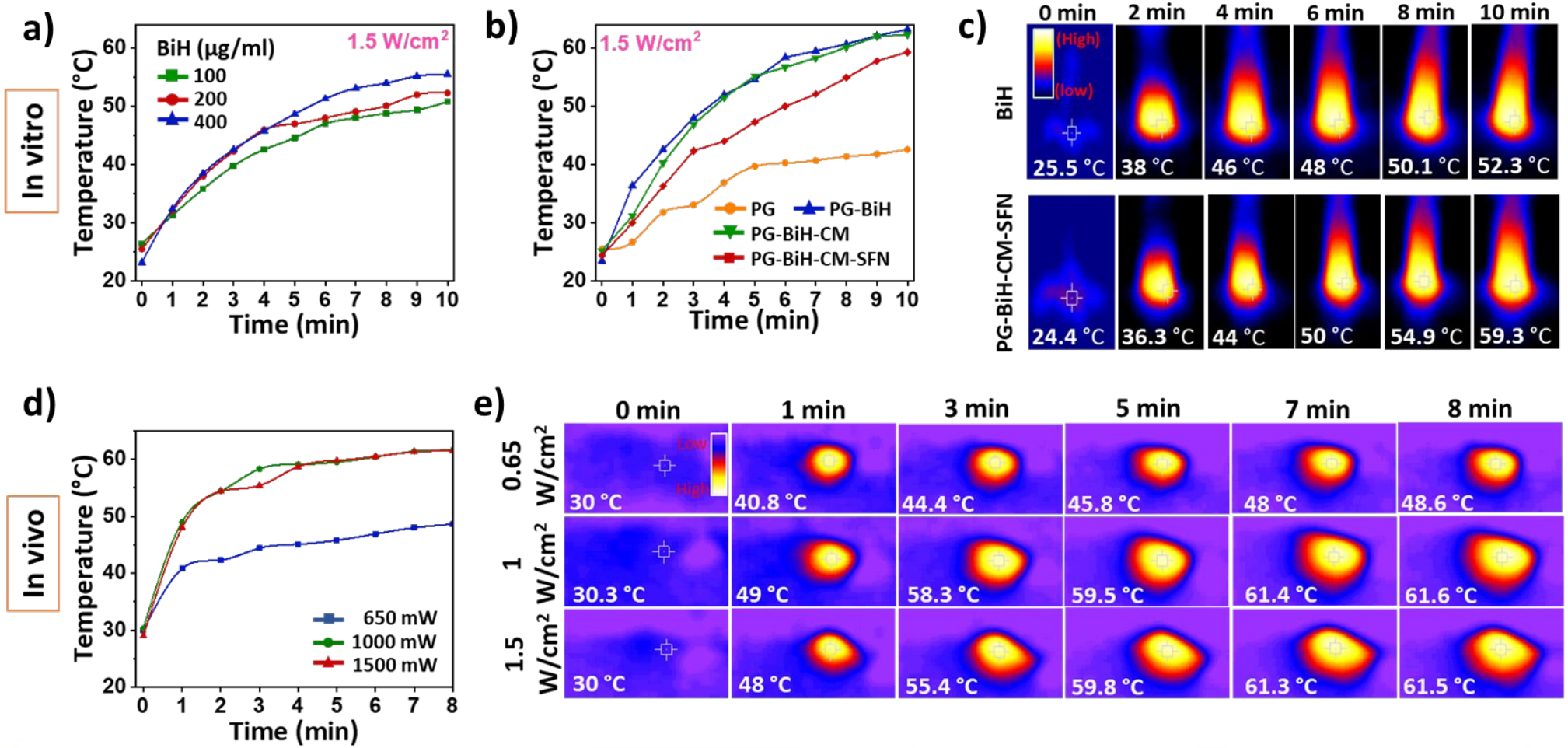


Injectability, Rheological Property, and Self-Healing Effect

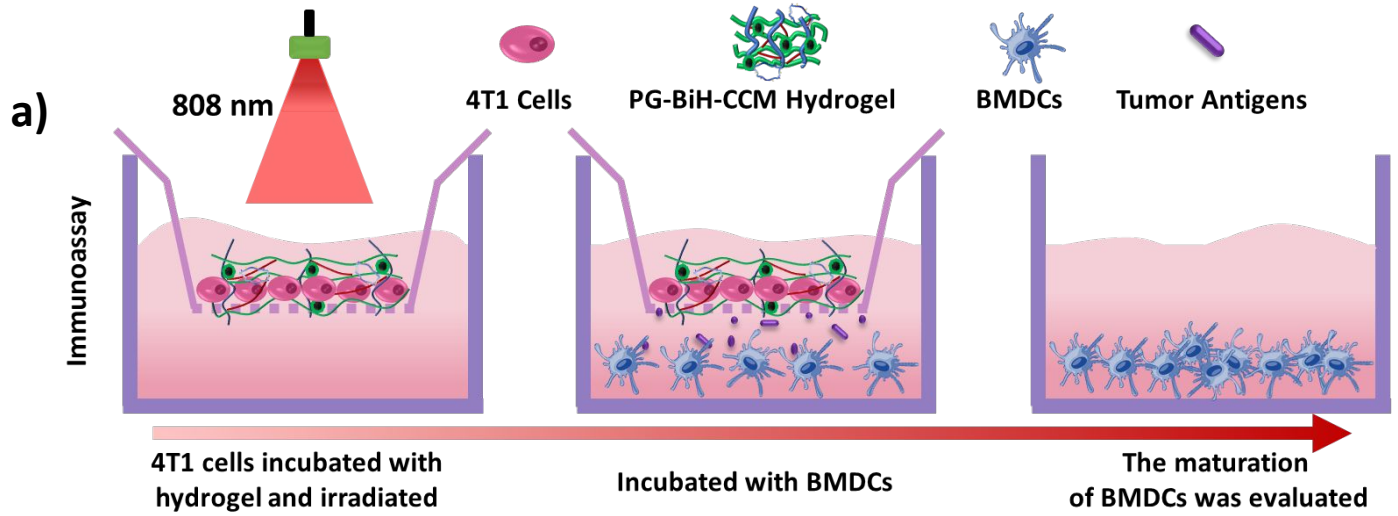


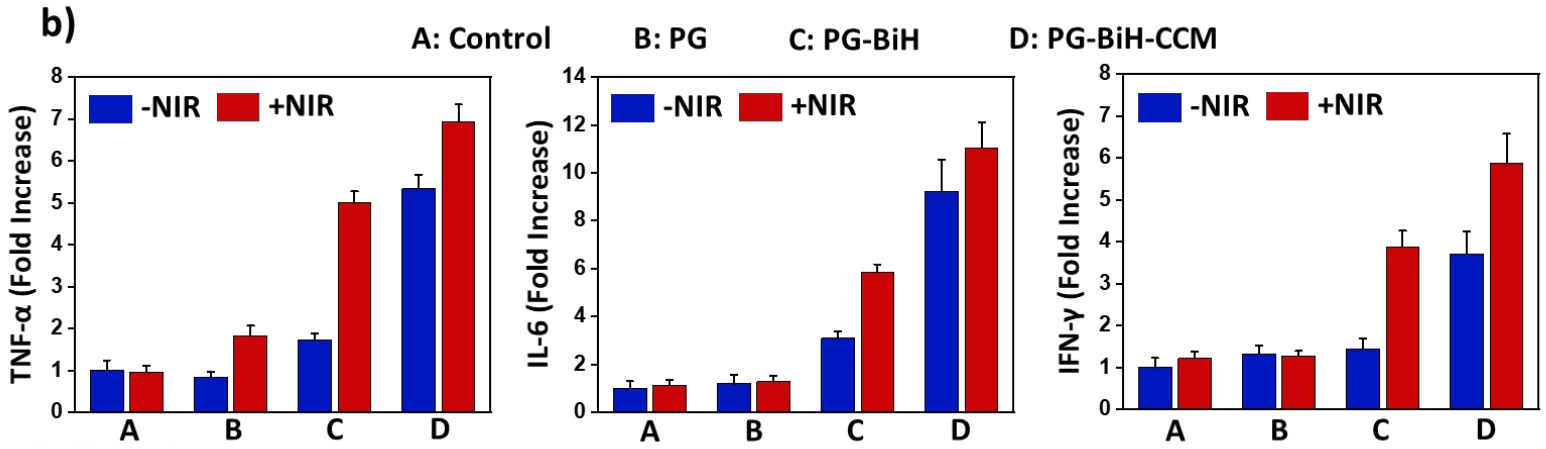


