

# Biostabilisation

consequences for sediment stability & floc  
entrainment

Sabine U. Gerbersdorf, Melanie  
Chocholek, Helen Lubarsky, Bernhard  
Westrich, David M. Paterson

[sabine.gerbersdorf@iws.uni-stuttgart.de](mailto:sabine.gerbersdorf@iws.uni-stuttgart.de)



# What is Biostabilisation?

- erosive response of sediments to hydraulic forces is significantly changed by the presence and metabolic activity of all kinds of organisms
- biostabilisation covers a broad range of activities (e.g. worm tubes, macrophyte canopies, biofilms)
- cohesive sediments: microbial produced **EPS** (extracellular polymeric substances) matrix to enhance binding forces

# How is Biostabilisation considered?

In research?

Environment ? Mainly intertidal areas

Organisms ? Microalgae

Interactions? Limited knowledge

Habitats? Sediment versus Flocs

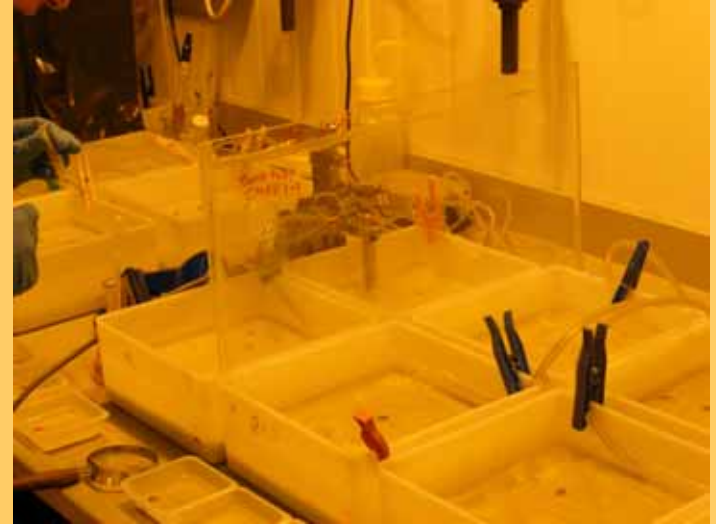
In sediment transport models?

First attempts, generally without biota

# Microbes as “ecosystem engineers”?

## A. Experimental design

Isolation of natural assemblages from sediments and incubation on glass beads.  
Monitoring of growth, EPS secretion and stability over time.



## B.1. Methods

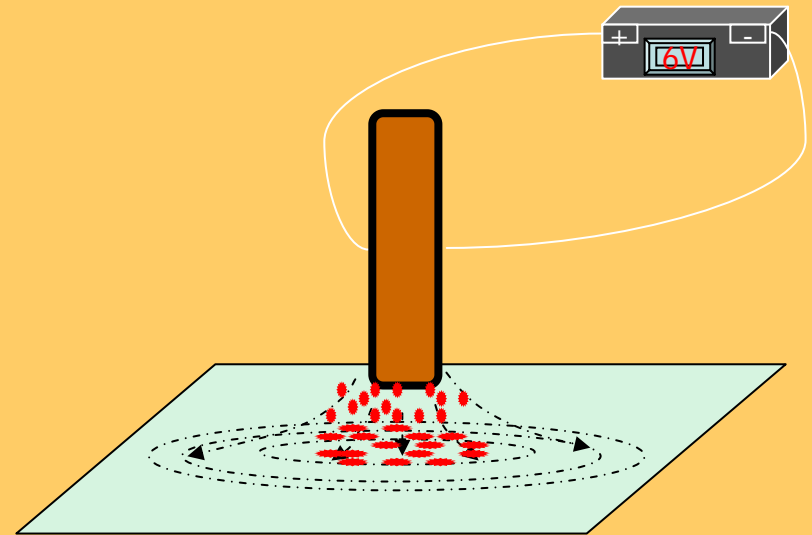
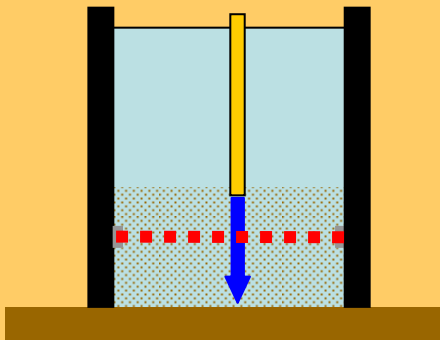
- bacterial cell numbers (Flow cytometry),
- bacterial assemblages (FISH)
- microalgal biomass (chlorophyll a)
- microalgae composition (microscopy)
- EPS quantity (photometer) and quality (GC-MS, Maldi-TOF)

