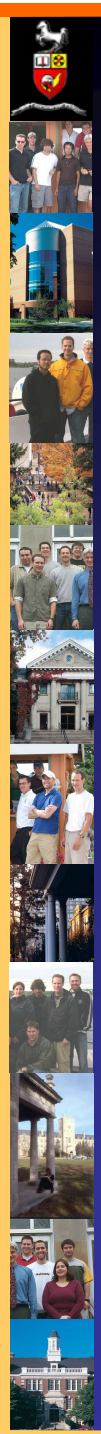


Real-Time Observation of Cellulose Biodegradation by Atomic Force Microscopy

Amanda Quirk, Jacek Lipkowski, Darrell Cockburn, Dan Glickman, and Anthony Clarke





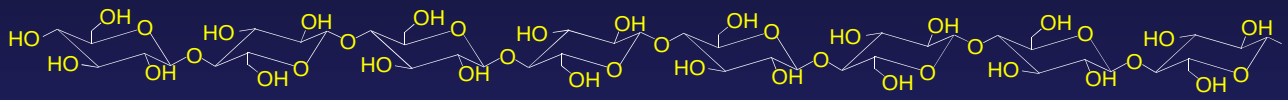


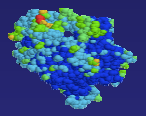






Cellulose Biodegradation





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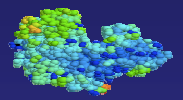
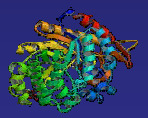
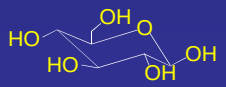
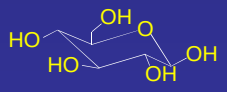


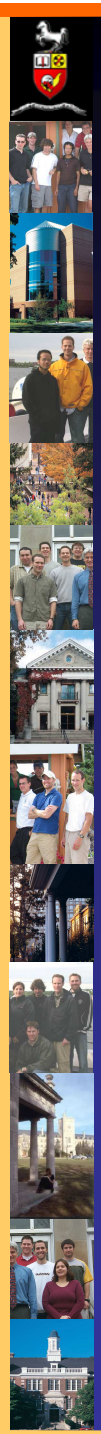
EG



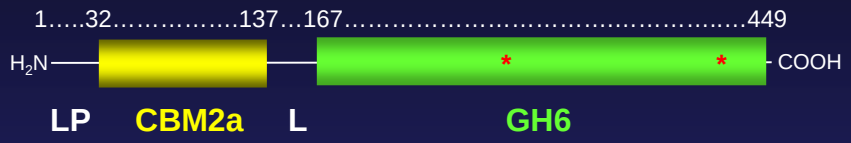
βG

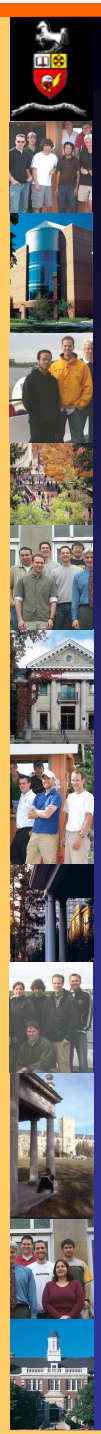




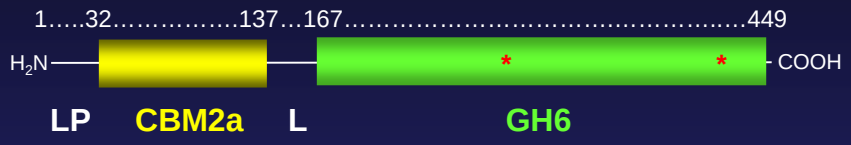


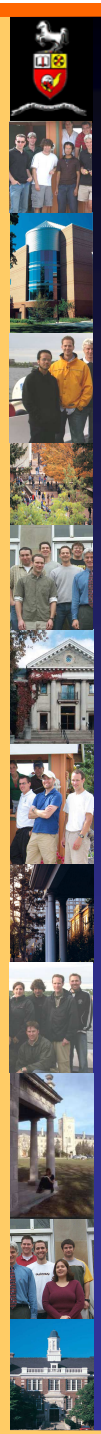
Cellulomonas fimi cellulase A (Cen A)



