

Nanomedicine and Nanoscale Delivery I

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ACROSS DISCIPLINES



Polymer theranostics with multiple stimuli-based activations



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NiCR NATIONAL INSTITUTE
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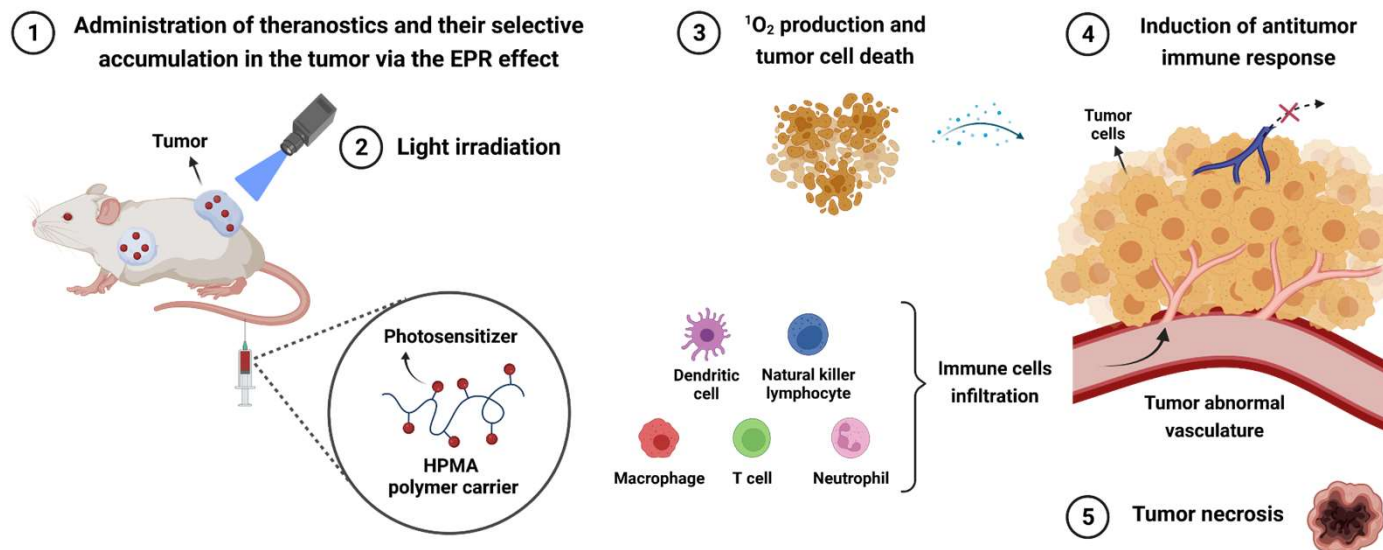
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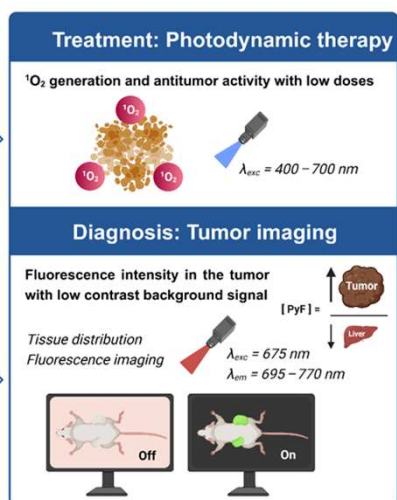
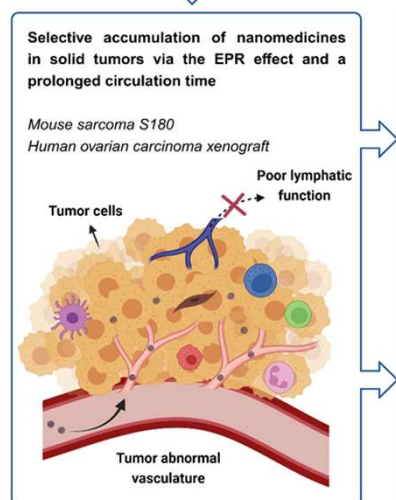
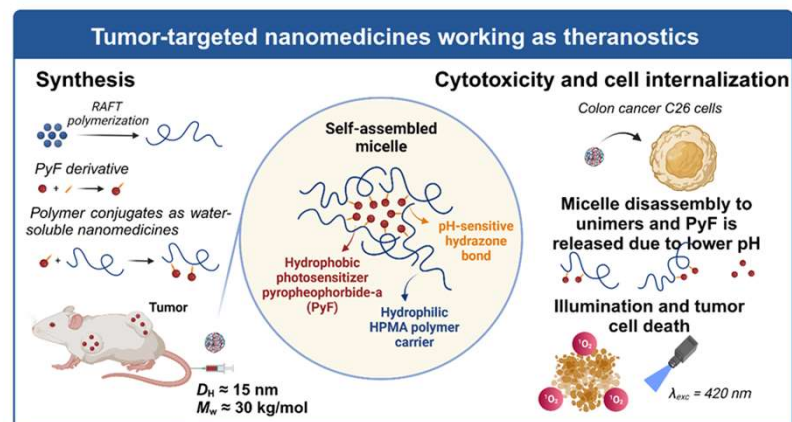
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Photodynamic therapy

