

# Catalysis

-a gateway to Industrial Biotechnology

# ACIB

Austrian Centre of Industrial Biotechnology

*Expanding biocatalysis from small to large  
molecule modification*



ACIB team @ Fürstenfeld, April 2010

Funded within the Austrian  
COMET programme by:



**(K2 competence centre  
granted for 10 years!)**

**ACIB**

Austrian Centre of Industrial Biotechnology

# **Austrian Centre of Industrial Biotechnology**

Non profit research company  
owned by Austrian Universities

**International research pgm started**

**Jan 1st 2010**

**Budget: ~12 Mio € / year**

**ACIB GmbH since May 2010**



# Pre-competitive research for IB

# ACIB

Austrian Centre of Industrial Biotechnology

Main research locations:  
**Graz – Innsbruck - Vienna**



## \* Company projects

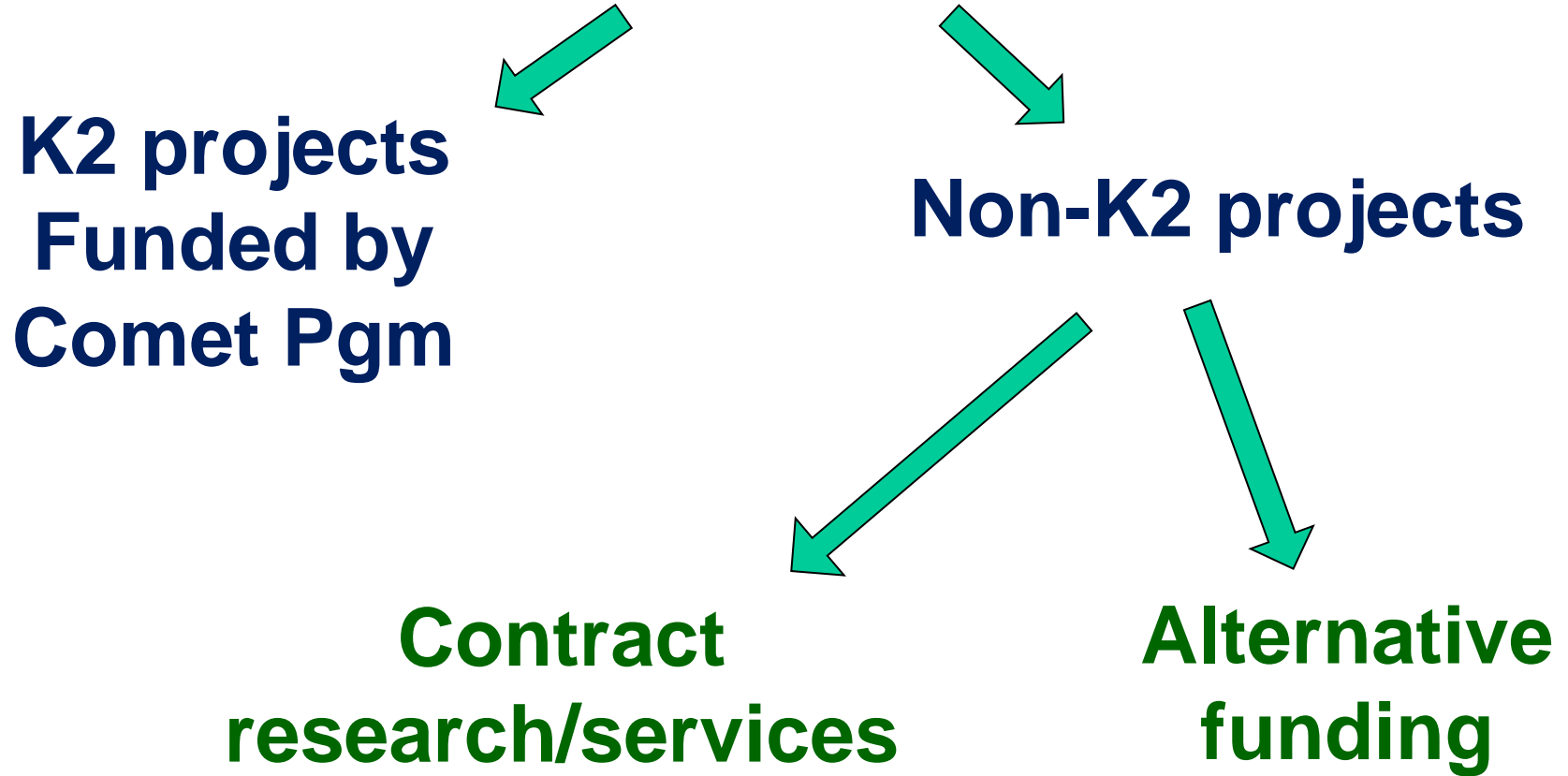
- \* **Strategic projects incl. junior groups**

