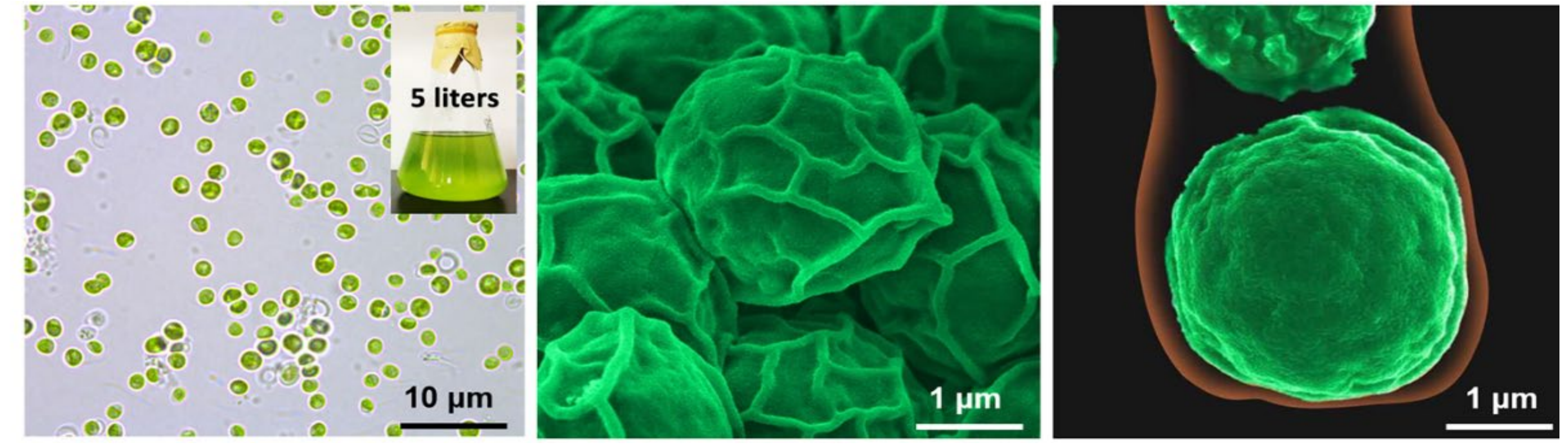


Bioengineered Microalgae-Based Therapeutic Platforms

Concept Overview

- **Microalgae** are living photosynthetic microorganisms that act as sustainable and biocompatible therapeutic carriers.
- Their light-driven activity, tunable surface chemistry, and bio-secretion capacity enable multifunctional biomedical applications.
- Integrating **biology + engineering + ecology** leads to next-generation living therapeutic materials.



