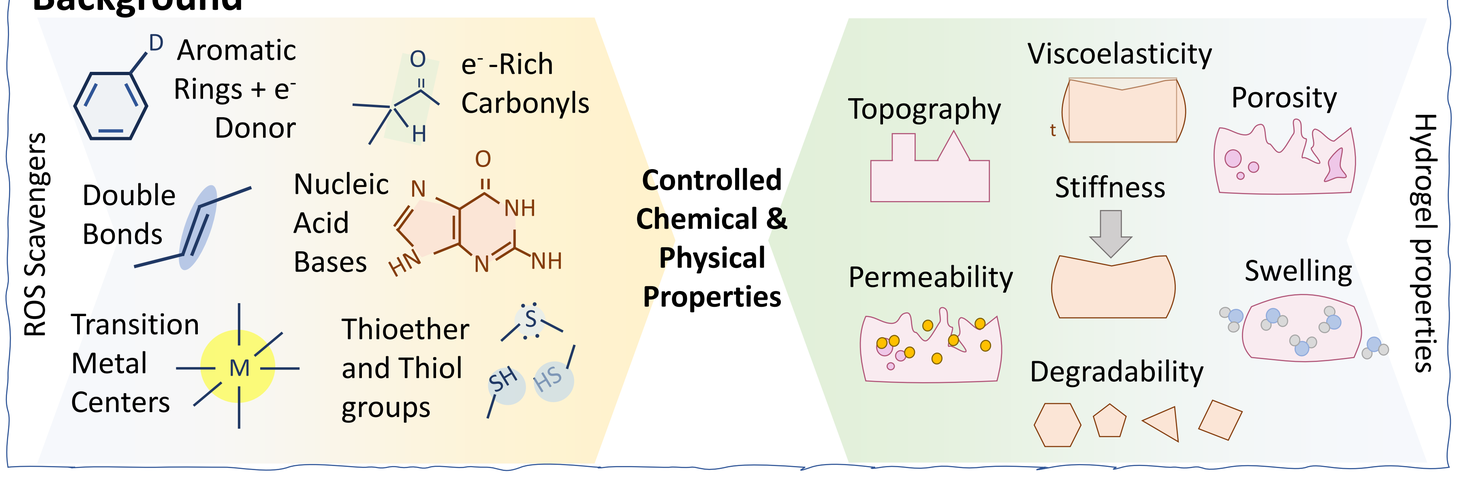
Reactive oxygen species (ROS) – scavenger soft hydrogels as adaptative platforms for biological systems

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Challenges

- Metabolic activity in cultured cells generates subproducts such as lactate, ammonia, and **reactive oxygen species**, among others, that accumulate in the cell environment.
- These species regulate but also trigger cellular responses associated with **senescence, reduced proliferation, cytotoxicity.**
- Frequent medium or extracellular matrix exchange increase the reagent consumption, disrupting **long-term culture stability,** and substantially raise experimental costs, especially in systems requiring specialized formulations[1].

Background[2-5]

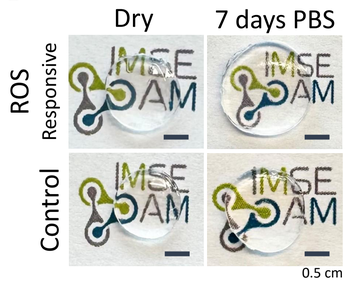


Our Approach

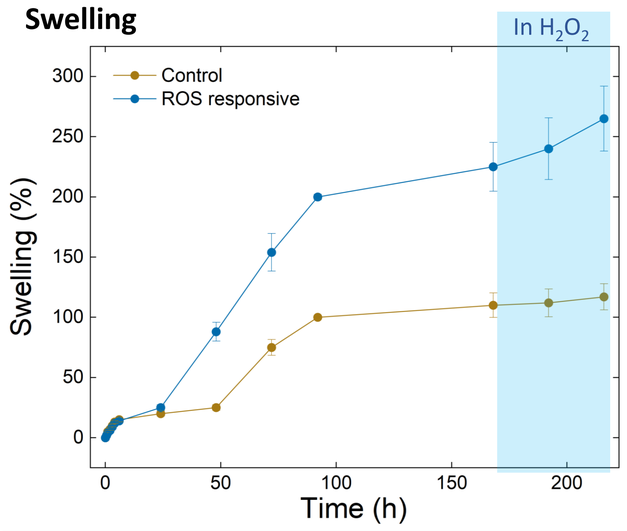
We focus on the engineering soft **thioether-based ROS-responsive hydrogels** that integrate into the biological culture systems. The biocompatibility is evaluated using ***Dictyostelium*** in **direct contact** with the hydrogel surface, and we further examined the development stages influenced by ROS-scavenging materials.