Evaluation of Photothermal Effect



Immunostimulative Effect of the Hydrogel

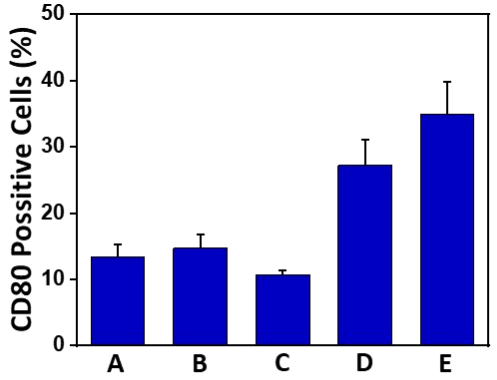


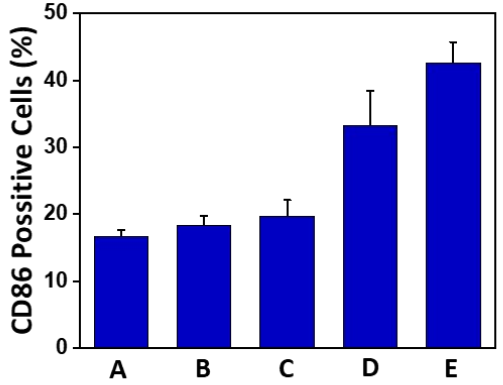


c)