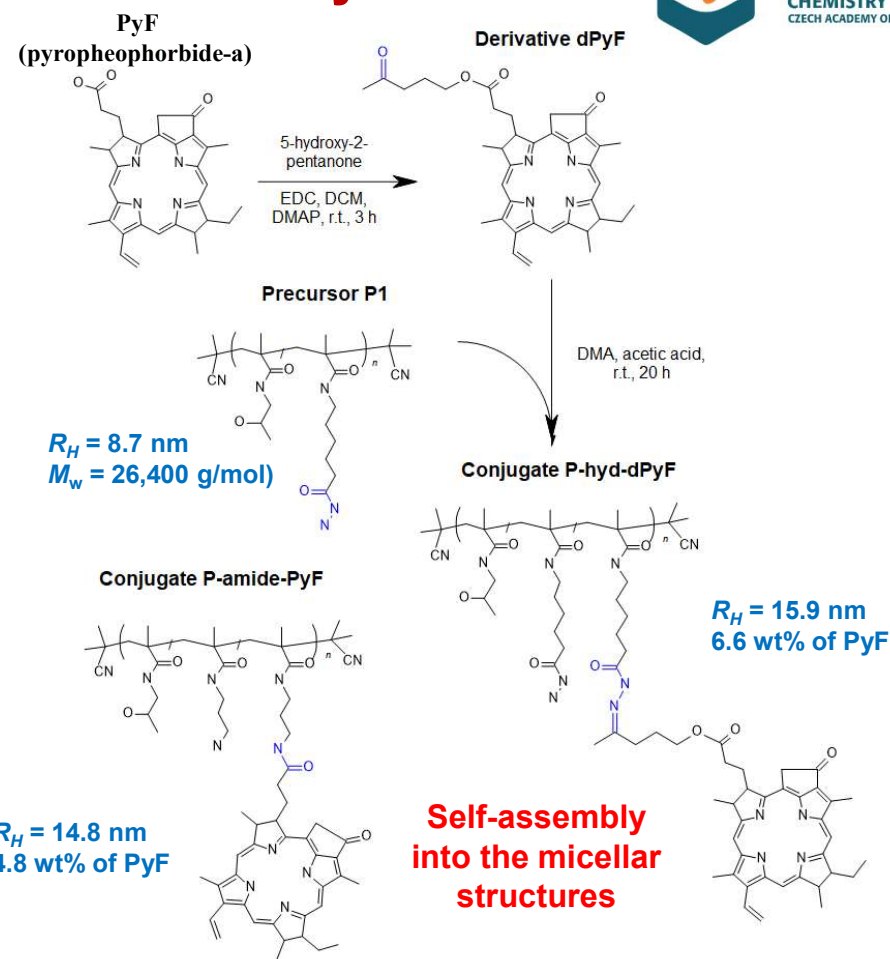


- Principle: photosensitizer strongly absorbs the light, which is then converted to energy and heat in the irradiated areas → production of reactive oxygen radicals, i.e., singlet oxygen species, $^1\text{O}_2$ ($^1\Delta_g$) → cell death;
- Advantages:
 - No long-term side effects;
 - Less invasive than surgery;
 - Unlike radiation, PDT can be repeated many times at the same site if needed.

