



Jellyfish on the menu: From a marine nuisance to culinary innovation

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Ph.D. Mie Thorborg Pedersen
Villum International Postdoc Fellow



SDU 

ETH zürich

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Current work

ETH zürich **SDU** 



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- Create fundamental understanding of the properties of jellyfish biocompounds to form fibrils to expand its potential for novel biomaterials



Co-funded by
the European Union



Sustainable Blue
Economy Partnership

- Create innovative solutions focusing on utilising side-streams from aquaculture, fisheries and by-catch to create valuable bioactive compounds for functional foods

Rise of jellyfish population

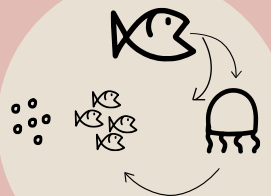
Negative impacts



Aquaculture



Fishing industry
by-catch



Ecosystem



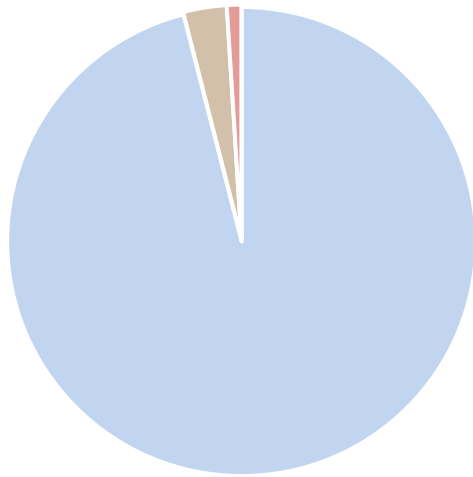
A valuable source?

Defeating it by eating it...?

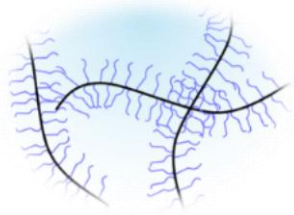


How to cook jellyfish?

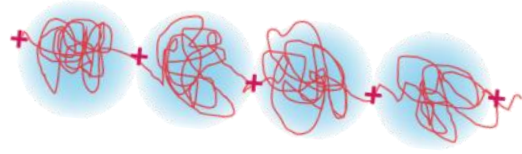
- Water (96 %)
- Salts (3 %)
- Biological matter (1 %)



Mucoproteins



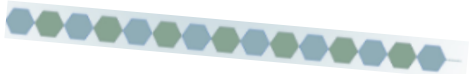
Elastin-like fibrils



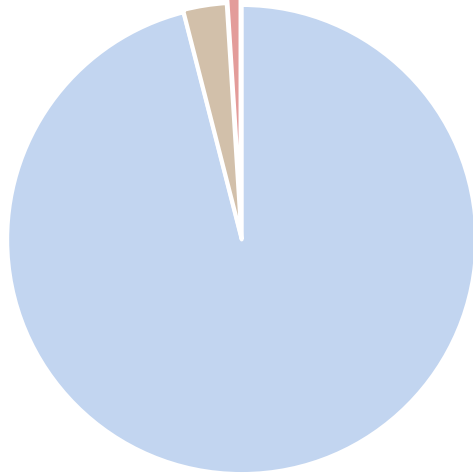
Collagen



Mucopolysaccharides



- Water (96 %)
- Salts (3 %)
- Biological matter (1 %)



How to cook jellyfish?



A traditional delicacy of Asian cuisine

- Long standing tradition in Asia – consumed for over 1000 years.
- Traditional preparation involves Alum salting (Heavy metals).
- **Global Consumption:** In 2024, global consumption of dried jellyfish reached **112,000 tonnes**, a **36% increase** from the previous year, with a market value of approximately **\$277 million USD**.
- Well-established **supply chains**, including seasonal harvesting.



FeCl_3



$\text{Cr}_2(\text{SO}_4)_3$



FeCl_2



Traditional Jellyfish in fish market, South Korea, Busan

From curiosity to cuisine? Jellyfish in Europe

- Regulated as a novel food under EU regulation.
- Limited supply chain.
- No culinary tradition.
- Studies show curiosity and openness to trying jellyfish, but consumer awareness is low.



Torri et al., The attitudes of Italian consumers towards jellyfish as novel food, Food Quality and Preference, Vol 79, 2020, 103782.

An emerging trend in gastronomy...?



Jellyfish crisp 2017
Used in a dish created by the chef Klavs Styrbæk, Denmark.



Fake jellyfish, 2018
Part of re-opening menu at Noma, Denmark.



Calcium-prepared jellyfish as starter, 2020
By the chef Giovanni Ingletti, Italy.



Raw jellyfish in marinade, 2021
Served at Alchemist, Denmark.



Fillet-O-jellyfish, 2022
Created by Kitchen Theory, London.

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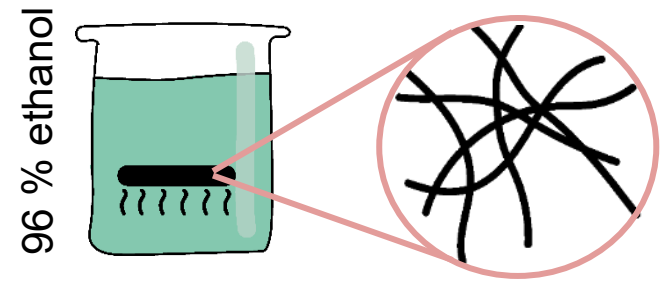
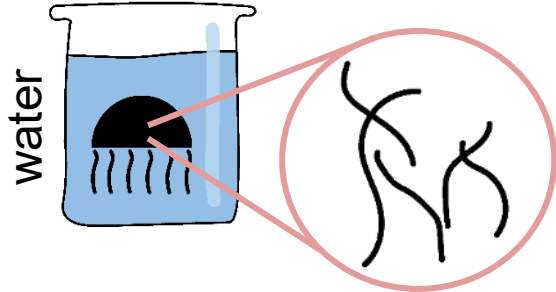


Raw jellyfish in marinade, 2021
Served at Alchemist, Denmark.

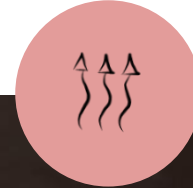


Fillet-O-jellyfish, 2022
Created by Kitchen Theory, London.