# Microbes as “ecosystem engineers”?

## B.2. Methods – Stabilisation

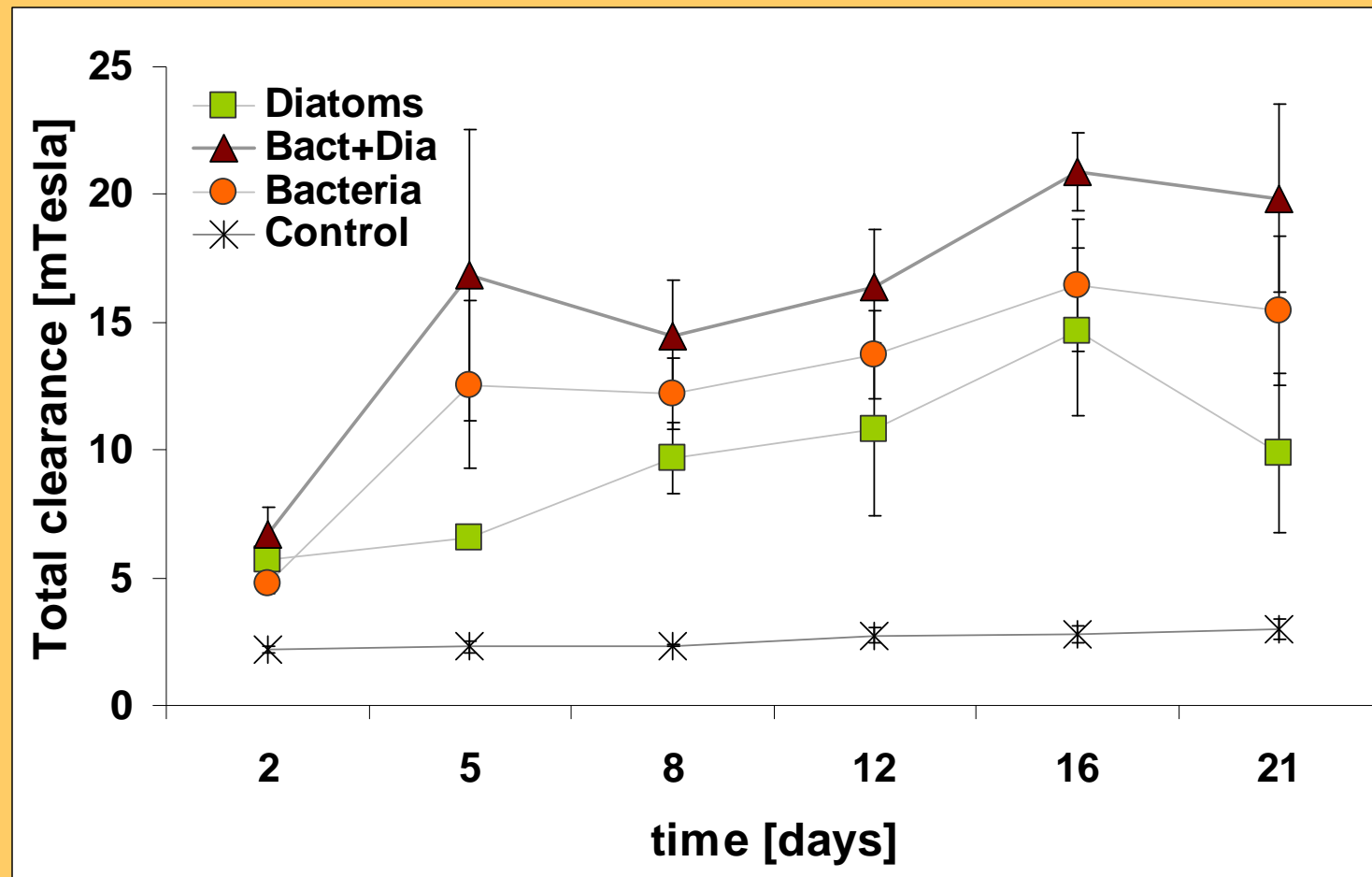
**CSM** – Cohesive Strength Meter

**MagPI** – Magnetic Particle Induction



# Microbes as “ecosystem engineers”?

Stabilisation over time – by MagPI