Aim of the study

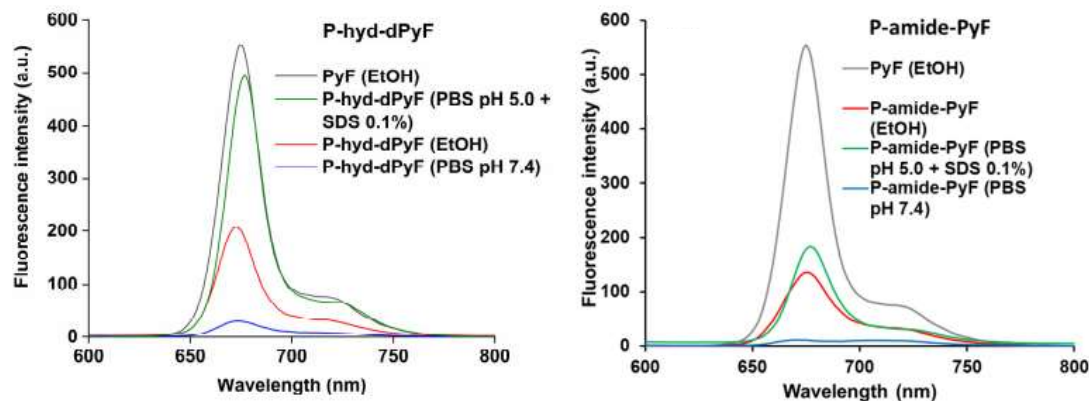


Synthesis



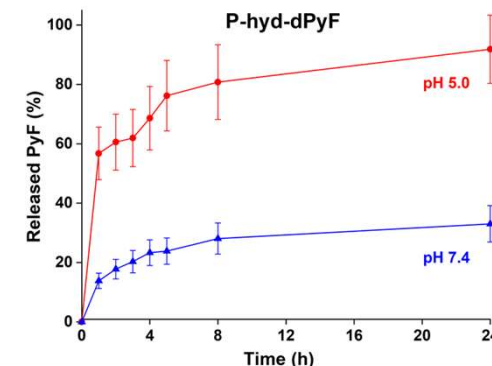
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Quenching and activation of fluorescence

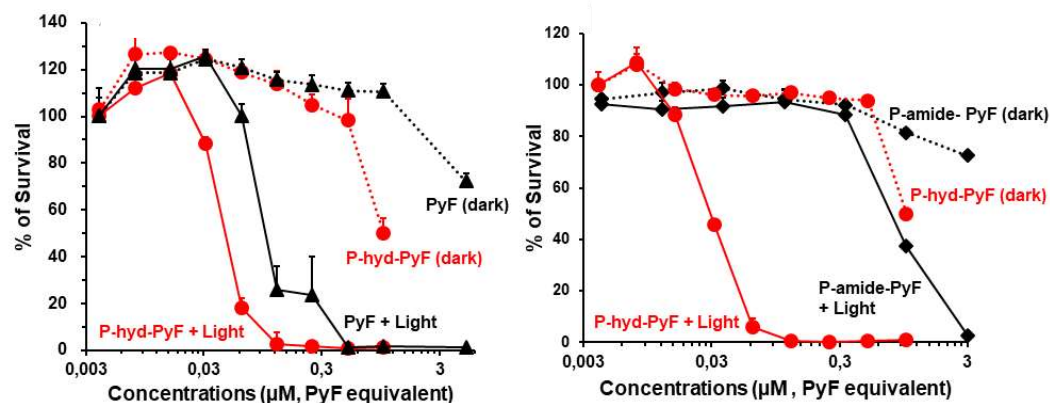


- The activation in acidic conditions was observed
- The fluorescence and $^1\text{O}_2$ generation is depleted after formation of micelles
- Full restoration of activity after disruption of the micelles and release of PyF