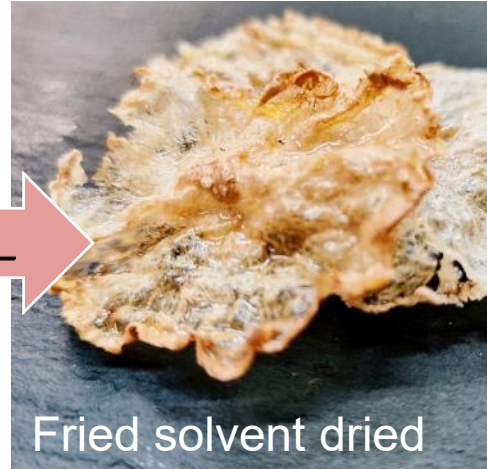
From polymer physics to culinary science



Freeze-dried - flakey



Solvent dried - crispy

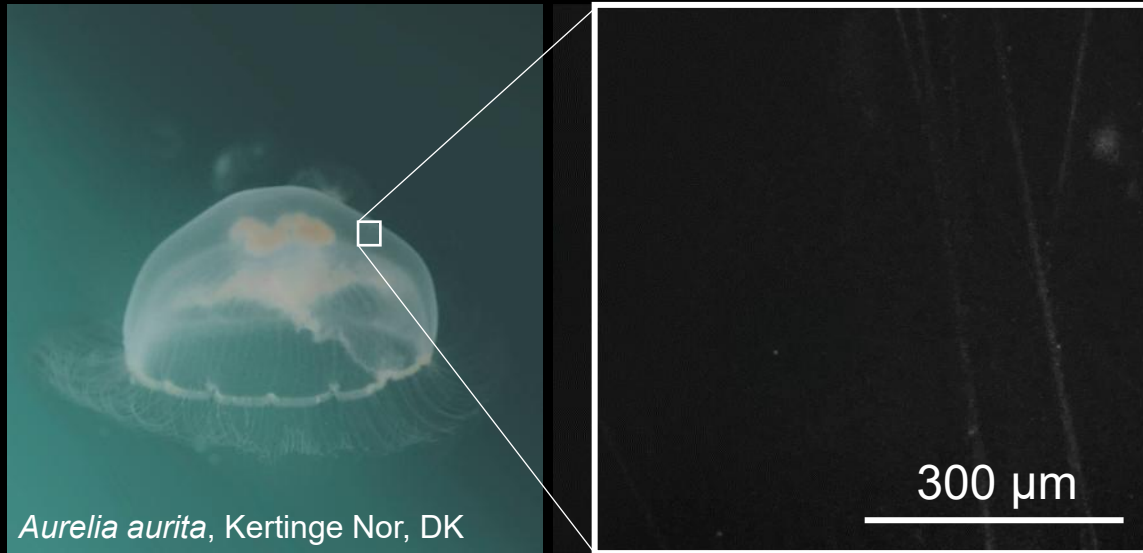


Fried solvent dried

Solvent-induced microstructure

Jellyfish in vivo

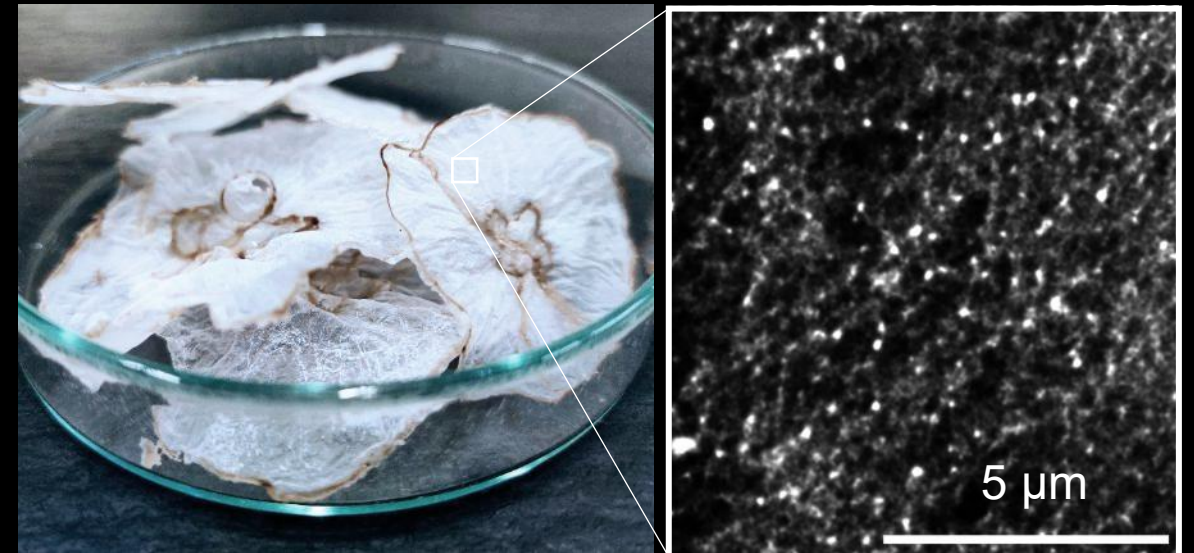
Two-photon microscopy, z-stack



% observation of meshwork (scale 1-20 μm)