# Microbes as “ecosystem engineers”?

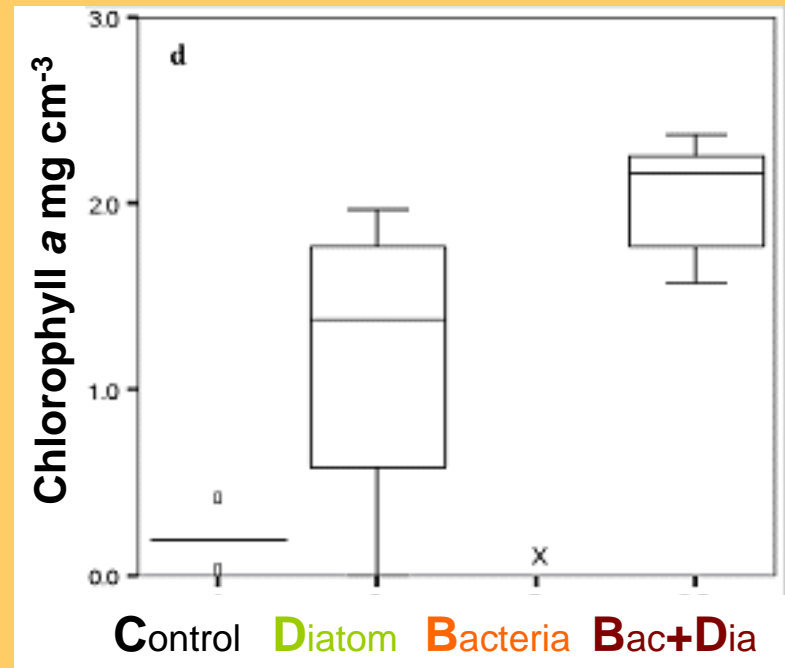
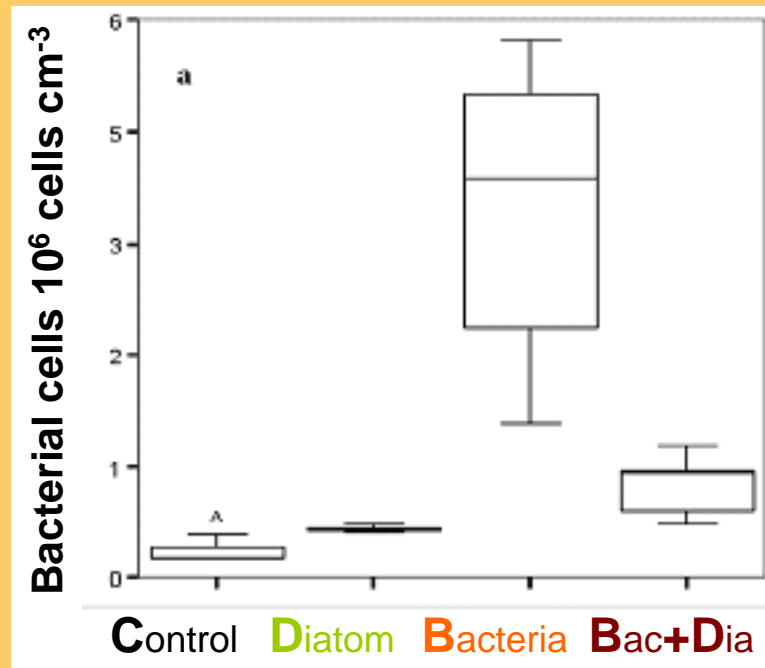
## Stabilisation over time

- ➔ bacteria do stabilize the substratum significantly
- ➔ bacteria stabilize better than diatoms
- ➔ no synergistic stabilisation effect in mixed assemblages

Why is this so ?