Synthesis and Characterization of the Hydrogels

Control P(HEMA-co-MAA-co-EGDMA) **and ROS-responsive hydrogels** P(HEMA-co-MAA-co-EGSA) were synthesized under UV light (4 mWcm^{-1}, 365 nm) and swollen in PBS for 7 days, with daily solution exchange to wash the residual monomers.

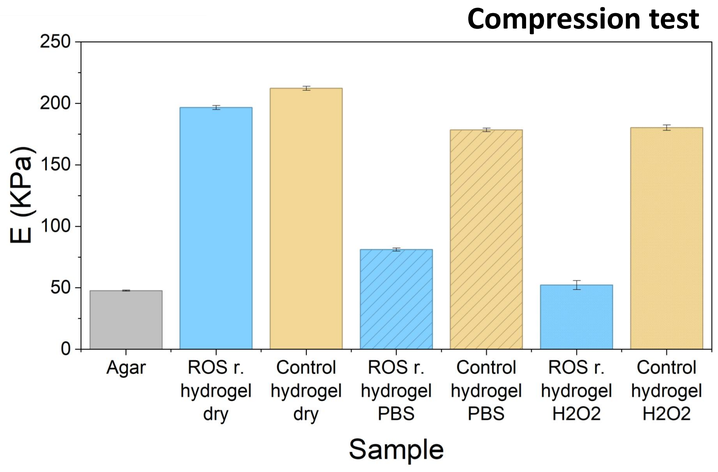


Swelling



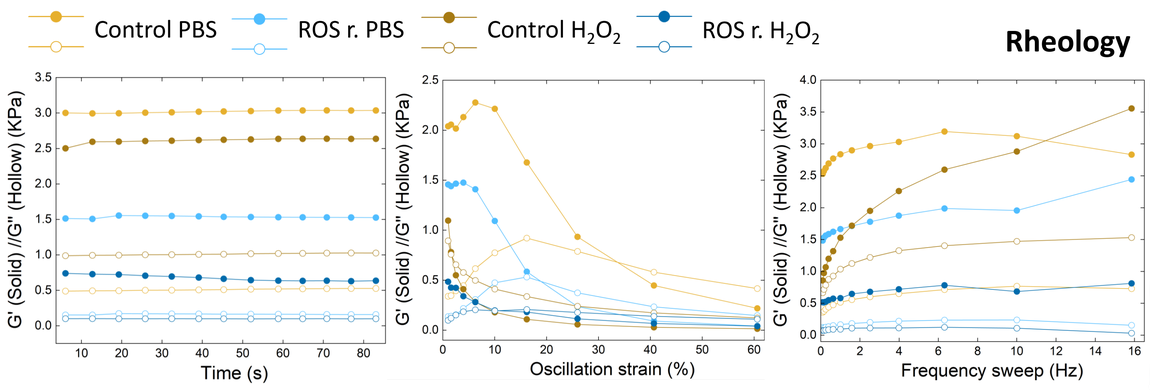
Both formulations reached their **maximum swelling at day 7 (168h).** The swollen hydrogels were incubated **in H_2O_2** for 2 days (48h). **ROS-responsive** hydrogels exhibited a **50% increase of swelling** compared to those in PBS, whereas the control hydrogels maintained their original swelling state.

Compression test



Young's moduli of ROS-responsive hydrogel is approx. 80 kPa and 200 kPa for the control hydrogel. Upon **H_2O_2 exposure**, the modulus decreased to 50 kPa and 180 kPa, respectively.