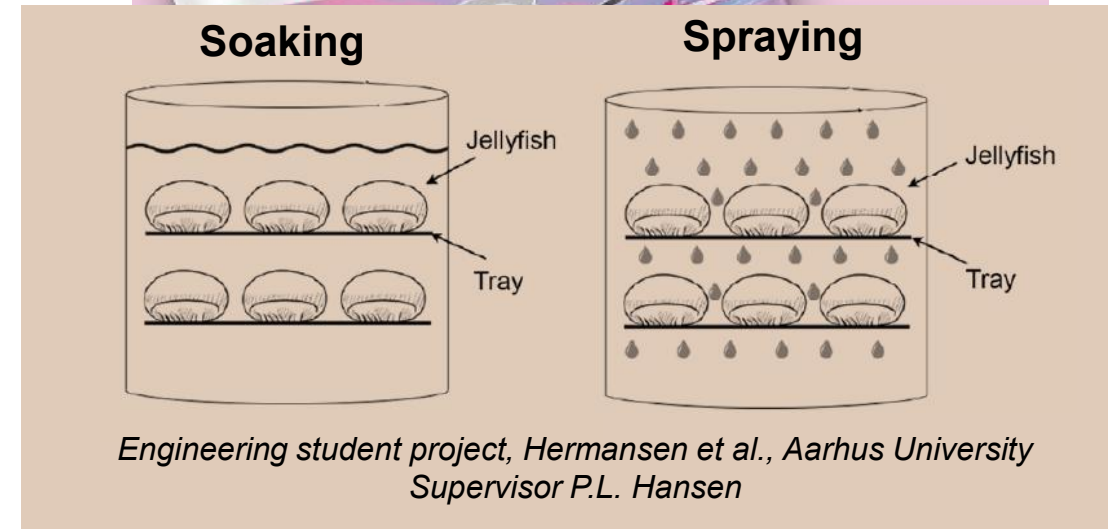
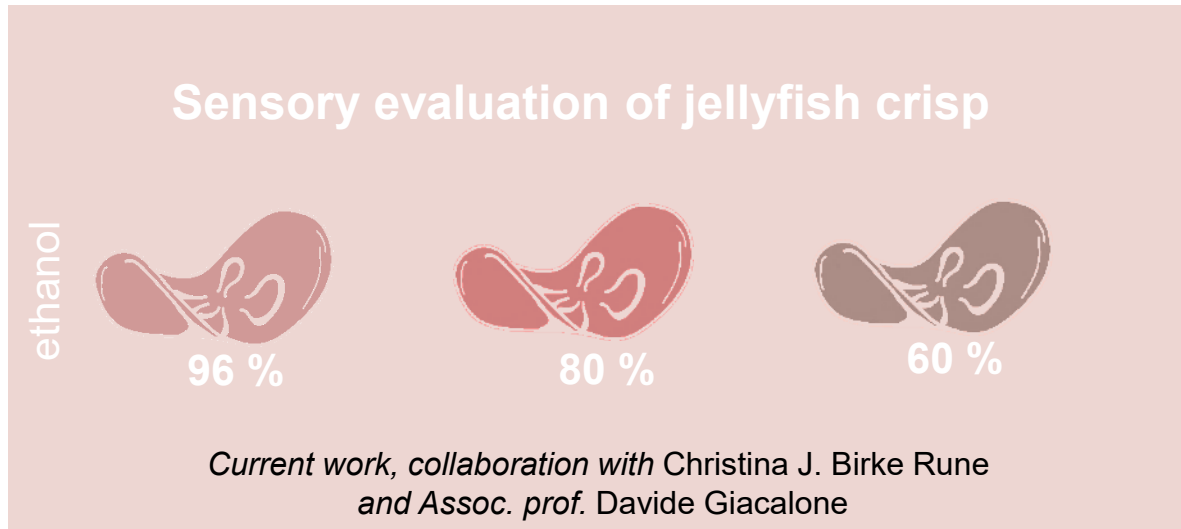
Jellyfish soaked in ethanol

Super-resolution microscopy



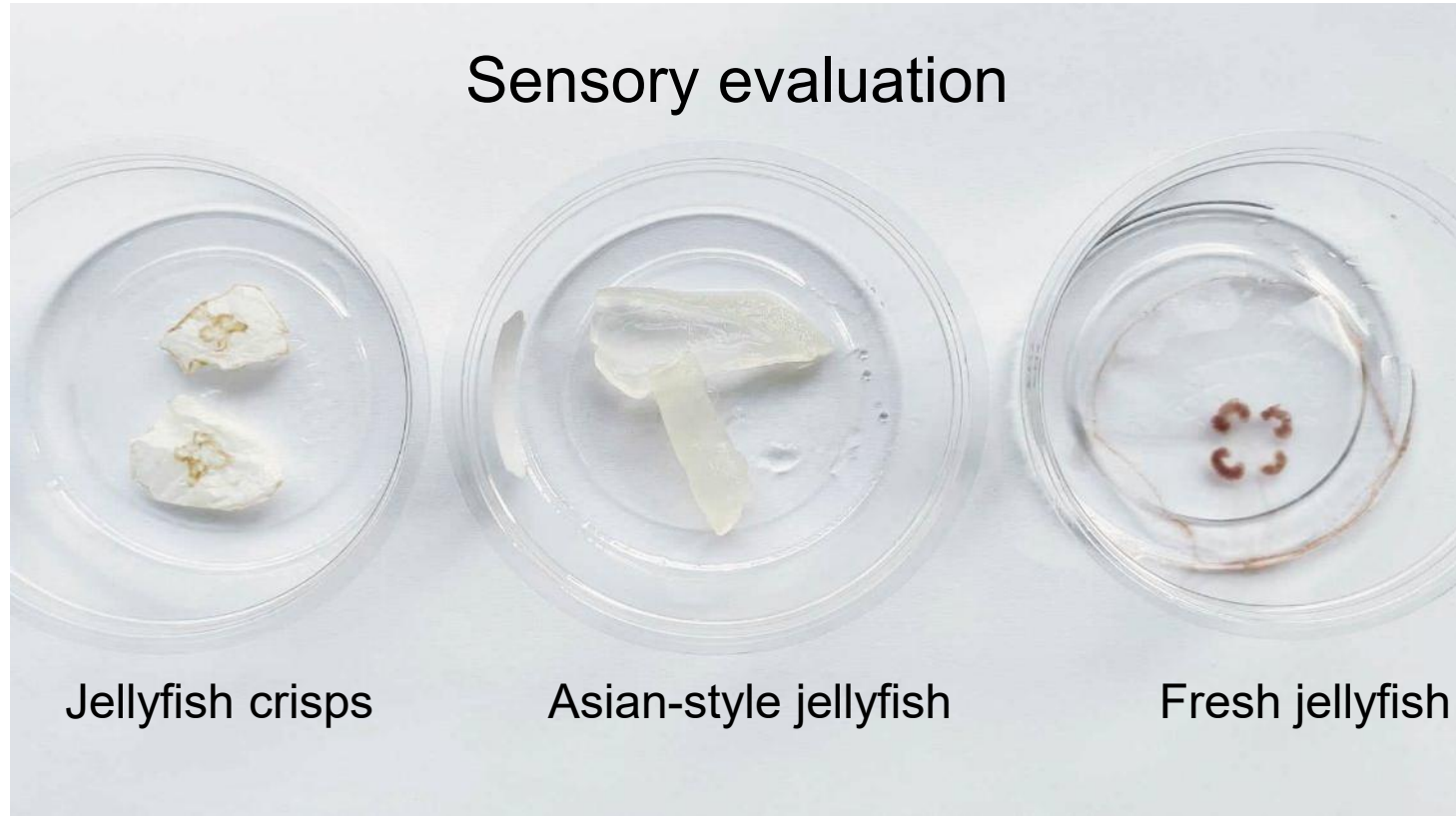
✓ observation of meshwork (scale 1-20 μm)

“Where can I buy the jellyfish crisp?”