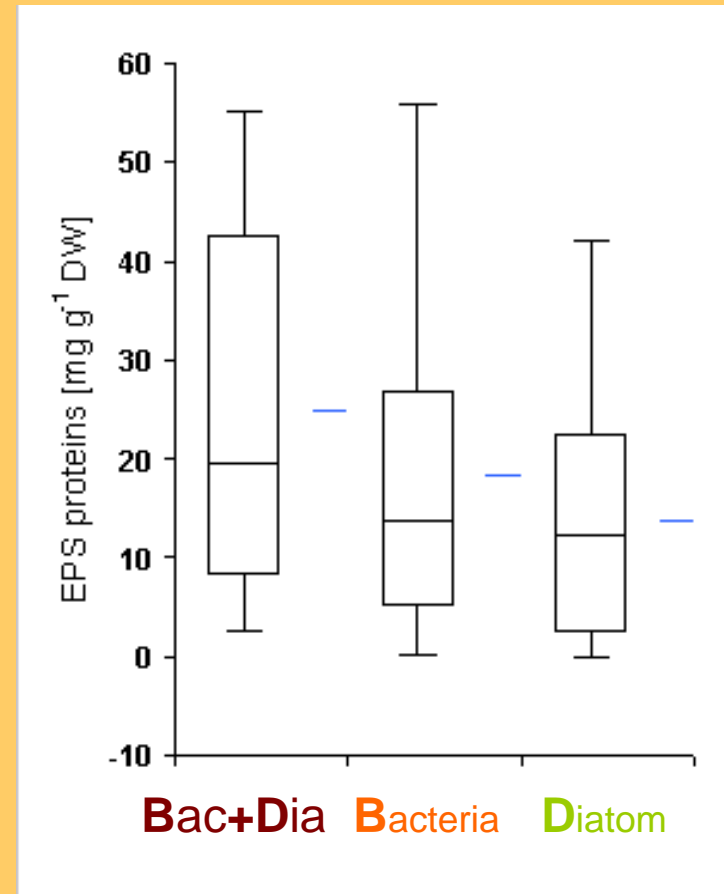
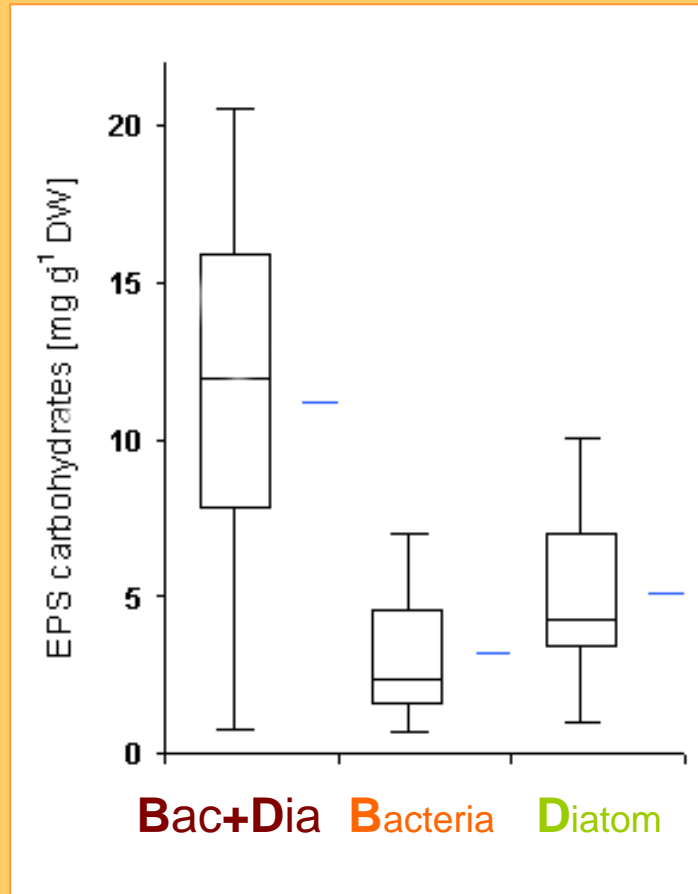
# Microbes as "ecosystem engineers"?