- \* **Non-K2 projects**



**+ international  
educational programme**

## ACIB GmbH

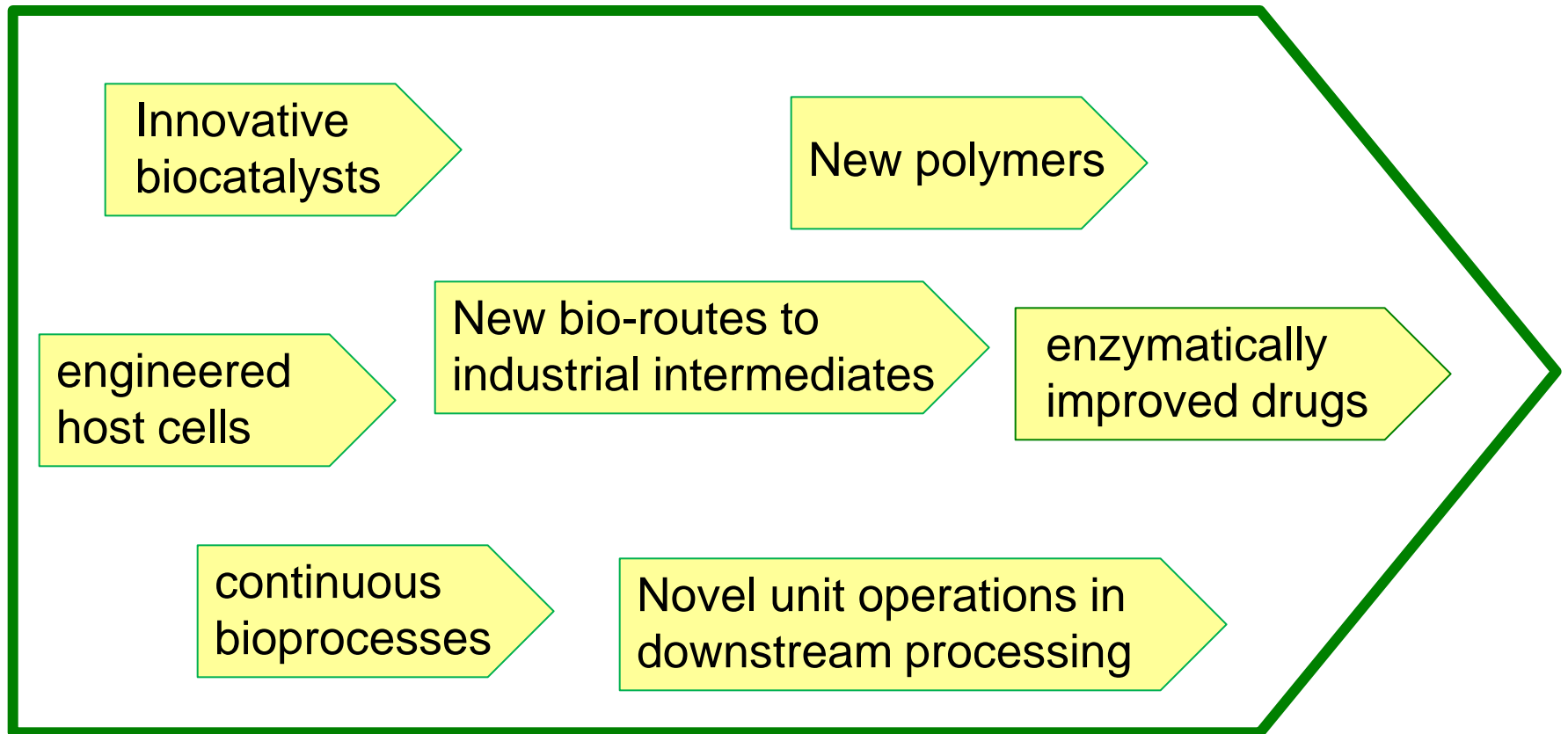


# MISSION

**ACIB**

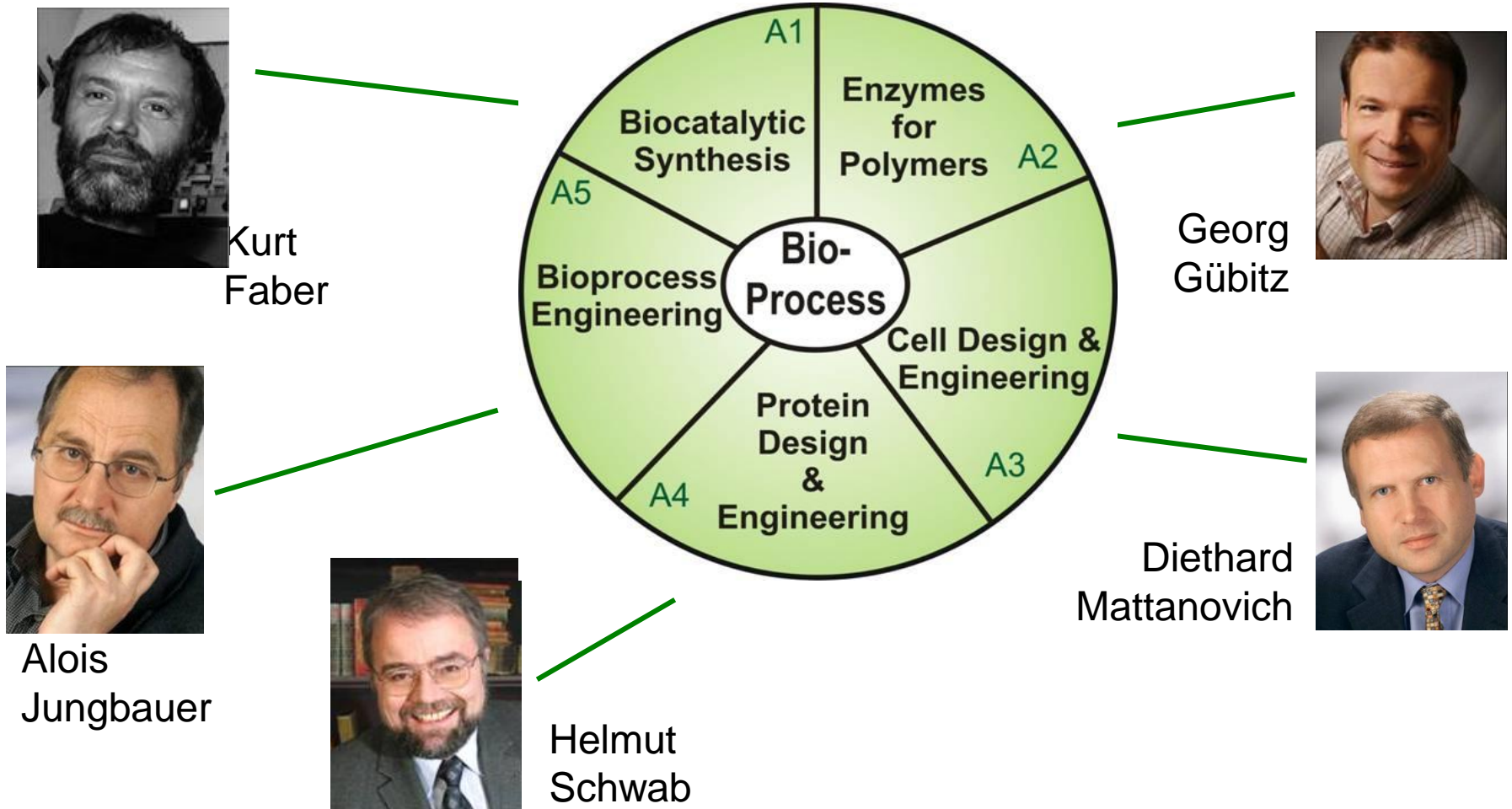
Austrian Centre of Industrial Biotechnology

## USE THE TOOLS AND CONCEPTS OF NATURE FOR INDUSTRIAL PRODUCTION



**ACIB's output - Value for all partners**

# 5 Areas: our structure for cross disciplinary research



# Expertise linked in projects



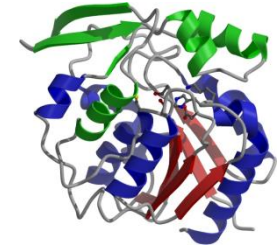
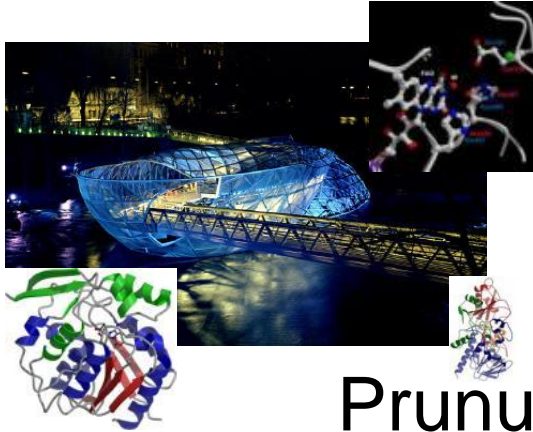
14.06.2010