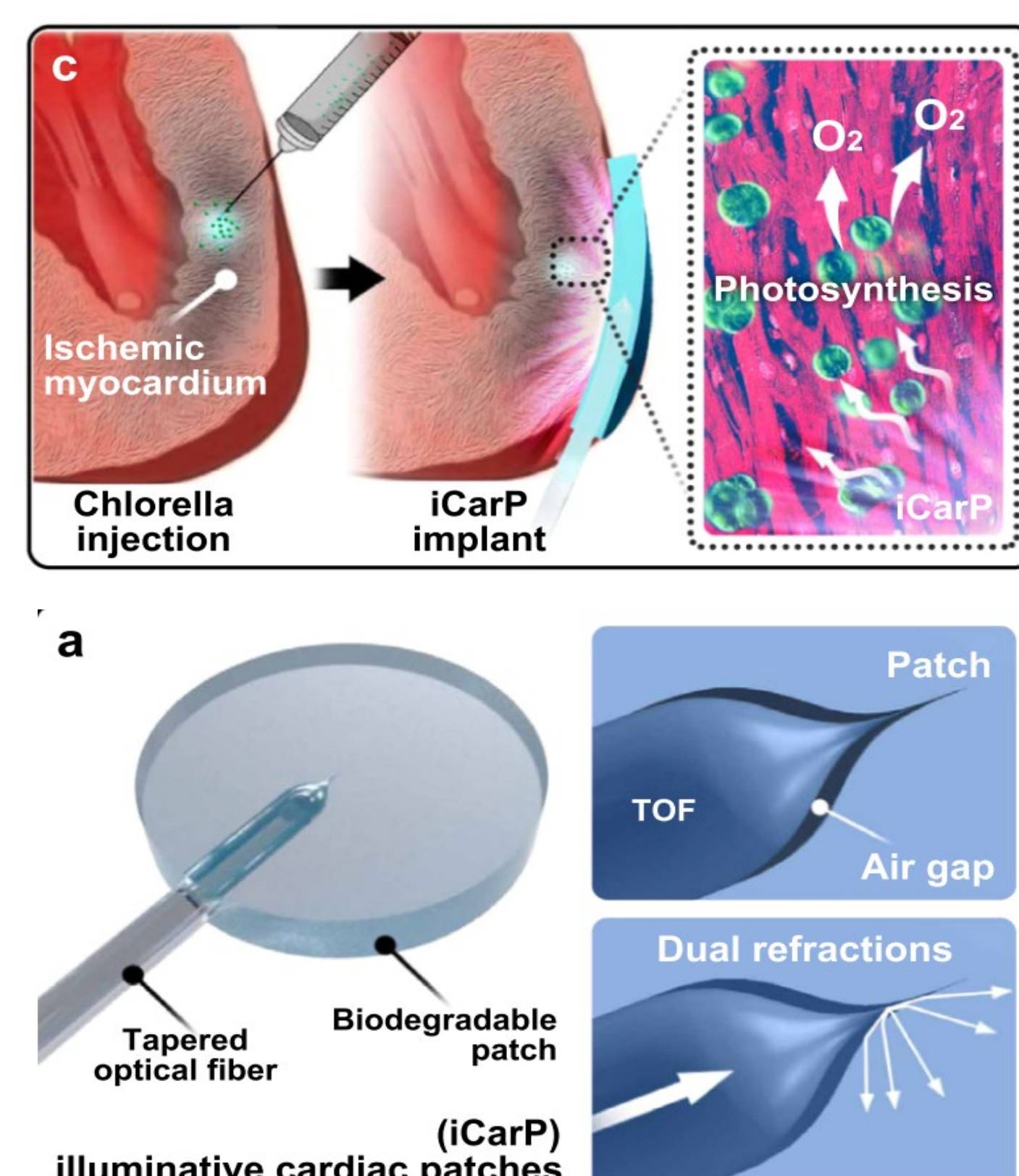
Advantages of microalgae platforms

- Natural & Green
- Low Cost
- Biocompatible & Safe
- High-Value Biomolecules

Photosynthetic Oxygen Generation

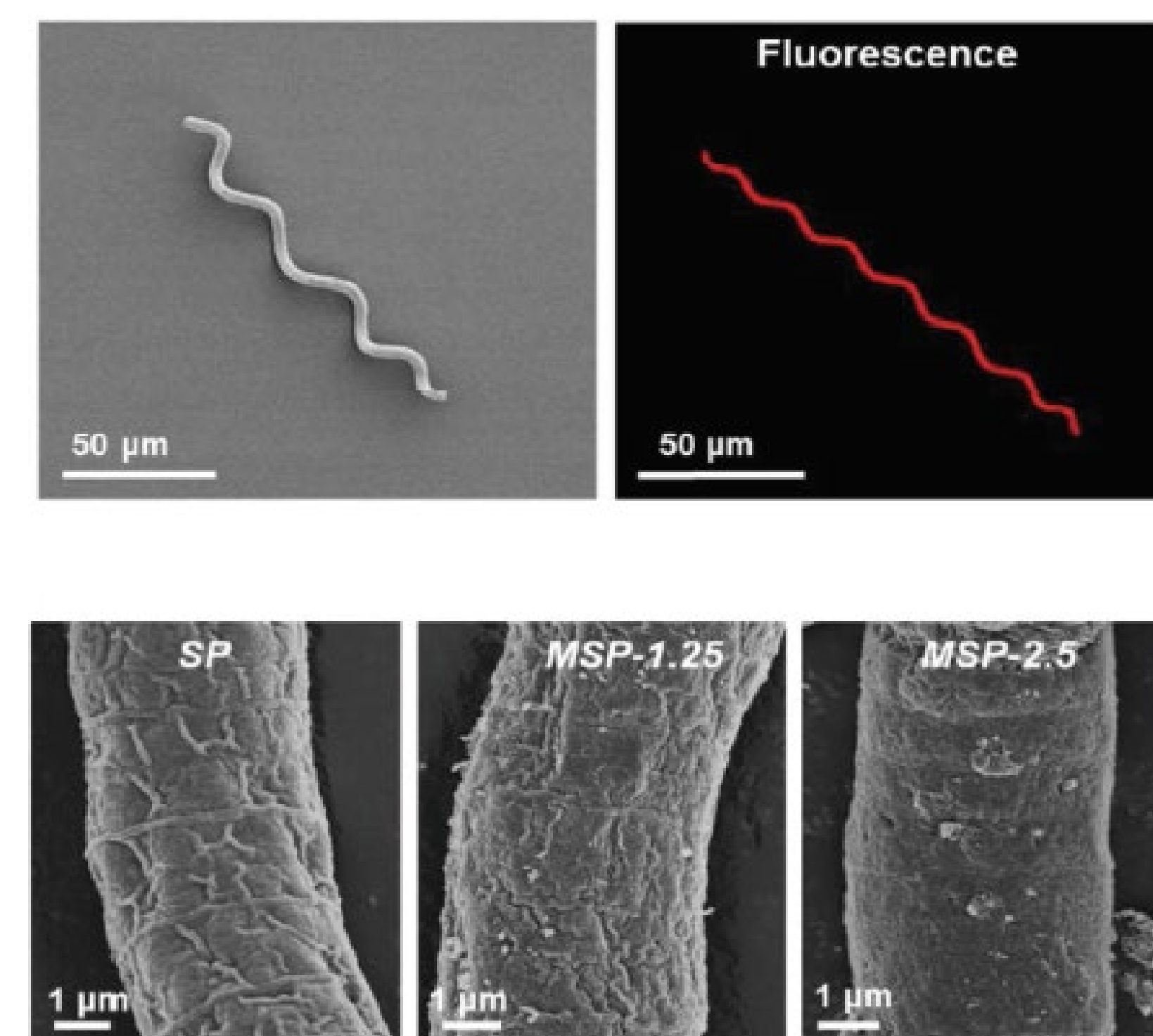
Hypoxia treatment (tumor/wound/cardiac repair)