Biomass / Cell numbers per treatment



# Microbes as “ecosystem engineers”?

EPS – carboos & proteins over time



# Microbes as “ecosystem engineers”?

→ no mutual benefit in mixed assemblages



joint action still provides best the ecosystem function “stabilisation”

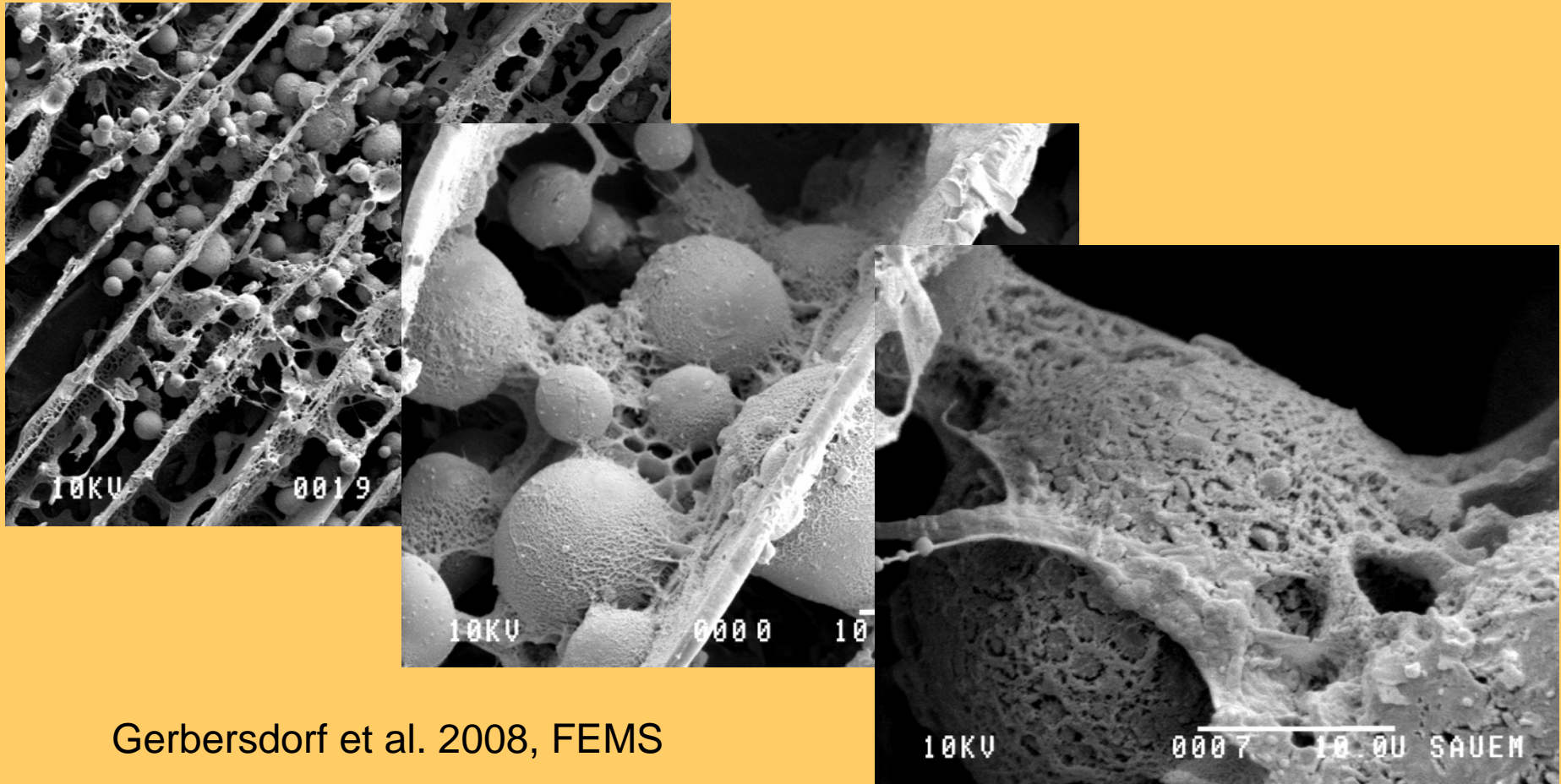
→ proteins have important role in stabilisation