© ACIB GmbH

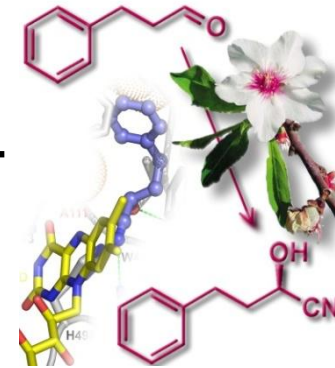
# Bio-Catalysis for small chiral building blocks

## Hevea brasiliensis S-HNL pyrethroids

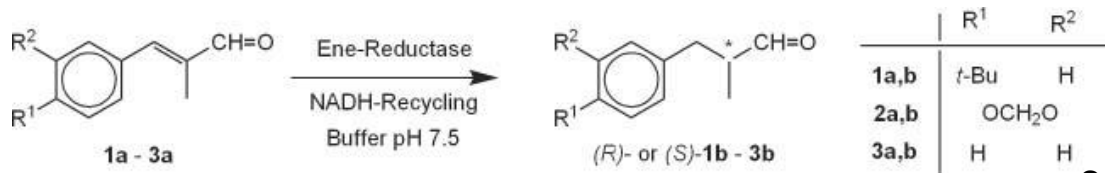
Hasslacher et al., Protein Expression and Purif 11:61 45



## Prunus amygdalus R-HNL ACE inhibitor cardiovascular drug vitamins



Glieder et al., Angew. Chem. Int. Ed. (2003) 42; 4815-4818, Weis et al., Angew. Chem. Int. Ed. (2005) 44 (30), 4700-4704  
Pscheidt et al., Adv. Synth Catal. (2008) 350, 13, 1943-1948



