

# Bio-Inspired Elastic Nanocomposite Foams of Resilin- Cellulose Binding Domain Bound To Cellulose Nanocrystals



Tal Ben Shalom

PI Prof. Oded Shoseyov



המכון למדעי הצמח  
וגנטיקה בחקלאות  
ע"ש רוברט ה. סמית

THE ROBERT H. SMITH  
INSTITUTE OF PLANT SCIENCES  
AND GENETICS IN AGRICULTURE

# Resilin is a Rubber Like Protein Abundant in Arthropods Locomotion Associated Organs

Cat flea jumping pads

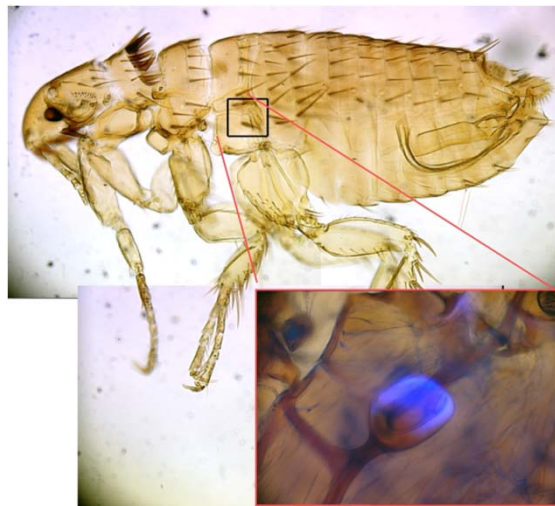
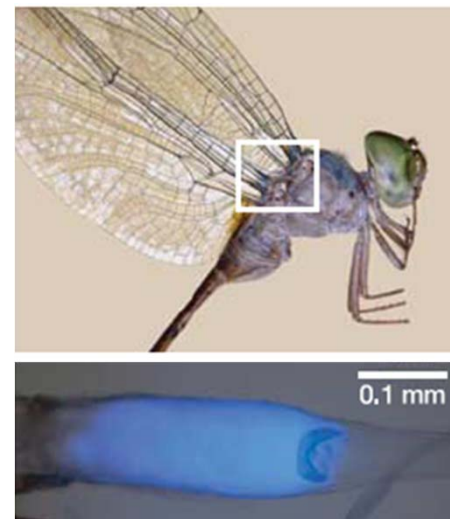


Image by Darren Wong & Dr David Merritt  
University of Queensland, Australia

Dragonfly flight tendon



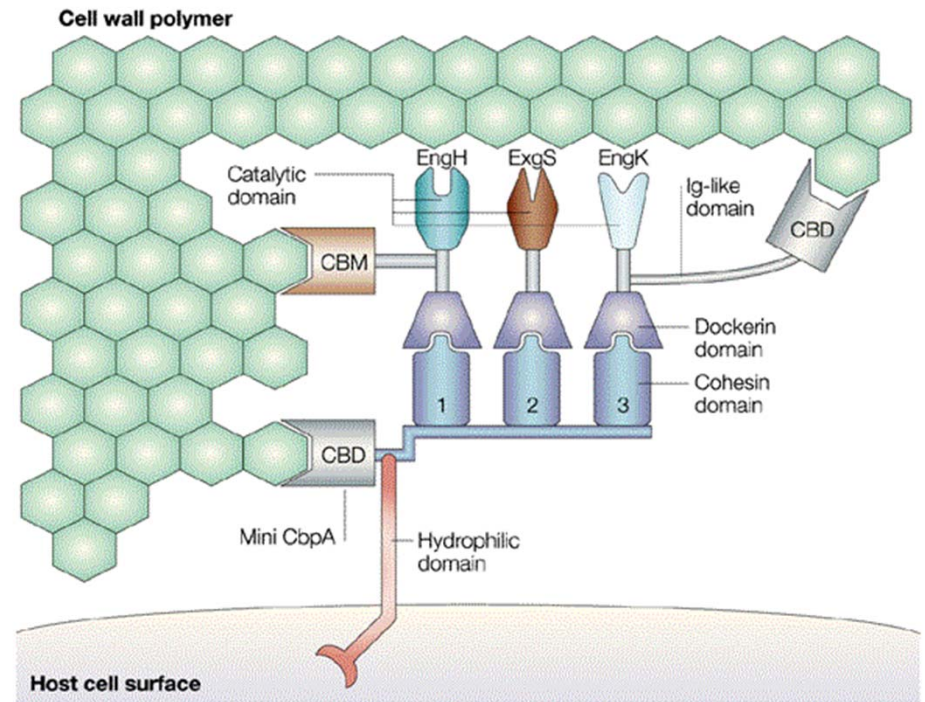
Elvin *et al.*, Nature. 2005

**Resilin is providing outstanding material properties including high resilience and fatigue lifetime for insect flight and jumping needs.**