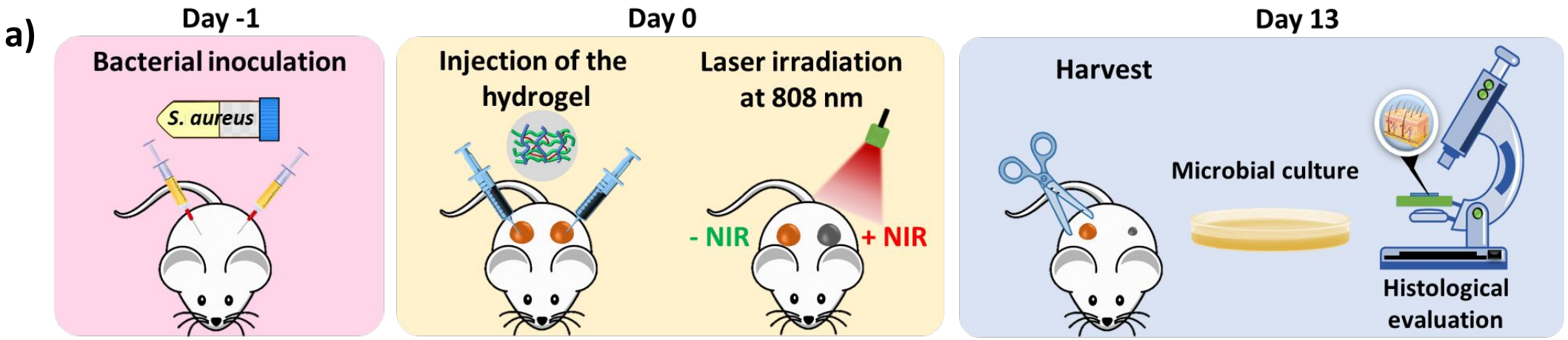
A: Control-NIR B: Control+NIR

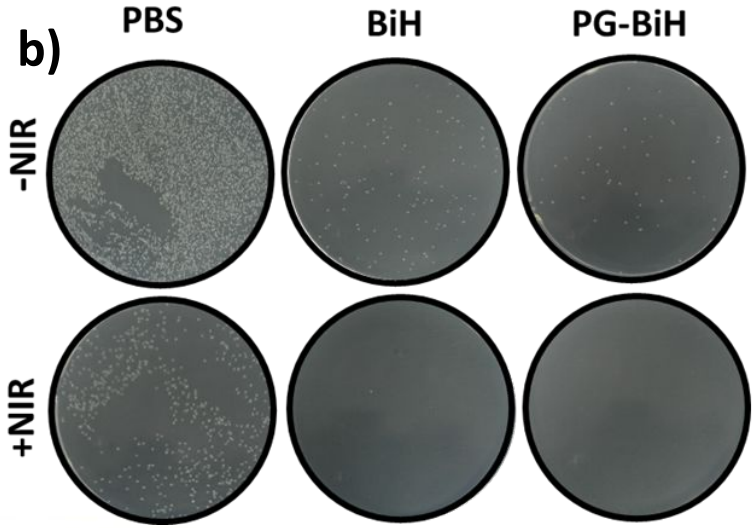
C: PG+NIR D: PG-BiH+NIR E: PG-BiH-CCM+NIR