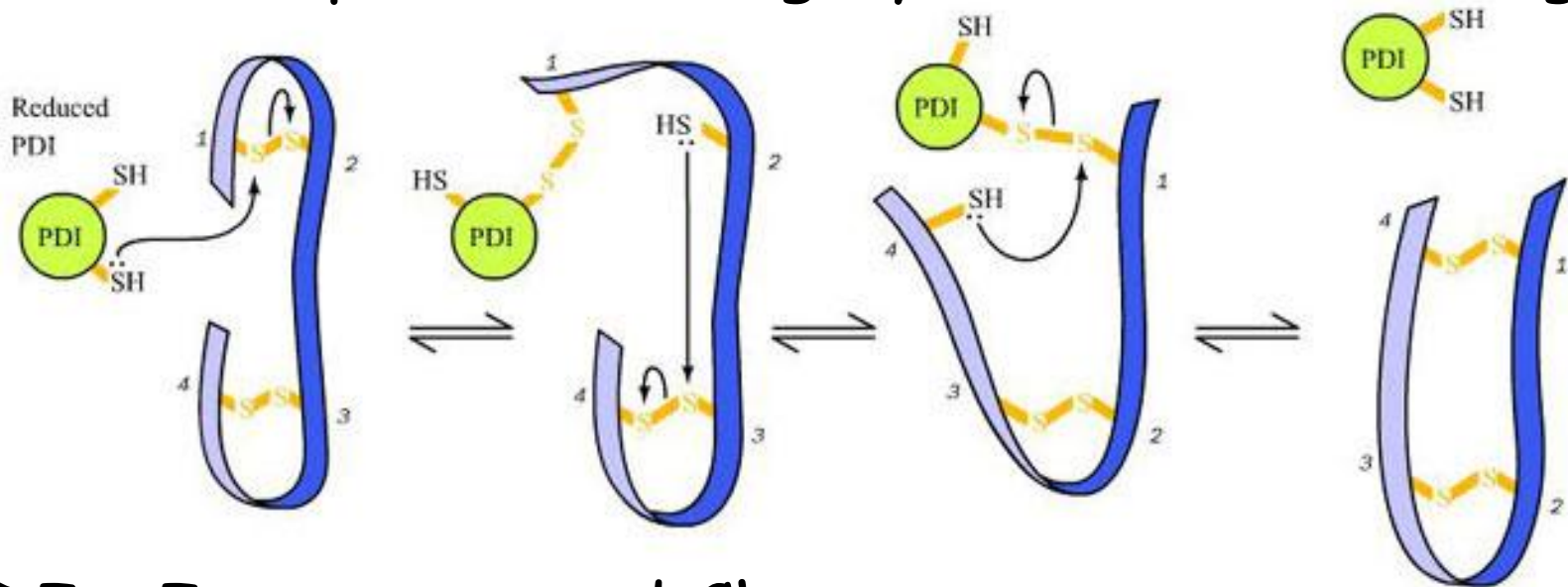
## OYEs Lilial™, Helional™

Stueckler et al Dalton Trans, 2010, in press



## Protein Disulfide Isomerase

Improved folding by disulfide shuffling



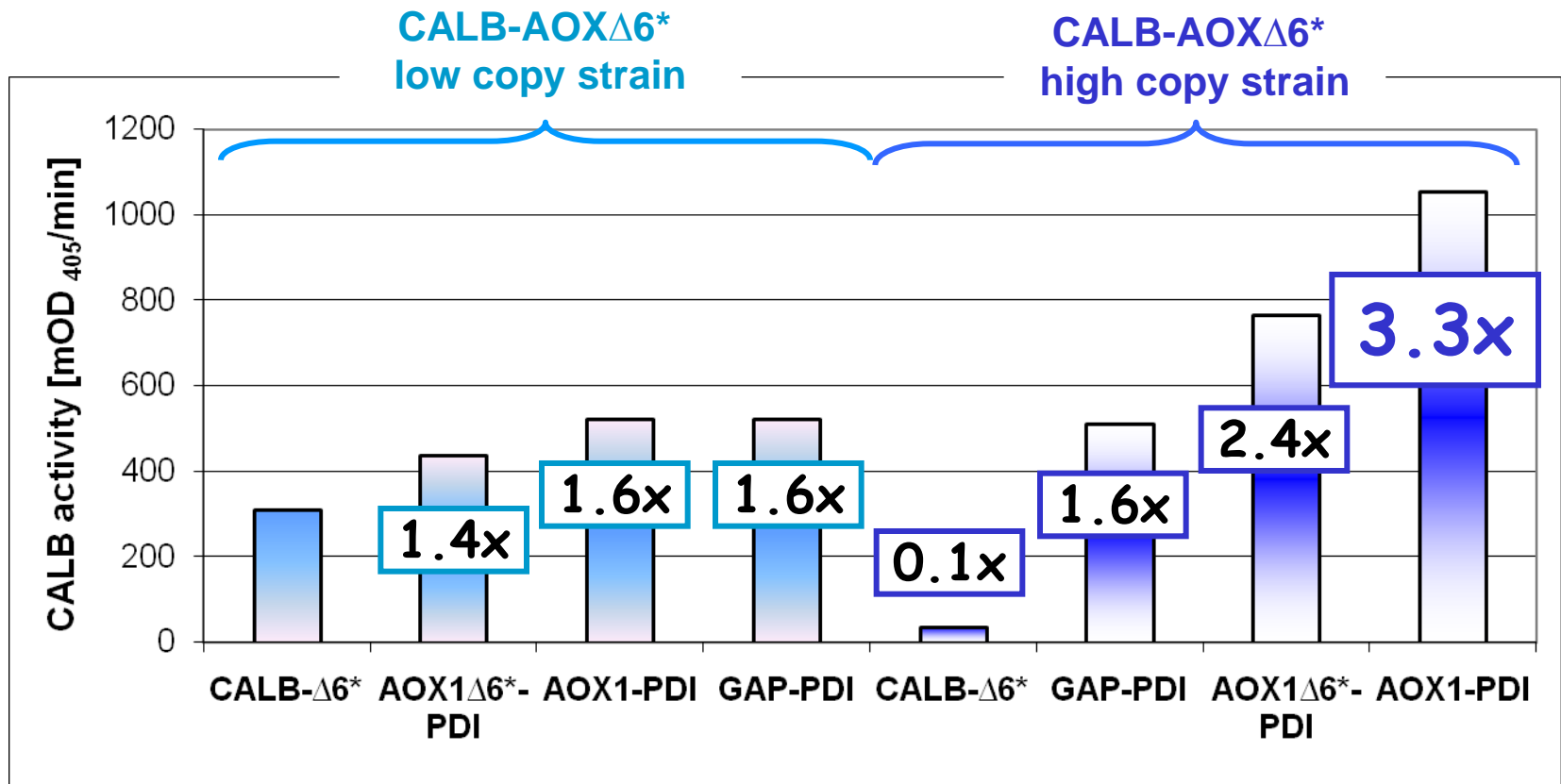
PDI = Isomerase and Chaperone

© Jennifer Ekstrom

# CalB Overexpression (*P.pastoris*)

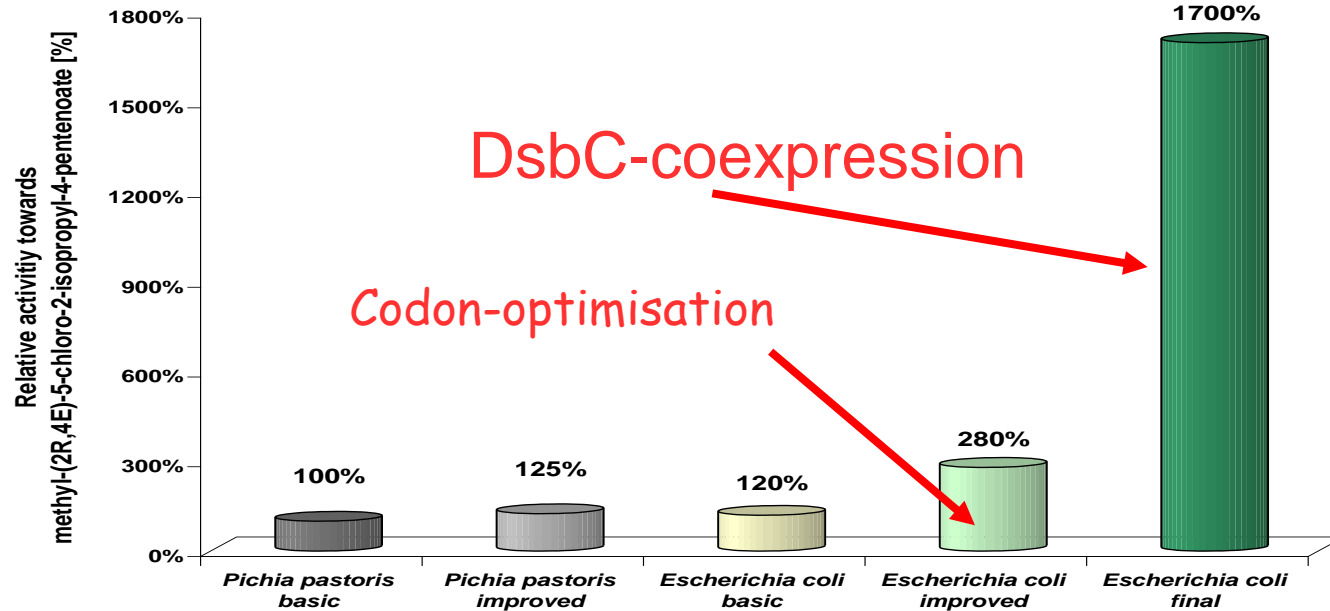
low and high copy number

## A combinatorial problem !!!

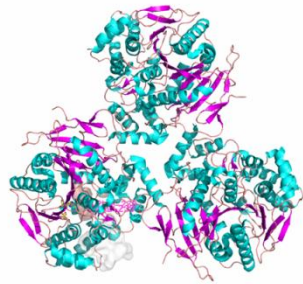


# Pharma PLE®:

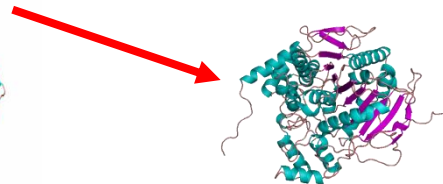
expression in cytoplasm of *E. coli*



Hermann M. et al., J Biotechnol. 2008 Feb 1;133(3):301-10.