pH-sensitive behavior

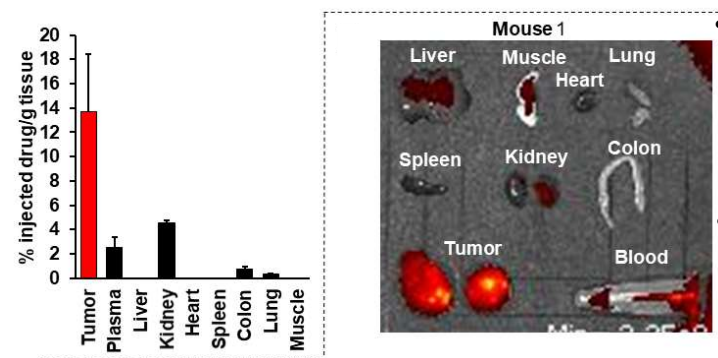


Dark and light cytotoxicity



- The P-hyd-dPyF conjugate showed similar dark toxicity as free PyF or nondegradable P-amide-PyF
- After illumination with light the P-hyd-dPyF showed much stronger cytotoxicity when compared to the P-amide-PyF or free PyF

Biodistribution

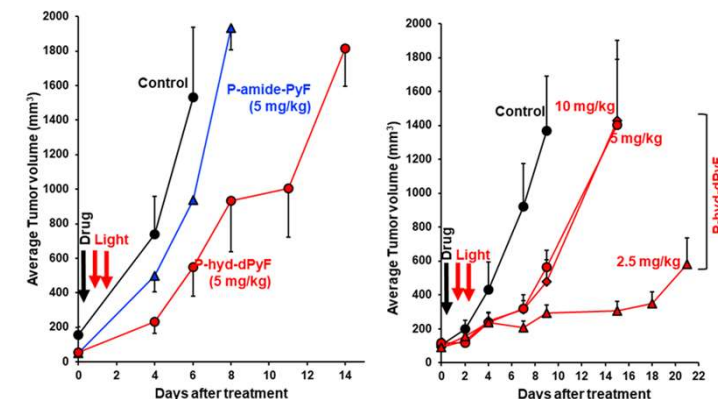


The fluorescence signal was observed predominantly from the tumorous tissue, with excellent ratio to liver. Almost all major organs were free of the fluorescent activity of the nanotheranostics.

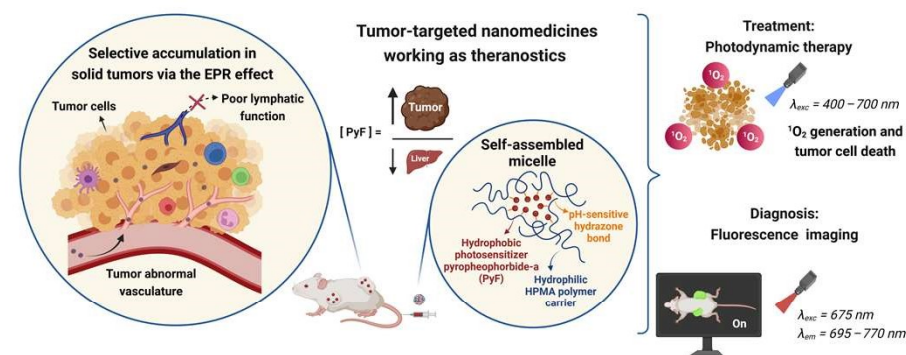
Conclusion

- The pH-sensitive theranostics was developed by employing the dPyF derivative and biocompatible copolymer
- The theranostics is completely switched off during the delivery and activated in the tumorous tissue
- The predominant tumor tissue accumulation was found showing the excellent diagnostics potential of the system
- The excellent efficacy was found for low dose treatment using the developed theranostics

In vivo therapeutic efficacy



- The P-Hyd-dPyF showed higher efficacy than nondegradable polymer system and free PyF
- Reversed dose dependence was found showing the excellent activity in low dose treatment of tumors



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Acknowledgement.



Financial support:



Co-funded by
the European Union



Thank you for your attention