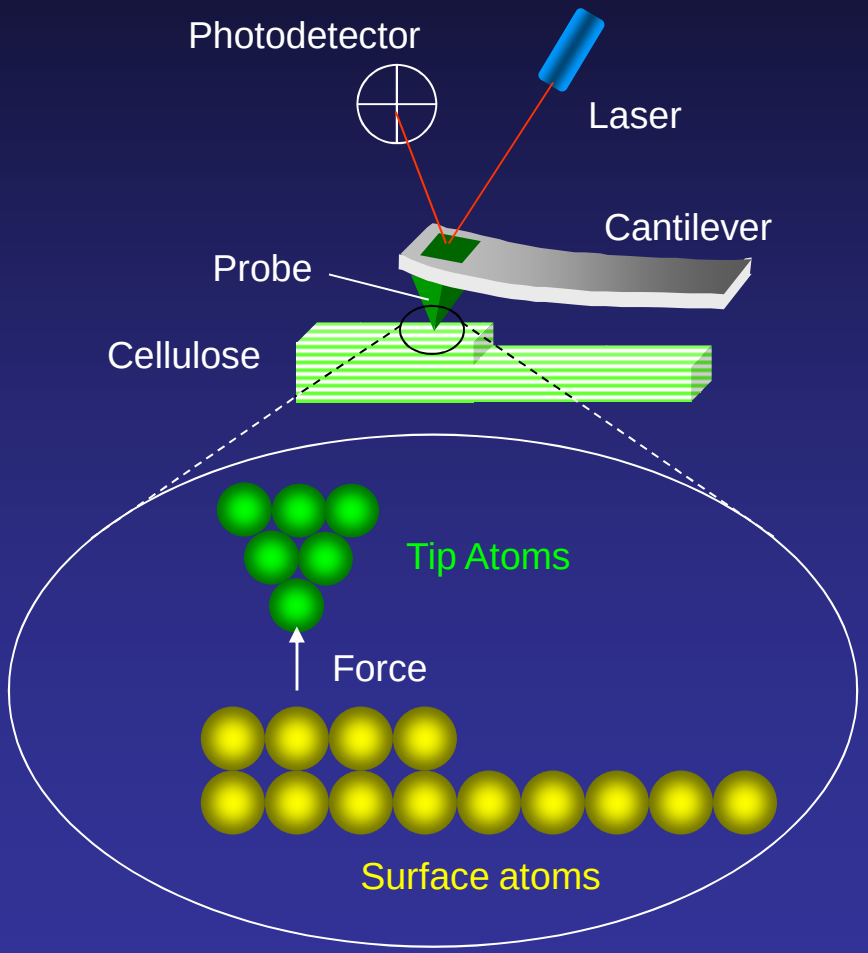


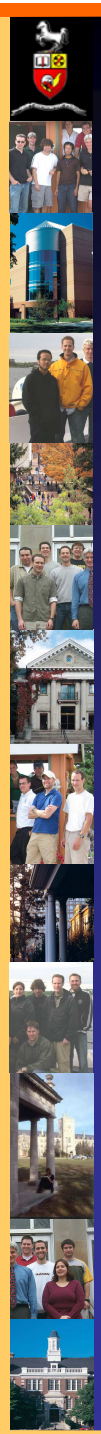
Cellulomonas fimi cellulase A (Cen A)