**APLE V263D is monomeric**

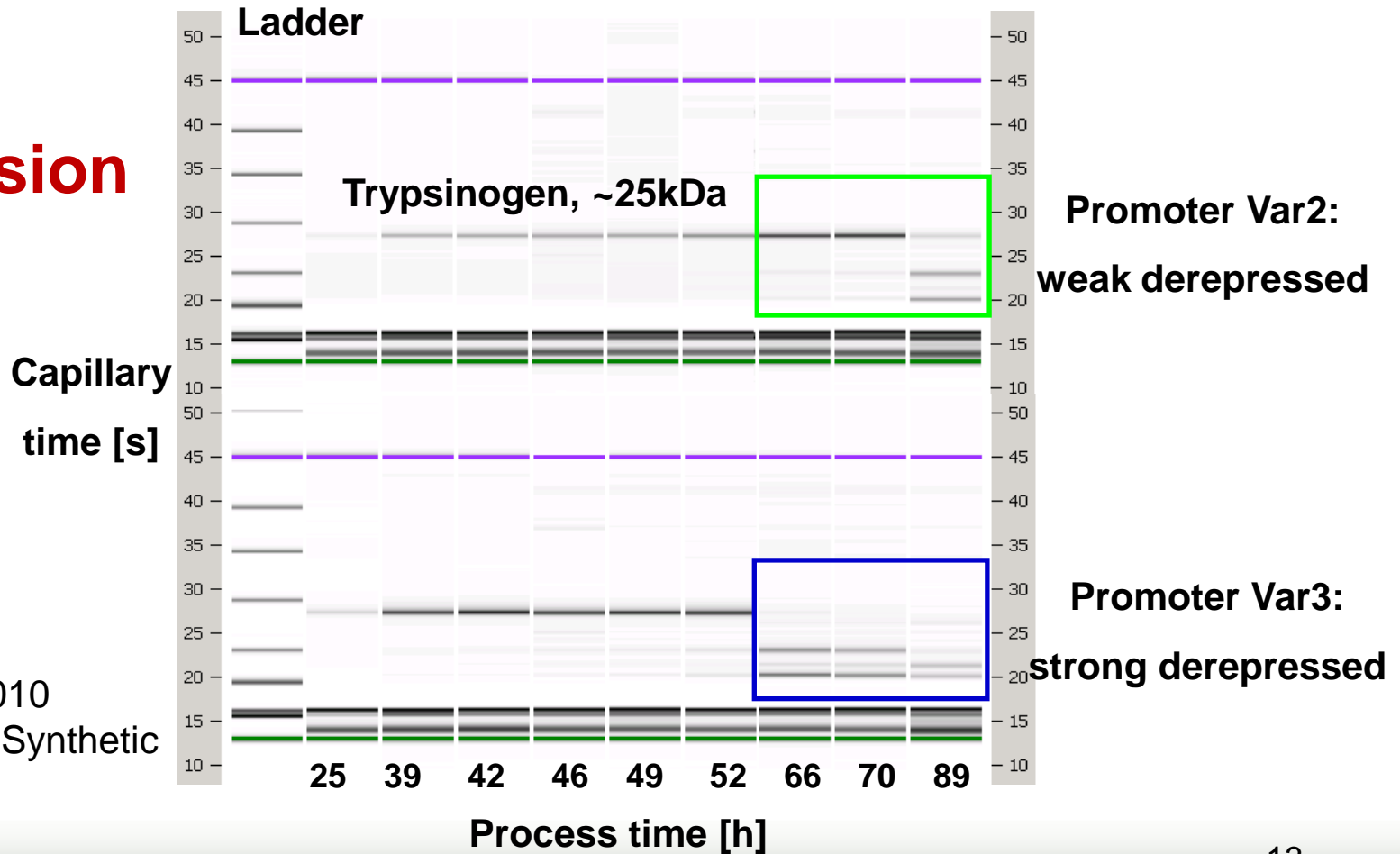


Unlimited. **DSM**

# Posttranslational Protein processing

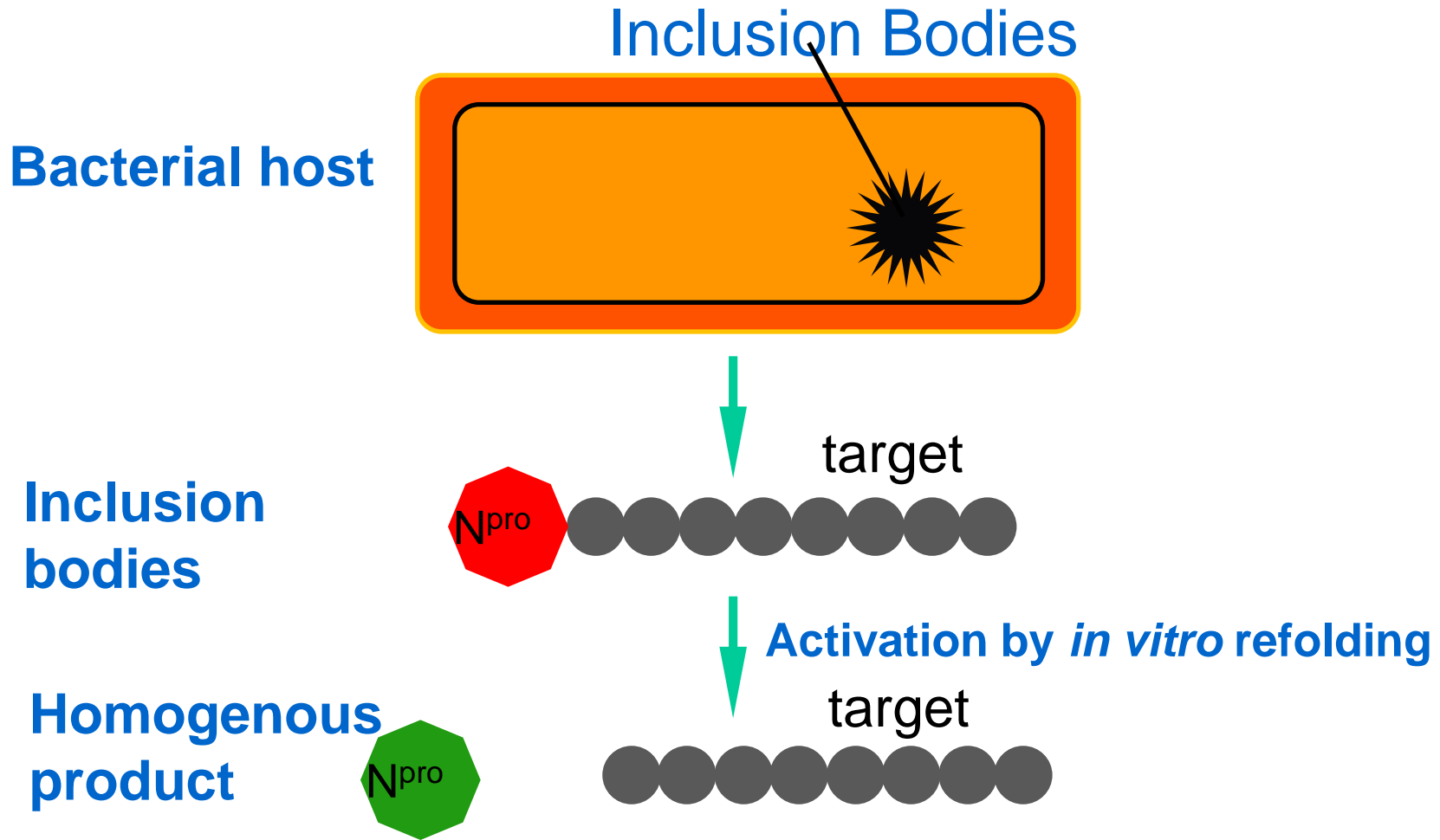
## Transformation of human insulin precursor to human insulin

**New expression tools**



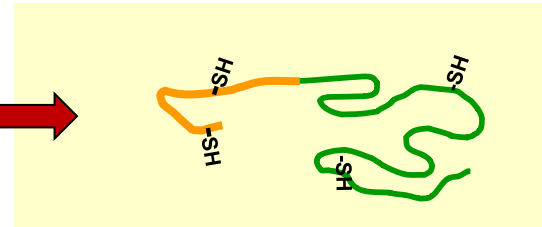
Ruth et al., 2010  
Systems and Synthetic  
Biology,.