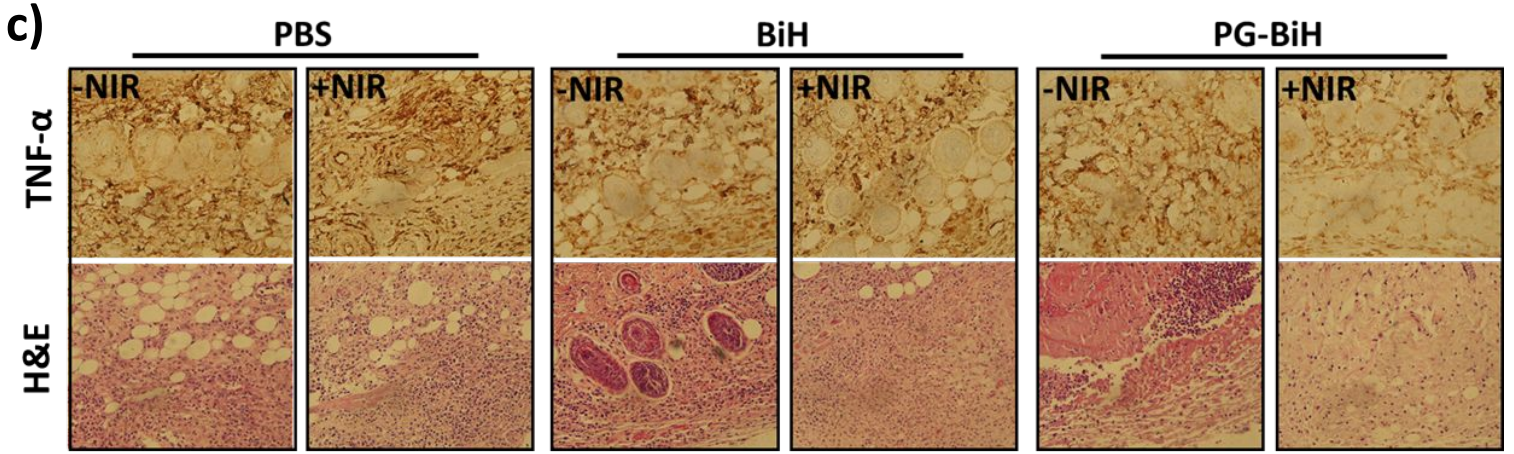




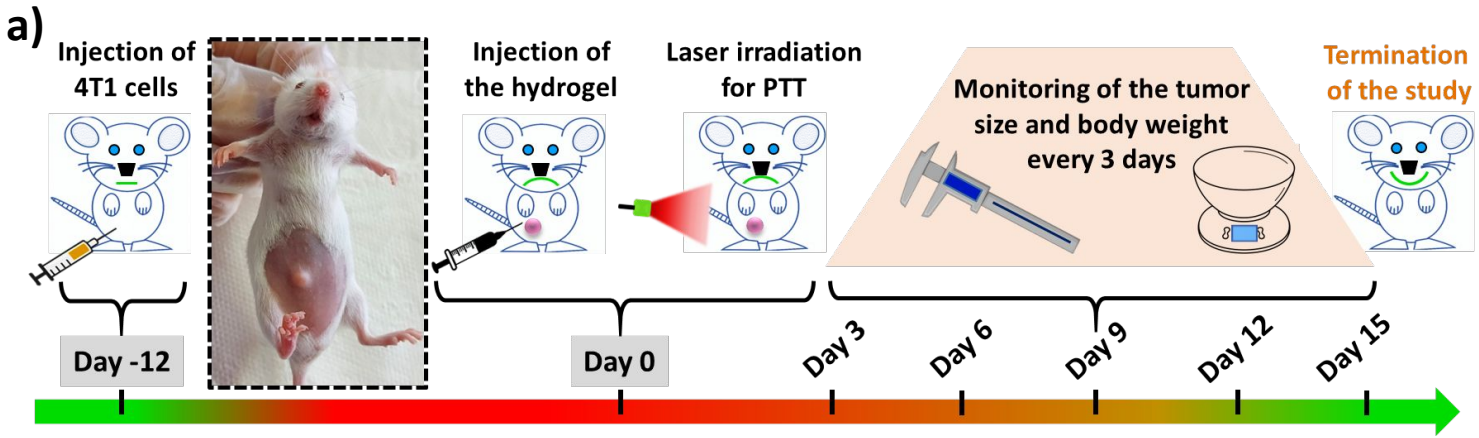
In vivo Antibacterial Activity of the Hydrogel