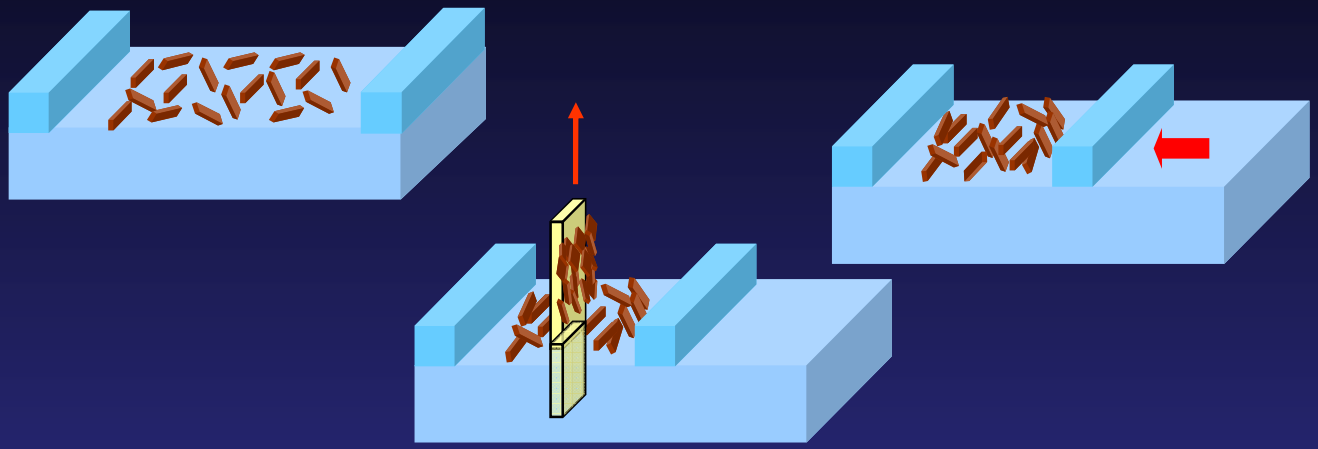


Atomic Force Microscopy



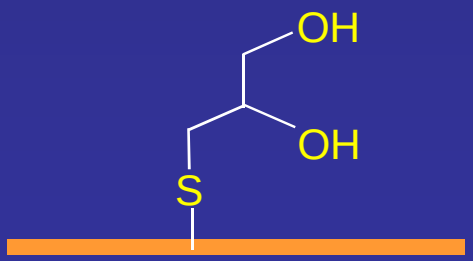


Cellulose application: Langmuir Blodgett

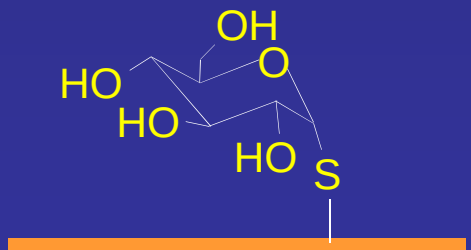


Preparation of gold surface

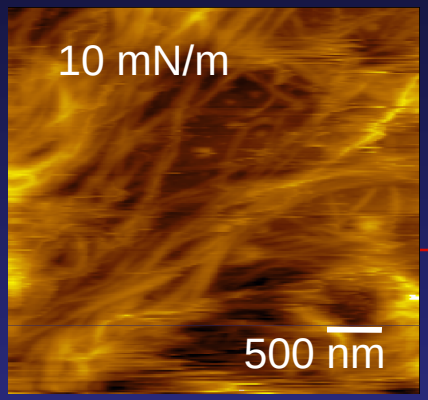
Thioglycerol

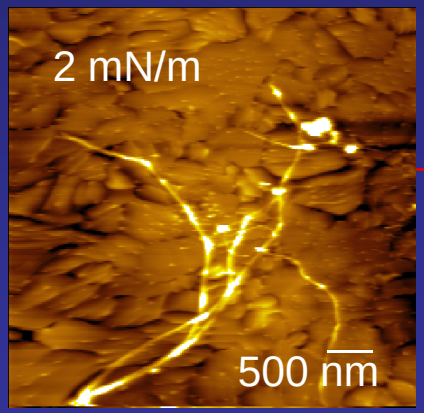


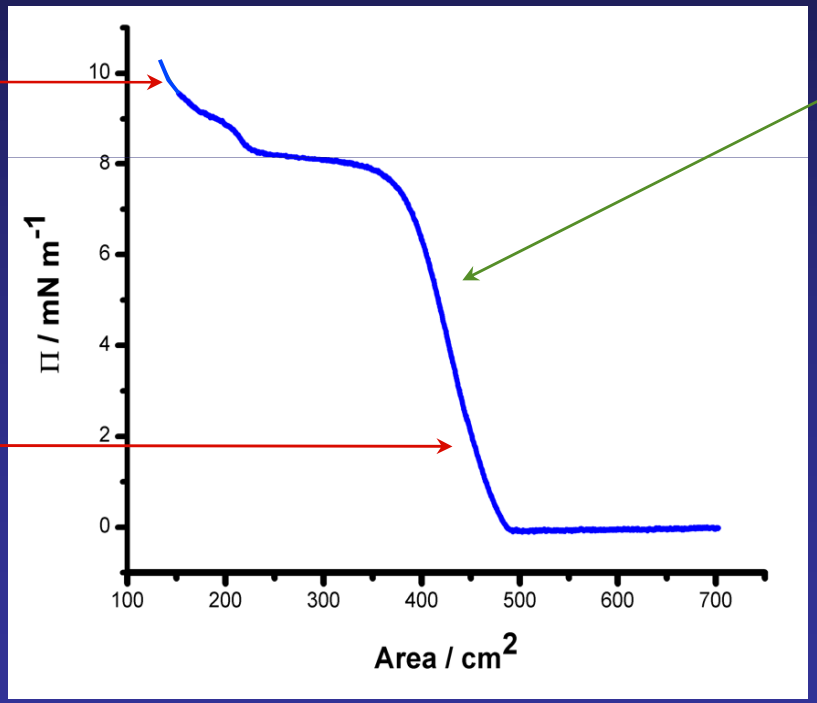
Thioglucose

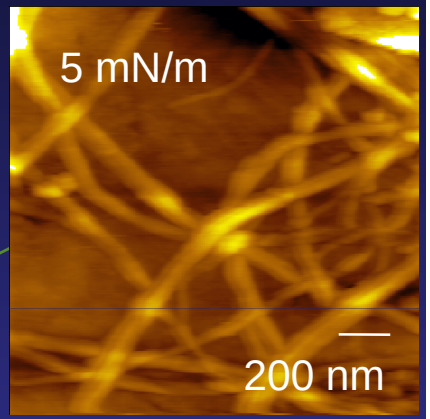