# N<sup>pro</sup>-Fusion technology

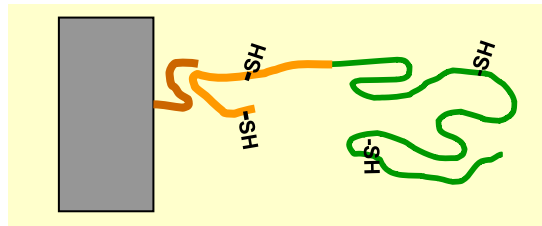


## Auto-protease N<sup>pro</sup> from pestivirus CSFV-Alfort

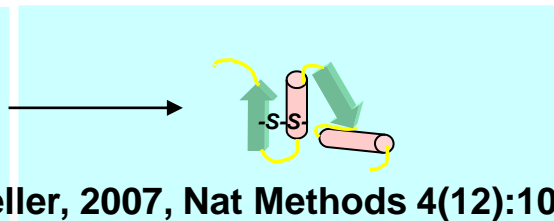
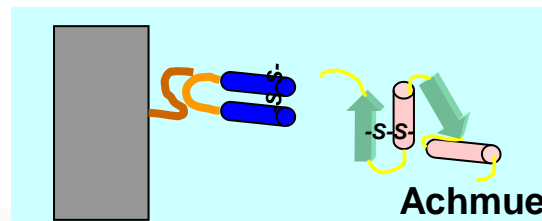
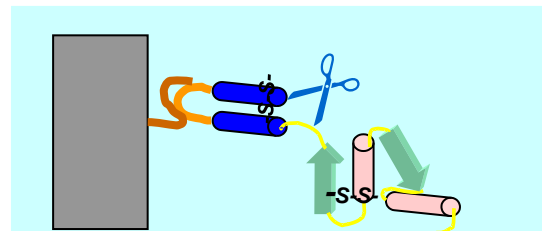
### Inclusion bodies



Chaotropic  
Conditions



Kosmotropic  
Conditions



Achmueller, 2007, Nat Methods 4(12):1037– 1043

- Denatured inclusion bodies loaded on affinity column
- On-column renaturation
- Autoproteolytic cleavage of fusion partner
- Target protein in high yield and quality
- Engineered variant for broad applicability

# >>Enzymes for polymers

## Enzymatic surface functionalisation of synthetic polymers (PAN, PAT, PA, PP)

- Conventional

- Low fastness
- harsh conditions
- Damage of materials  
(e.g. 15 % weight loss for PET finishing)
- Polymer bulk properties changed