No significant discrimination between crispiness

Jellyfish crisps show promising consumer acceptance



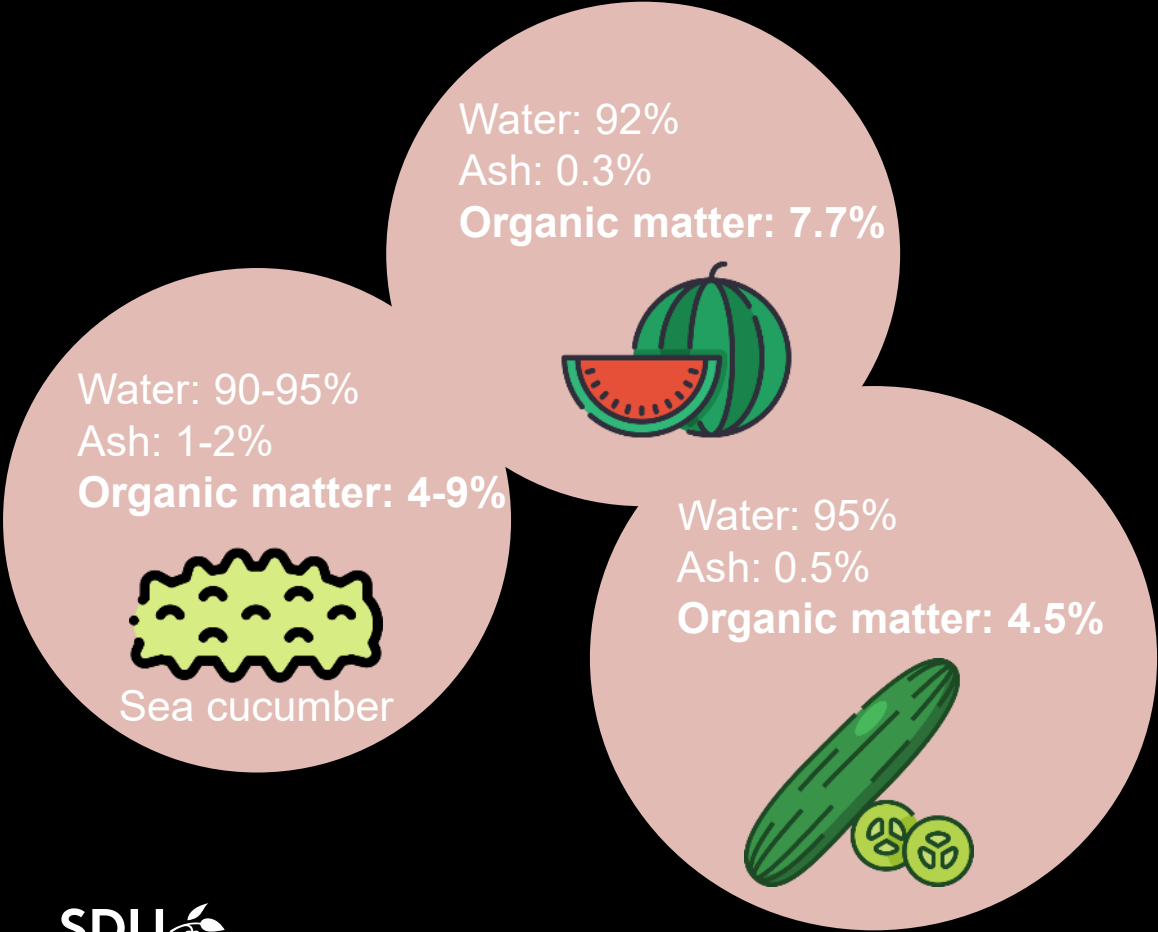
- Jellyfish crisps were **significantly more liked** compared to Asian-style and fresh jellyfish.
- Liking score was high, compared to familiar commercial snacks