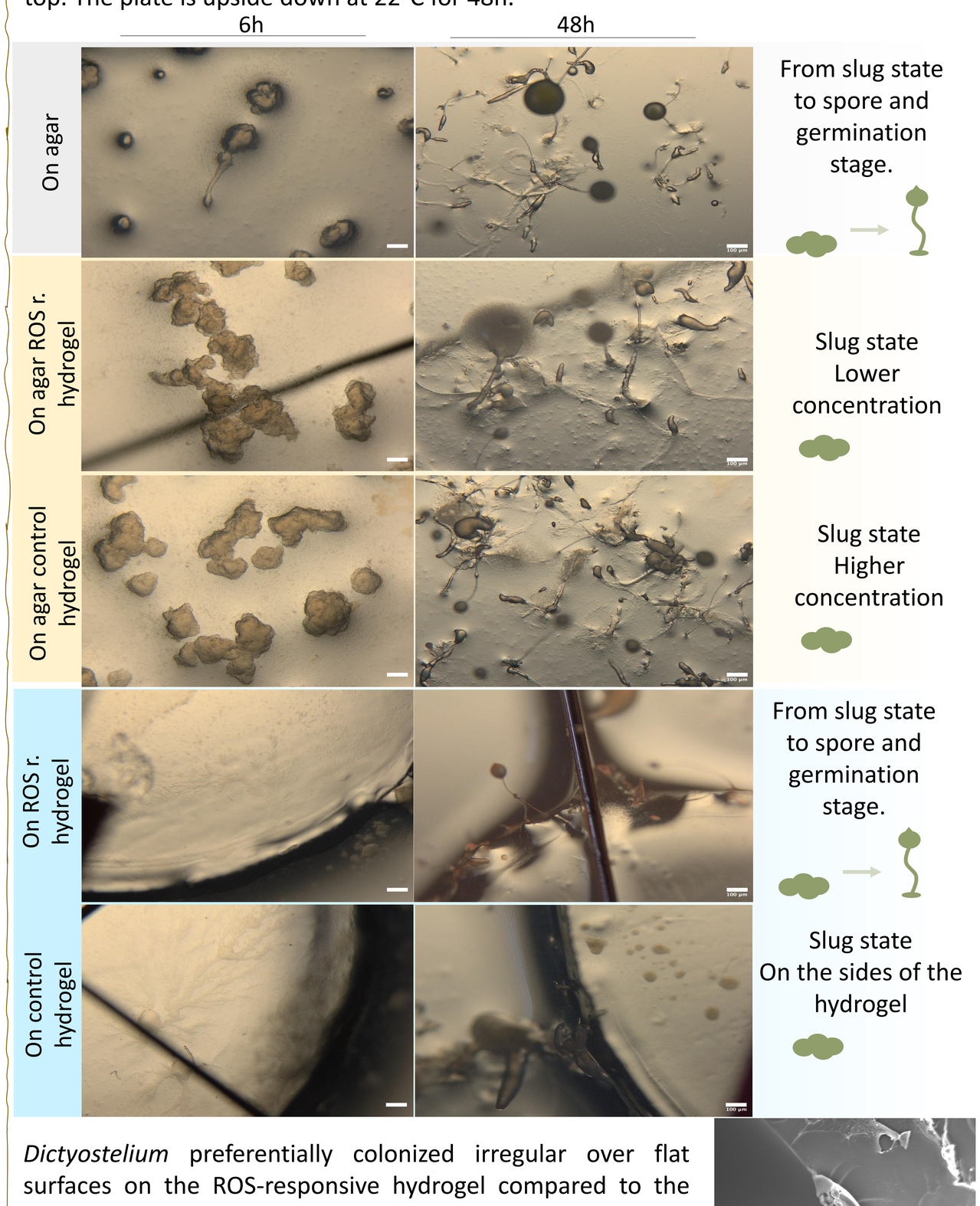
Rheology



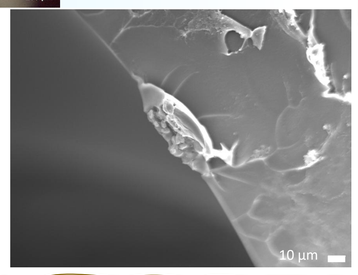
Hydrogels have shown **elastic behavior**. Control hydrogels are stiffer than ROS-responsive hydrogels in PBS and in H_2O_2. ROS-responsive hydrogels **in H_2O_2** are **softer and more dynamic** than those immersed in PBS.

Dictyostelium

Hydrogels were placed in agar plates and a solution of *Dictyostelium* was dropped on top. The plate is upside down at 22°C for 48h.



Dictyostelium preferentially colonized irregular over flat surfaces on the ROS-responsive hydrogel compared to the control and even agar (SEM image), which suggests that both surface topography and ROS-responsiveness create a more favorable environment for these organisms.



Take Home messages:

- ✓ **Chemical composition:** The molecular structure of the hydrogel influences how *Dictyostelium* interacts and develops on the material.
- ✓ **Surface topography:** Irregular or patterned surfaces promote *Dictyostelium* development more effectively than flat, smooth interfaces.
- ✓ **Swelling and stiffness:** These physical properties regulate ROS uptake.

References:

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