- Enzymatic

- Act on surface only
- mild conditions
- Highly specific

PET

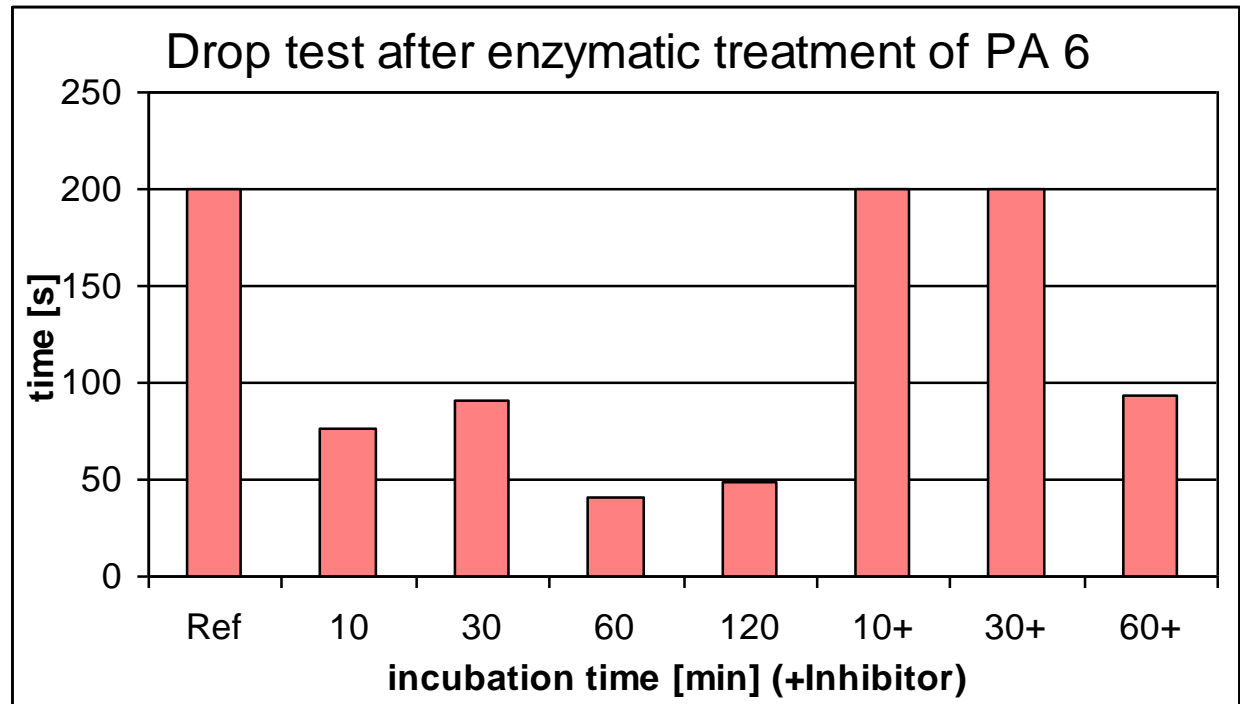


# PA-Hydrolases



*N. farcinica:*  
*First bacterial*  
*polyamidase*

increase hydrophilicity

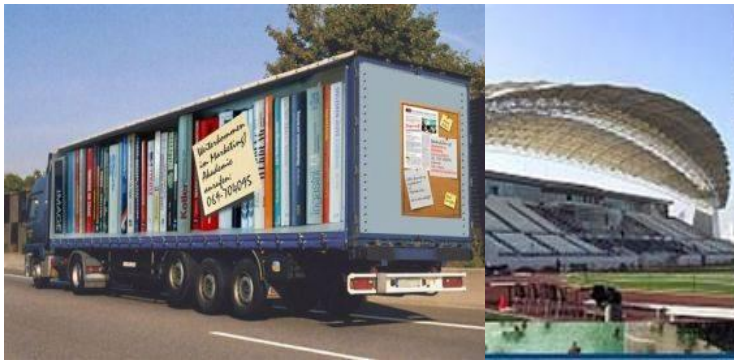


Almansa et al. Biocat. Biotrans. 26, 371 – 377

Heumann et al. 2008, Biotechnol Bioeng, 102, 1003-1011

# Lipase, Cutinase hydrophilisation of PET

Technical materials: PVC coated PET

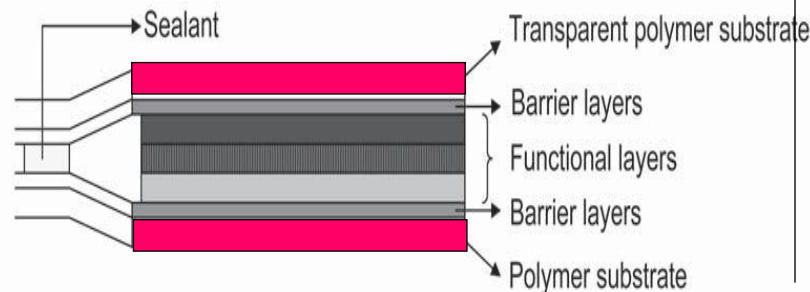
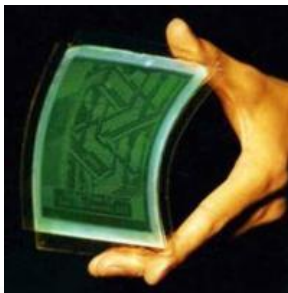


80 %  
reduction  
of adhesives

Functional  
sportswear



Flexible electronic devices  
**Enhanced bonding to PET**

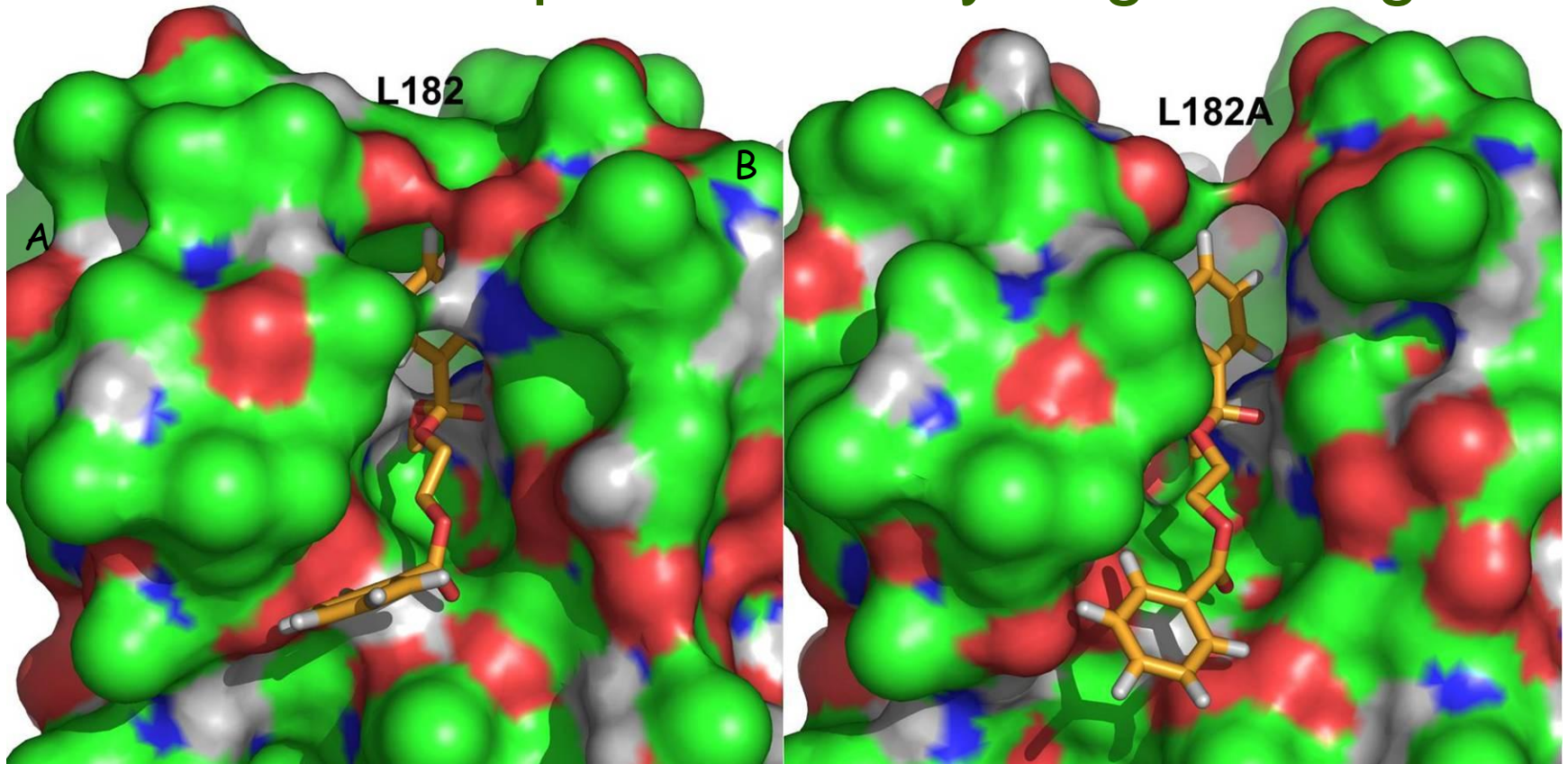


**Enhanced:**

- Breathability
- Moisture uptake
- Antistatic behavior
- Reduced pilling
- Handle
- Finishing fastness