- Performs in situ photosynthesis, releasing O_2 continuously.
- Relieves tissue hypoxia and enhances angiogenesis & cell viability.
- Embedded in hydrogels or microneedles for **controlled O_2 supply**.



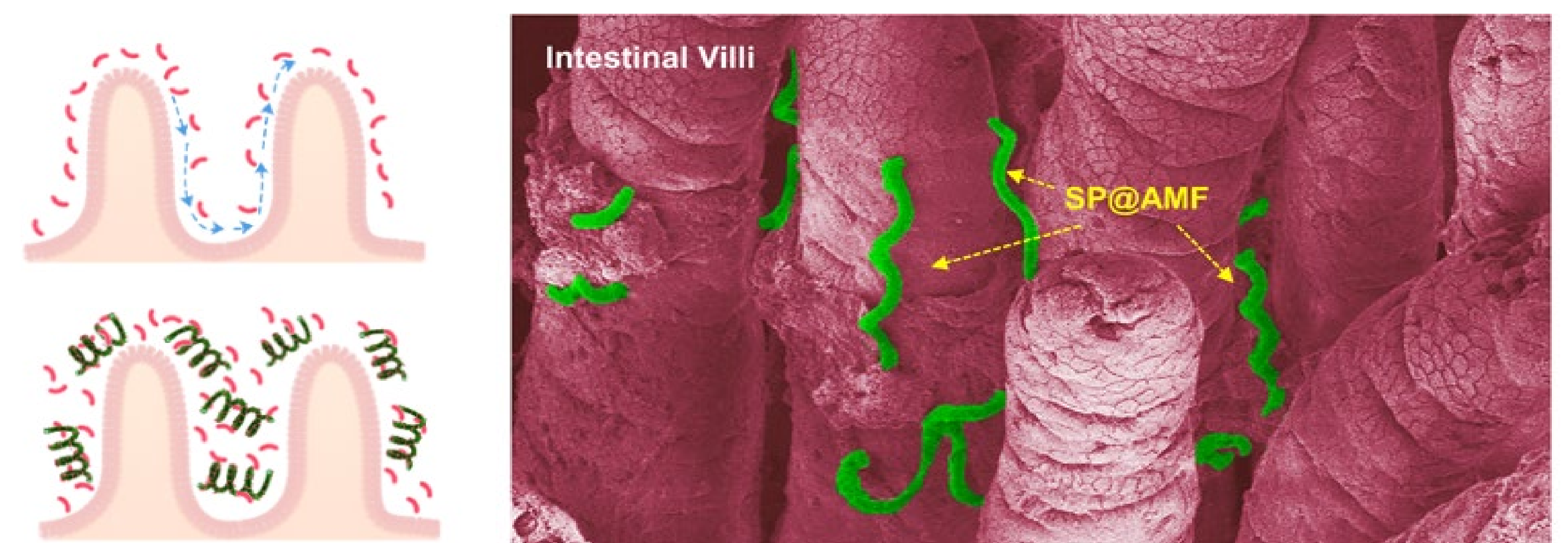
Engineered Microalgae Microrobots

- Surface functionalized with responsive nanoparticles.
- Enable light and magnetic-driven navigation to target sites.
- Integrate re-oxygenation, imaging, and drug release in one system.
- Allow **precision therapy** guided by FL, PA, and MRI.