interwoven proteins + carbohydrates  
create best binding force

# Microbes as “ecosystem engineers”?

EPS matrix – visualization by LTSEM



Gerbersdorf et al. 2008, FEMS

# Microbes as “ecosystem engineers”?

## Postentrainment & Flocculation

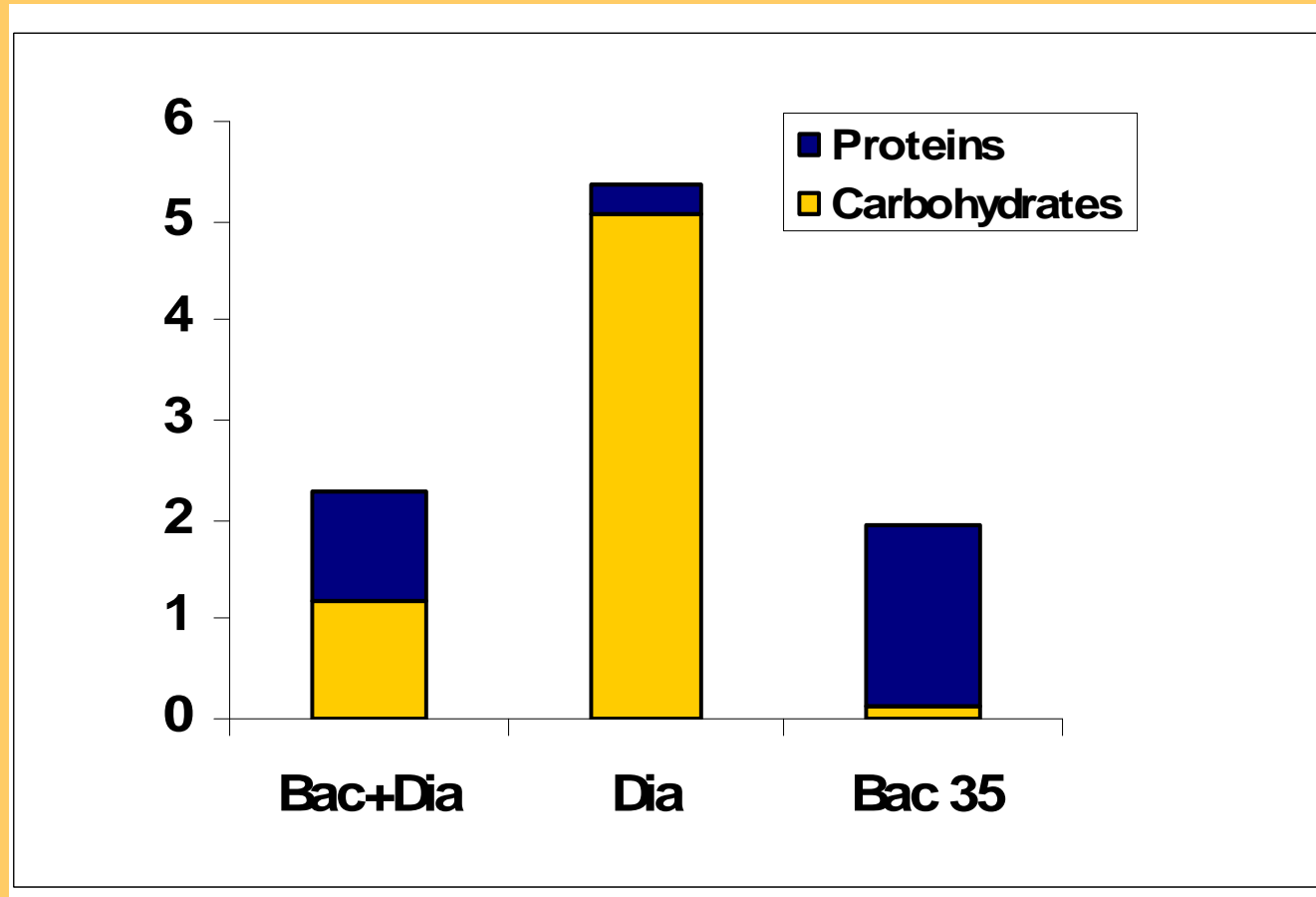


Gust Chamber - Microcosms



# Microbes as “ecosystem engineers”?

## Postentrainment & Flocculation



# Microbes as “ecosystem engineers”?

Organisms that create, modify and maintain habitat (Jones 1997)



**YES**

- ➡ Learn more about organisms / interactions involved & binding features of the EPS matrix
- ➡ Long-term goal: Implementation in predictions of sediment erosion & transport!

# Acknowledgements



Marie Curie Actions  
EU



Ministerium für Wissenschaft, Forschung und Kunst  
Baden-Württemberg