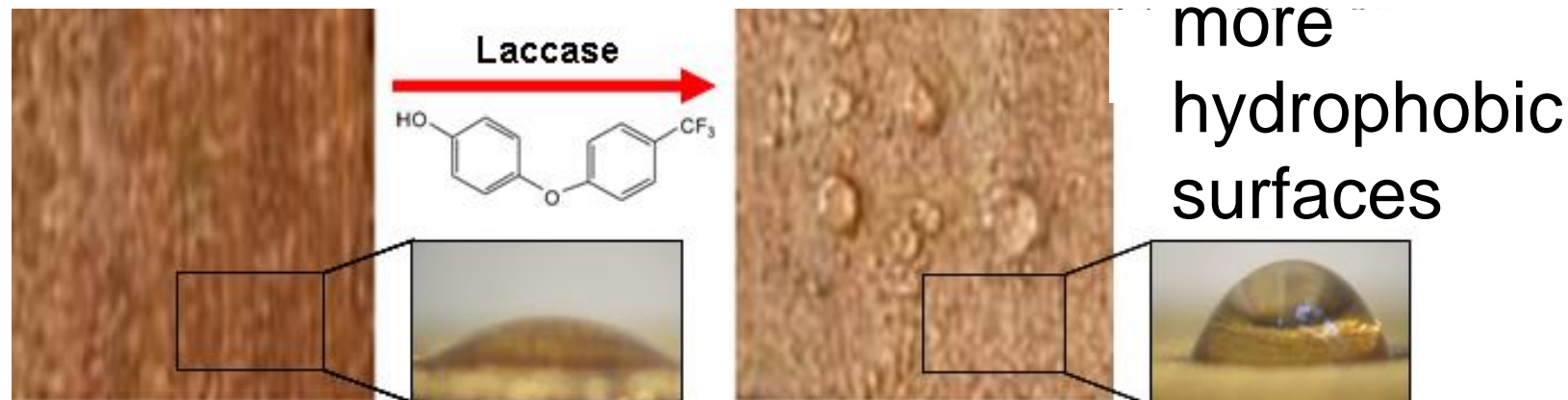
# Polyesterases

## 5-fold improvement by engineering



Araujo. et al. 2007, J. Biotechnol. 128, 849-857.

# Functionalisation of lignocellulose



Treatment	Fluoro content % (XPS)	Contact angle °
4-(Trifluoromethoxy)phenol	0	48
4-(Trifluoromethoxy)phenol + laccase	3.21	58
4-(4-Fluorophenoxy)phenol	0	44
4-(4-Fluorophenoxy)phenol + laccase	6.39	88
4-Fluoro-2-methylphenol	0	52
4-Fluoro-2-methylphenol + laccase	0.26	58

## ACIB GmbH

➤ Short term collaborations

➤ High service character

➤ Secrete know how

Non-K2 projects

Contract  
research/services

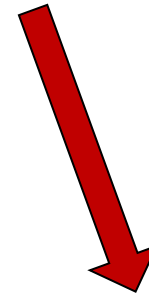
Alternative  
funding

## ACIB GmbH

- EU projects (FP7)
- Austria (FWF, FFG, ...)
- External  
„incoming & reintegration“  
Stipends
- other clusters, networks...

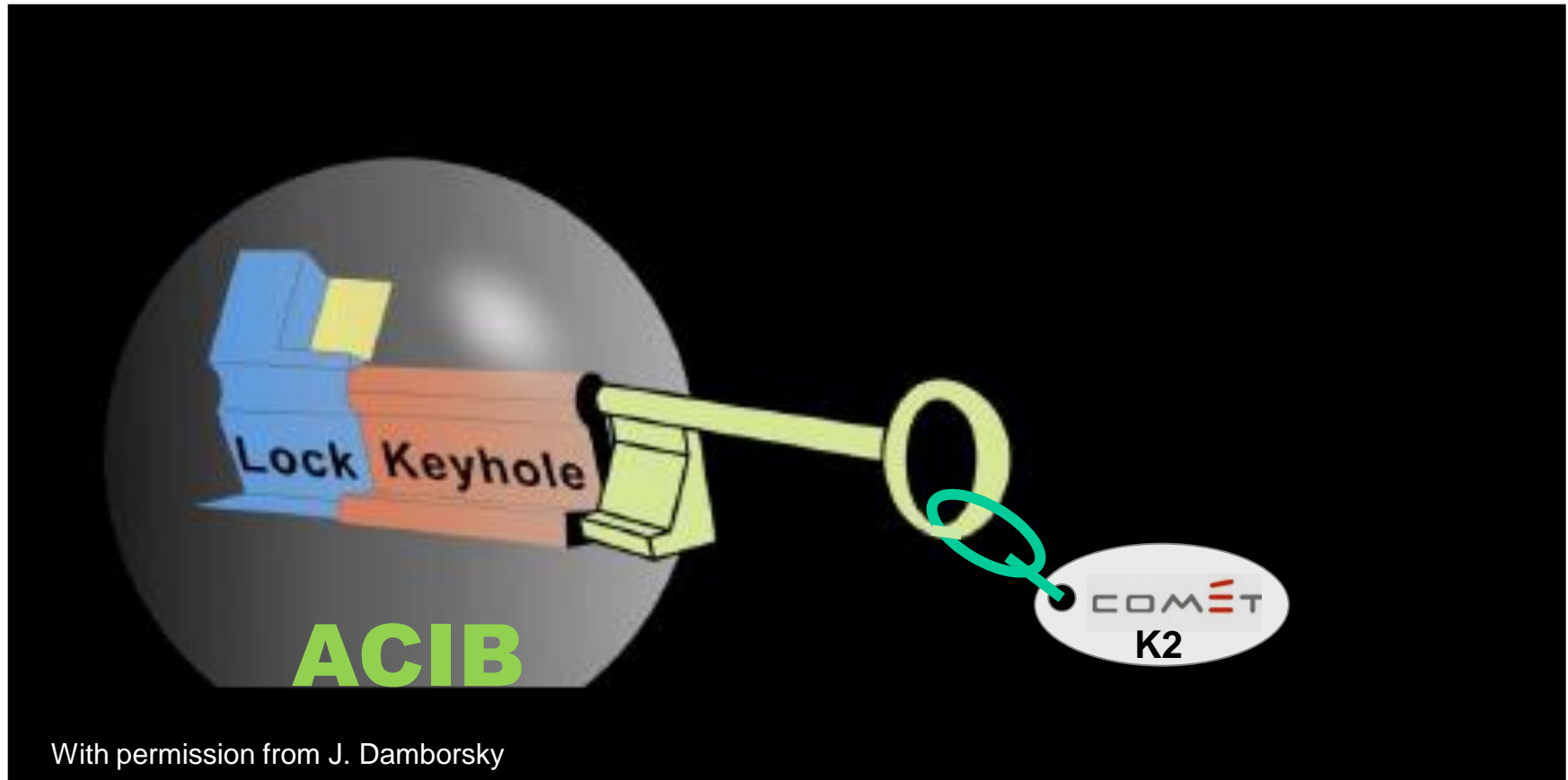


**Non-K2 projects**



**Alternative  
funding**

# ACIB – a catalyst for IB





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