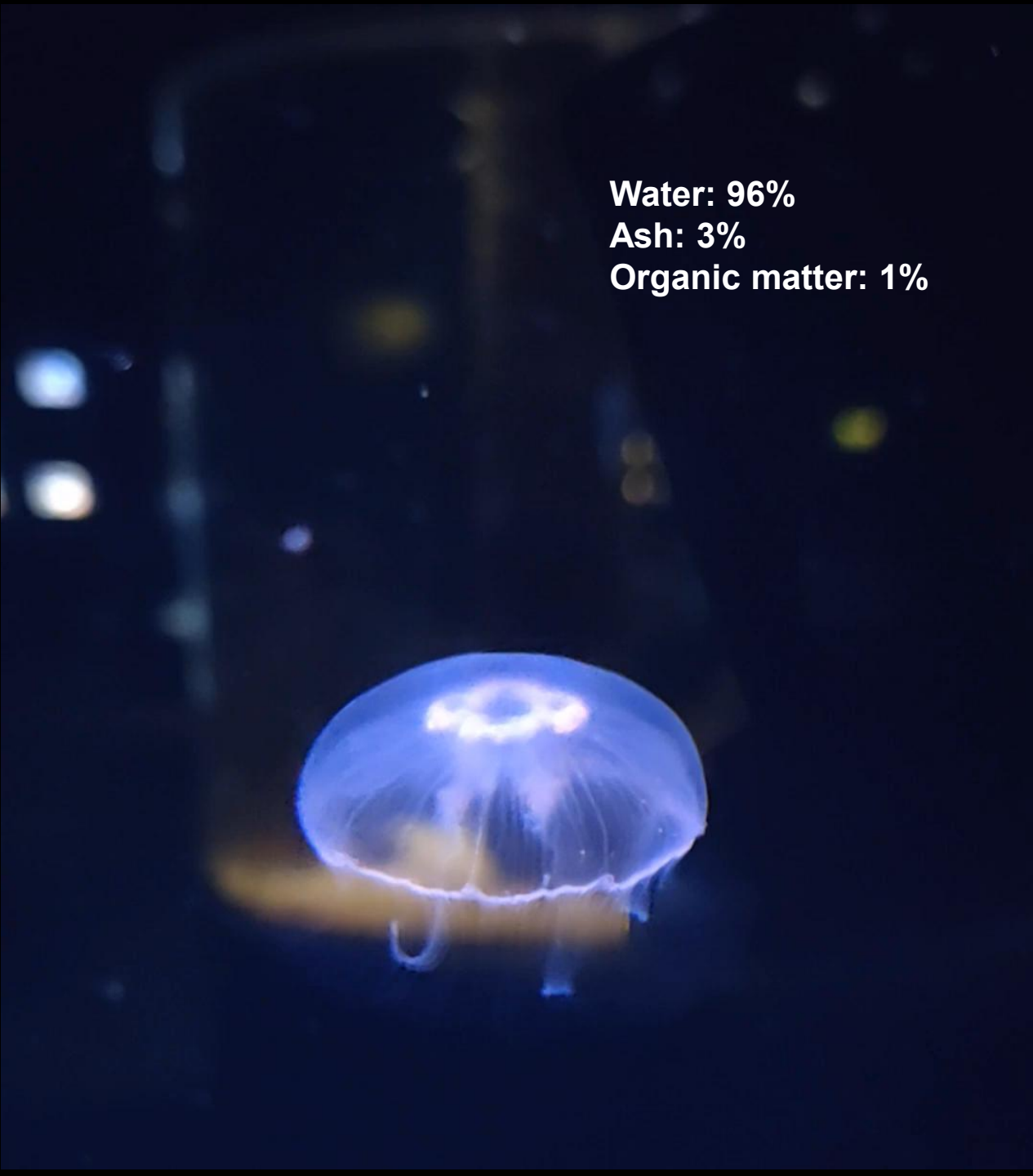
A multi-functional structuring ingredient