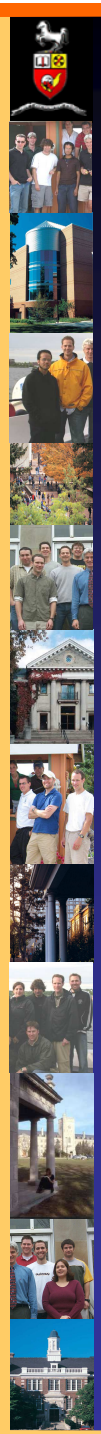
Pressure-area isotherm of cellulose binding



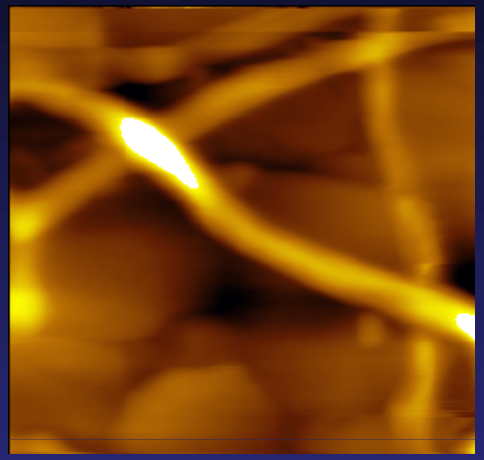




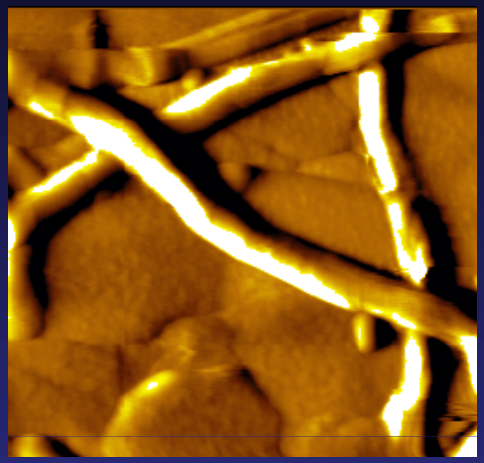




AFM imaging of cellulose



Topography



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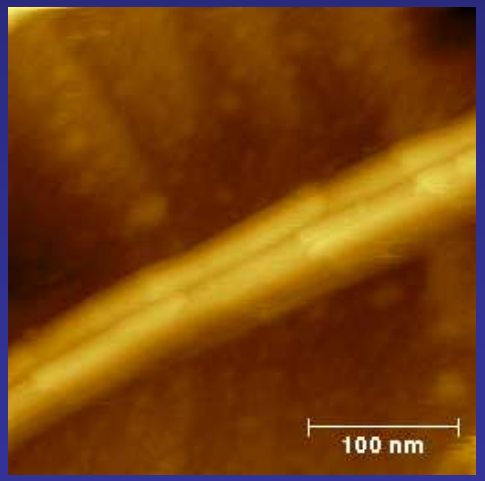
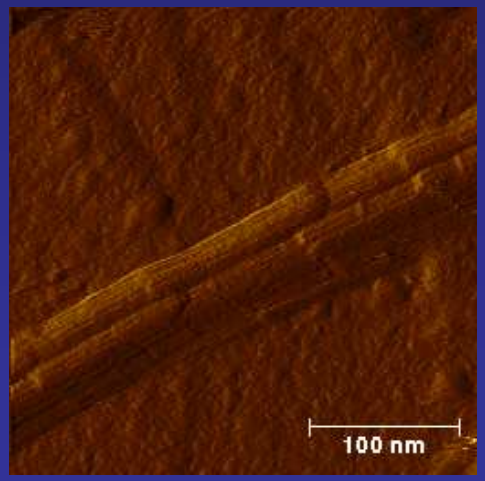
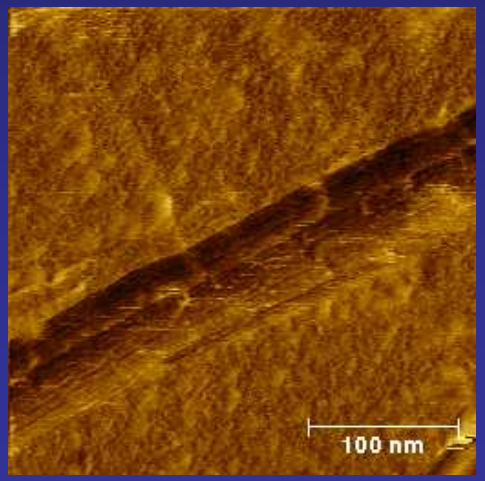