Microbiota Interaction & Symbiotic Therapy

Intestinal retention and targeted delivery

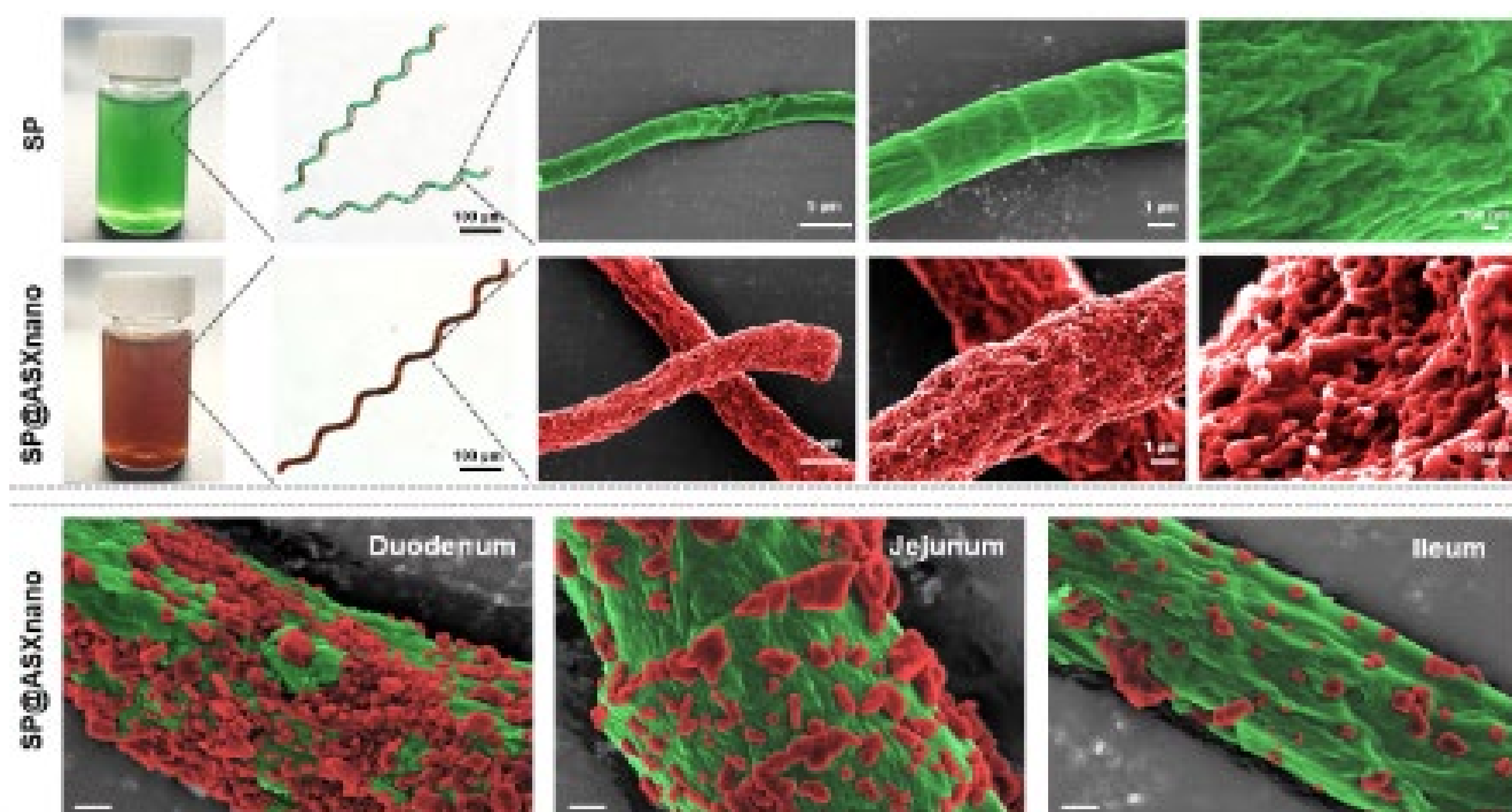


- Helical or mucoadhesive structures for GI adhesion.
- **Long-term intestinal retention** and localized therapy.
- Effective for IBD, radiation injury, and colon repair.
- Continuous local treatment in the gut microenvironment.

Microalgae-Based Drug Delivery Systems

Biodegradable, biocompatible carriers

- Allow adsorption, conjugation, or encapsulation of therapeutics.
- Adaptable to oral, injectable, and transdermal routes.
- Provide sustained release and enhanced bioavailability.



Conclusions

Engineered microalgae represent a new generation of **living therapeutic materials**, integrating **sustainable biology** with **advanced biomedical engineering** to create eco-friendly, multifunctional platforms for precision medicine and regenerative healthcare.

Organizers