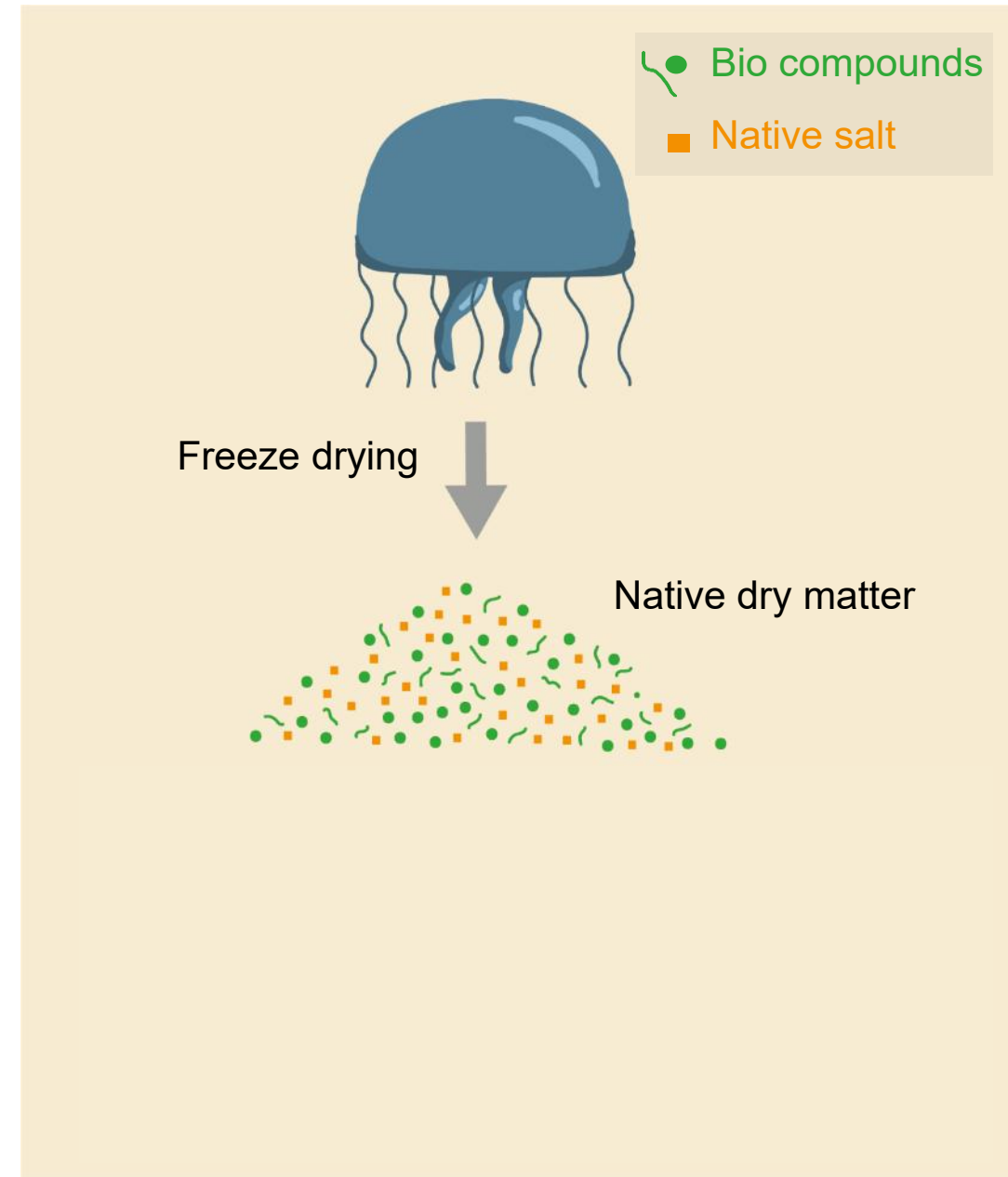
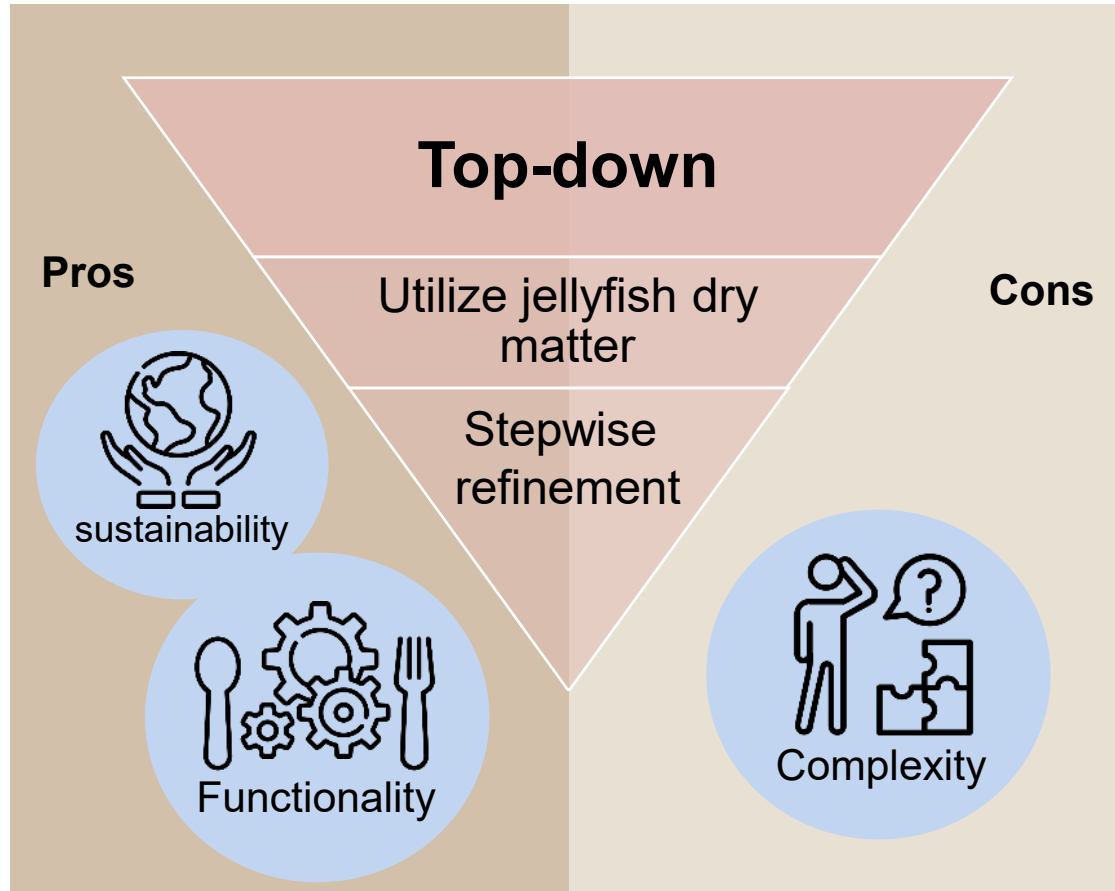
A utilization dilemma