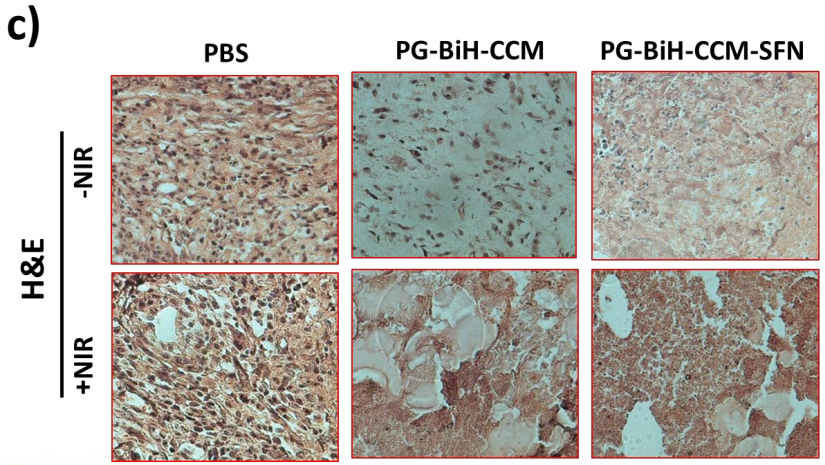


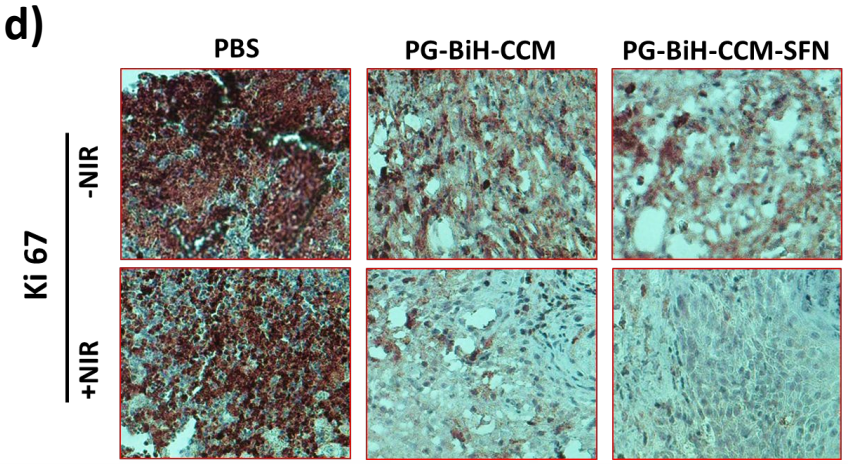


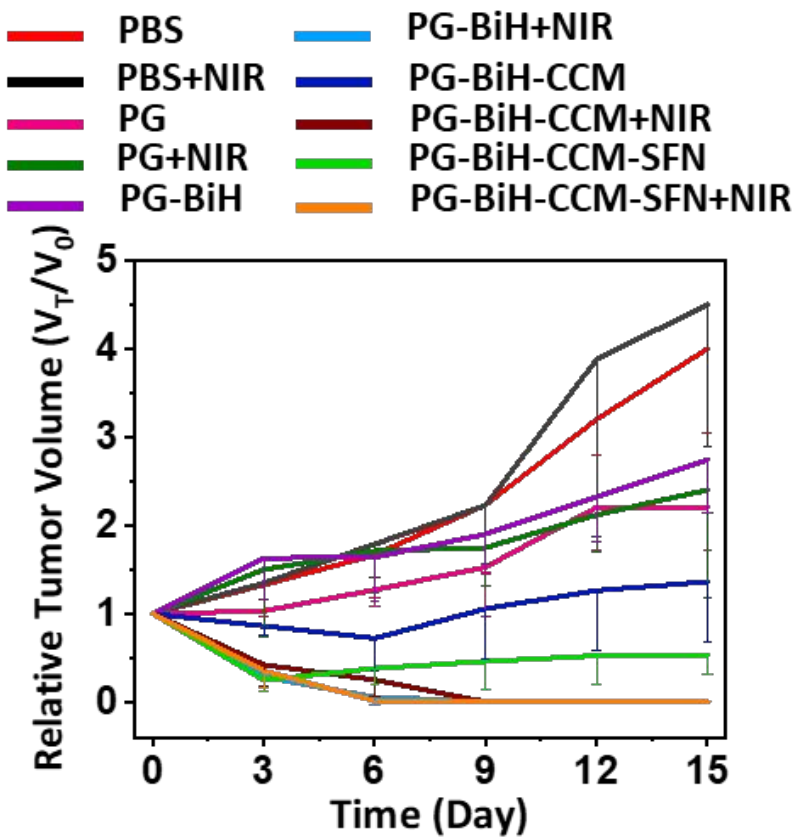


In vivo Anti-Tumor Effect of the Hydrogel









Conclusion

- Successful fabrication of a self healable hydrogel
- Excellent light-to-heat conversion performance
- Desirable biocompatibility
- Potent antibacterial effect
- Sustained drug release from injectable hydrogel at the cancer tissues over a long period
- Synergistic effect of chemotherapy, photothermal therapy, and immunotherapy

Acknowledgements

S. Abbaszadeh
PhD student

V. Nosrati
PhD student

K. Musaie
Pharm.D

m.a.shahbazi
@umcg.nl

#Groningen @ UMCG

SIGRID JUSELIUS STIFTELSE
Sydäntutkimussäätiö
Stiftelsen för hjärtforskning
Finnish Foundation for Cardiovascular Research
BAYER
erc
ACADEMY OF FINLAND
European Research Council
FACULTY OF PHARMACY
JANE JA AATOS ERKON SÄÄTIÖ
HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI
BUSINESS FINLAND
HiLIFE
HELSINKI INSTITUTE OF LIFE SCIENCE
FCT
Fundação para a Ciência e a Tecnologia
FINNISH NATIONAL AGENCY FOR EDUCATION
JENNY AND ANTTI WIHURI FOUNDATION
umcg
INNOVATIVE TRAINING NETWORKS
@MSCActions
MSCA RISE 2020
MSCA INDIVIDUAL FELLOWSHIPS 2020
P4FIT
cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY
NETPORE
Network on porous semiconductors and oxides
Nano2Clinic
Cancer Nanomedicine - from the bench to the bedside

Dr. Santos' Lab | YouTube
@Santos_Lab15 | Twitter
h.a.santos@umcg.nl

CRS 2022 Annual Meeting & Expo

July 11 – 15, 2022 | Montreal Congress Center, Montreal Canada

Advanced Delivery Science

THANK YOU!

SantosLAB