# Cellulose Binding Domain - CBD

- CBD binds to Cellulose by hydrophobic interactions and forms a strong and stable connection.
- E.coli was genetically engineered to produce recombinant Resilin fused to CBD to enable resilin's binding to Cellulose Nanocrystals.

Exon 1



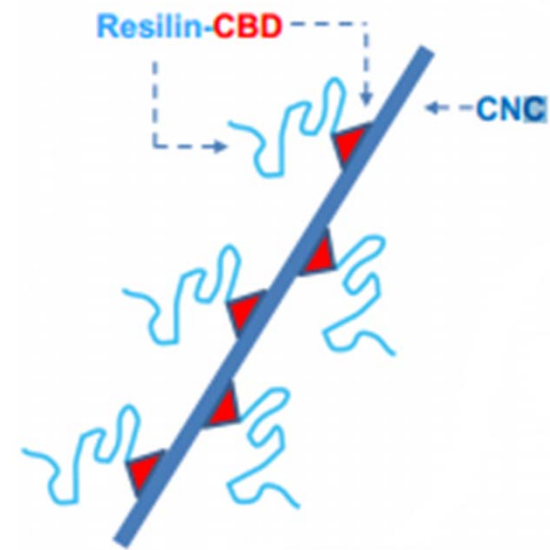
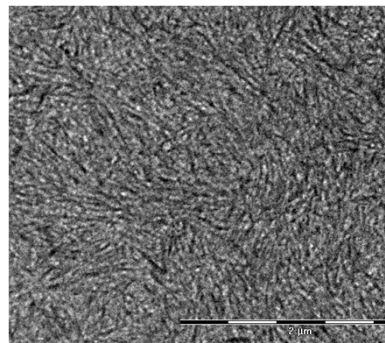
Nature Reviews | Microbiology

Cellulosomes: plant-cell-wall-degrading enzyme complexes  
Roy H. Doi & Akihiko Kosugi *Nature Reviews Microbiology* 2, 541-551 (July 2004)

# Cellulose Nanocrystals (CNC) Biobased Nano-Particles Reinforcement Nano



TEM images of the cellulose whiskers



Cellulose Nanocrystals comprised with tensile strength similar to super strong materials

The stiffness of a Cellulose Nanocrystals is estimated to be about 150 Gpa

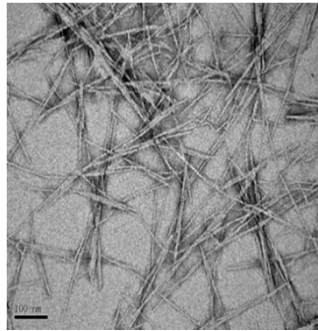
# Summary

Resilin with  
CBD linker



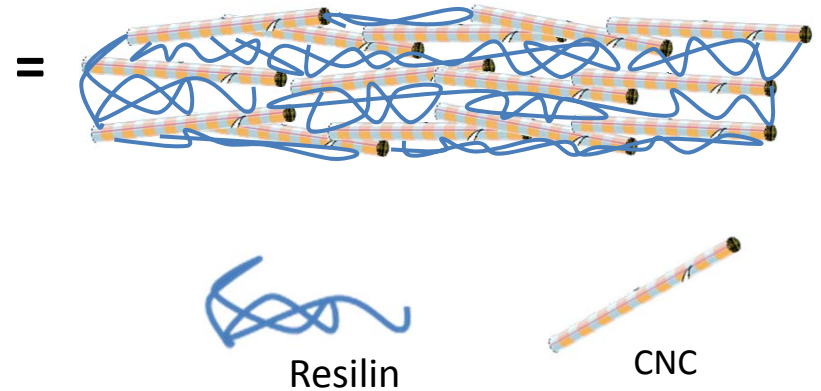
Elasticity

Cellulose  
nanocrystals



Strength

CNC-resCBD foam



we hypothesized that Cellulose Nanocrystals and resilin composites foams would display useful mechanical properties featuring both strength and elasticity.