Water: 96%
Ash: 3%
Organic matter: 1%

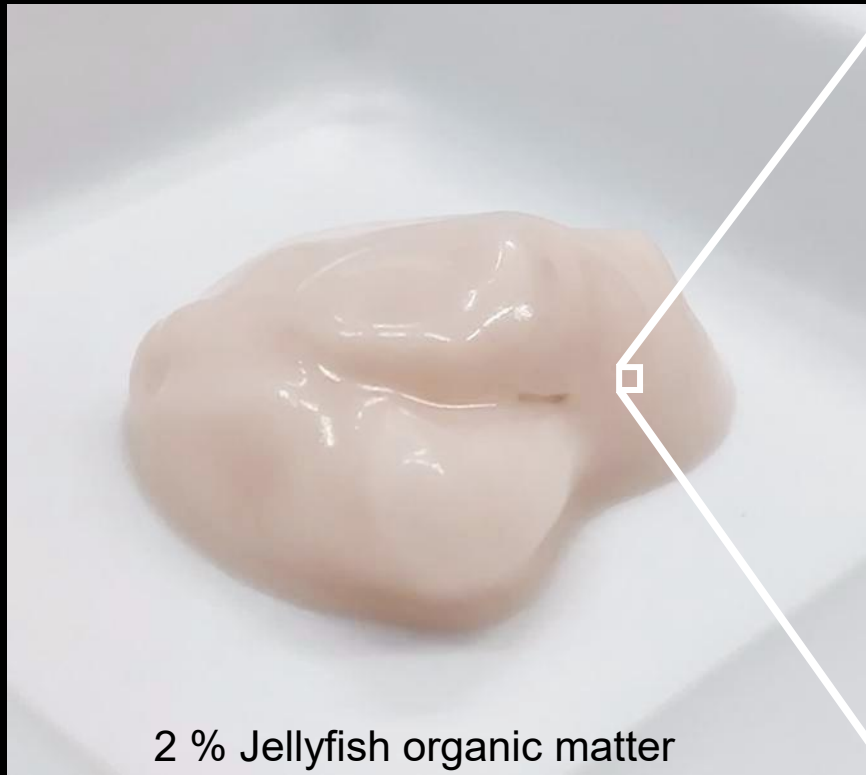


A simple approach

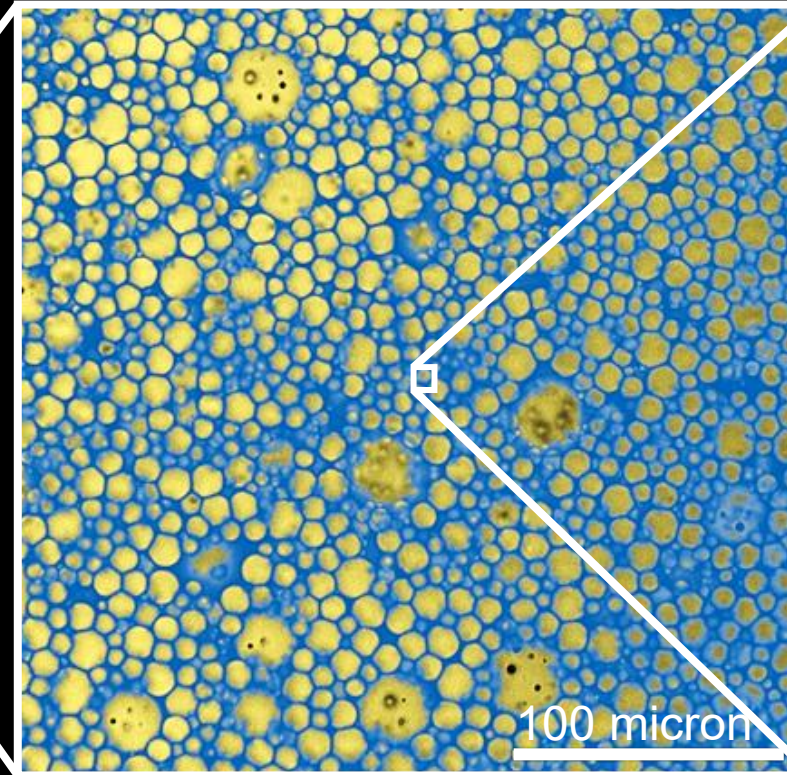


Creation of Jelly-based emulsion

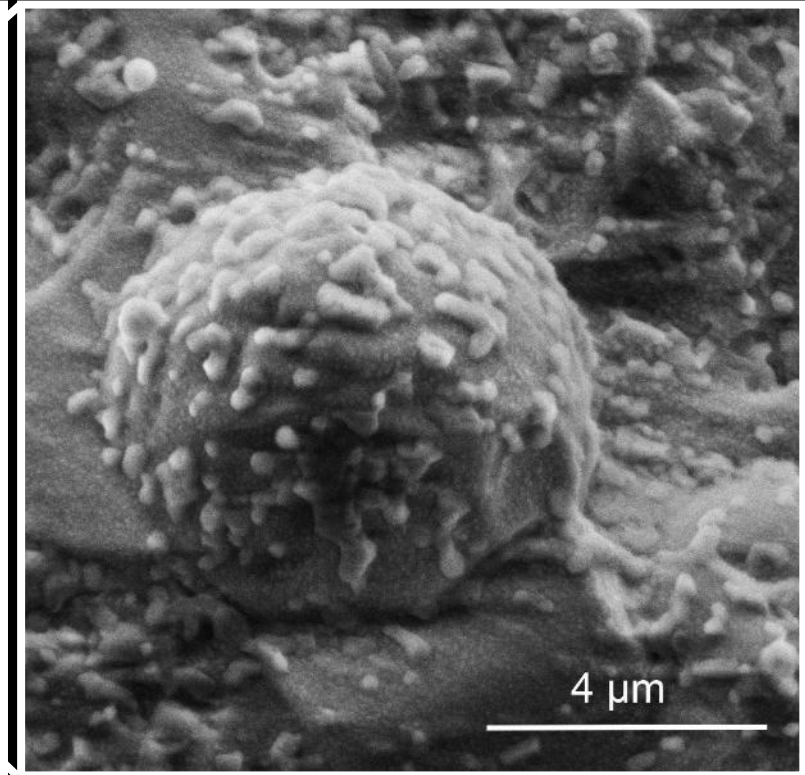
o/w emulsion (7:3)



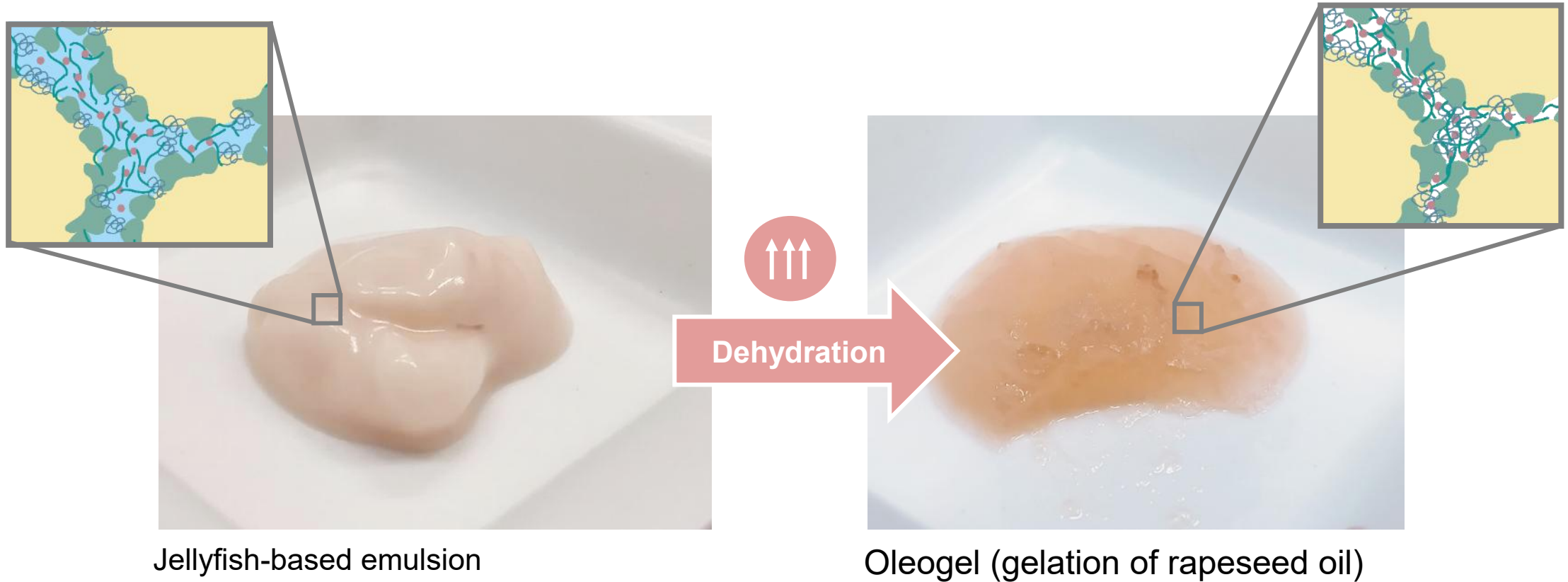
Label-free (CARS) microscopy



Cryo-SEM

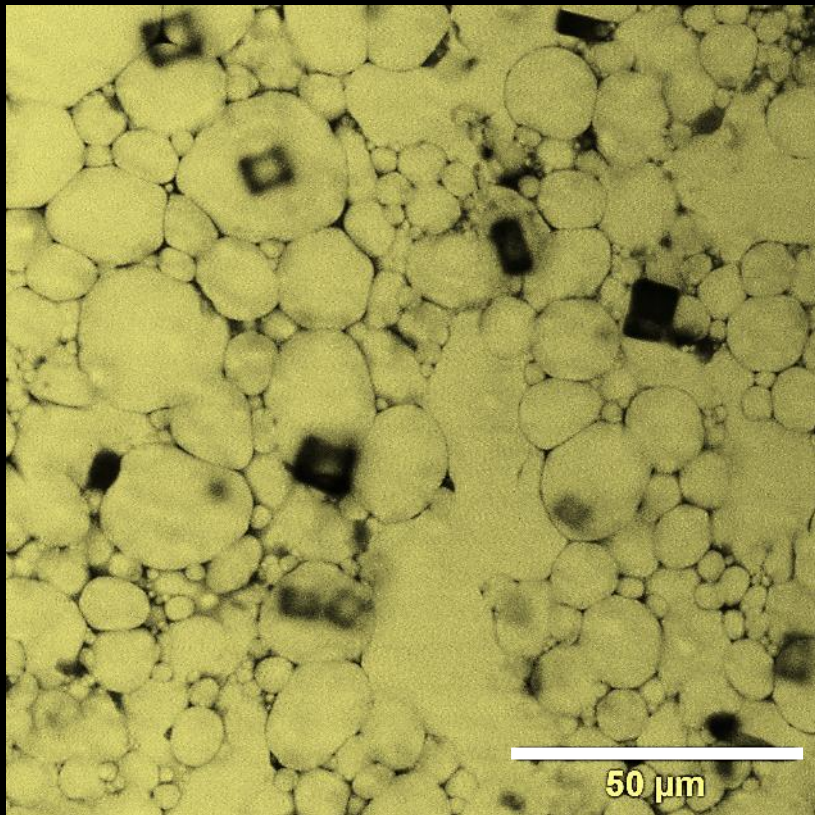


Natural spontaneous oleogelation

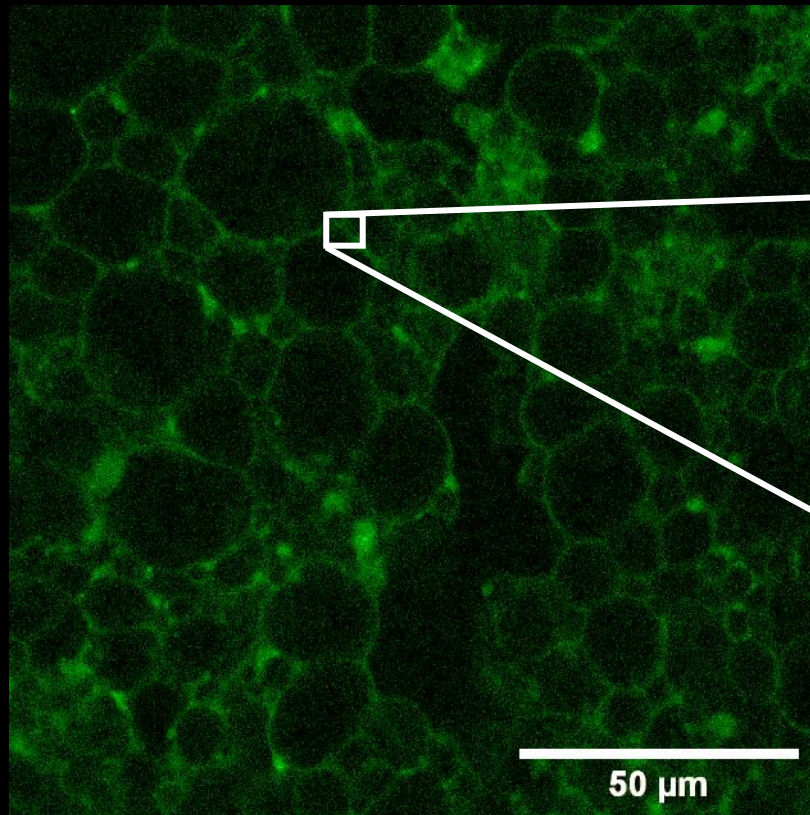


Microstructure of "Jellyfish butter"

Label-free (CARS) microscopy

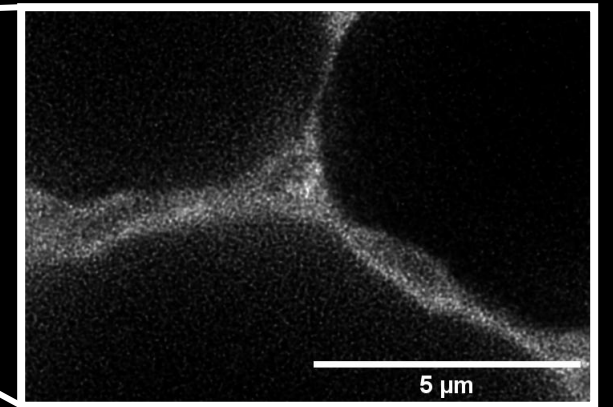


■ Oil droplets



■ Bio structures (Auto fluorescence)

Super-resolution microscopy



z-stacks

Commercial challenges

Sustainable
jellyfish-based foods
vs.
Plant-based trends



AI generated commercial for jellyfish-based mayonnaise and butter.

Summary



Jellyfish won't feed the world
but they can play a role in diversifying sustainable food sources.



Jellyfish-based foods represent a creative avenue in the Blue Economy
and applications beyond food



Current food trends favor plant-based products
challenging for jellyfish despite its potential sustainability and low ecological footprint.



Supply and infrastructure are barriers in Europe
where jellyfish harvesting and processing are not yet well-developed.



Crisps



Emulsion



Foaming



Gelation



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Assoc. prof. Paul Kempen



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