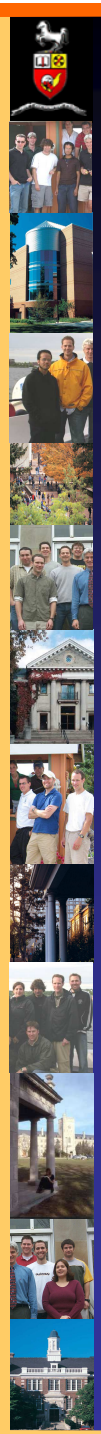
Topography



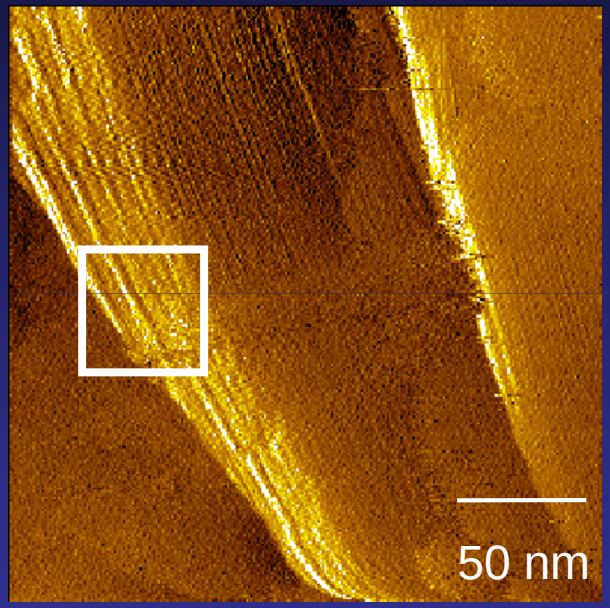
Amplitude

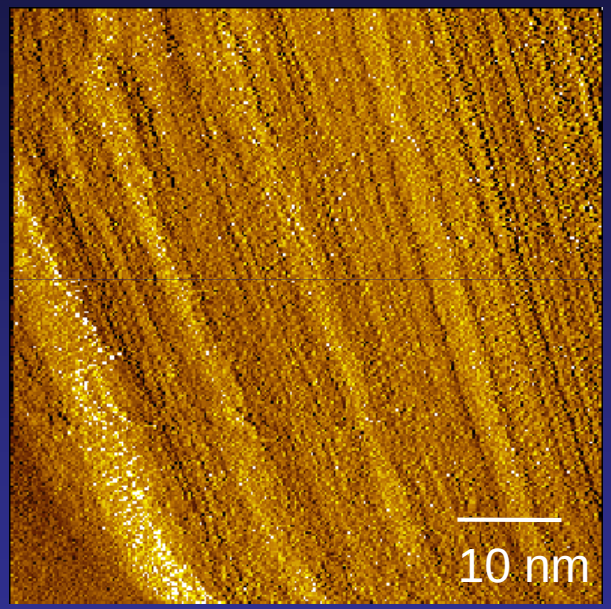


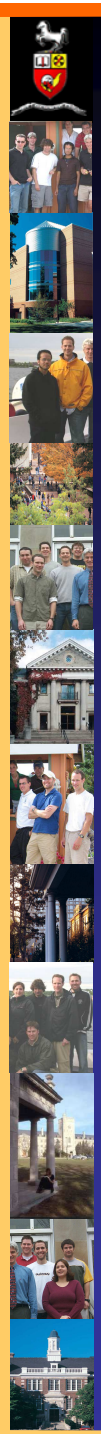
Phase



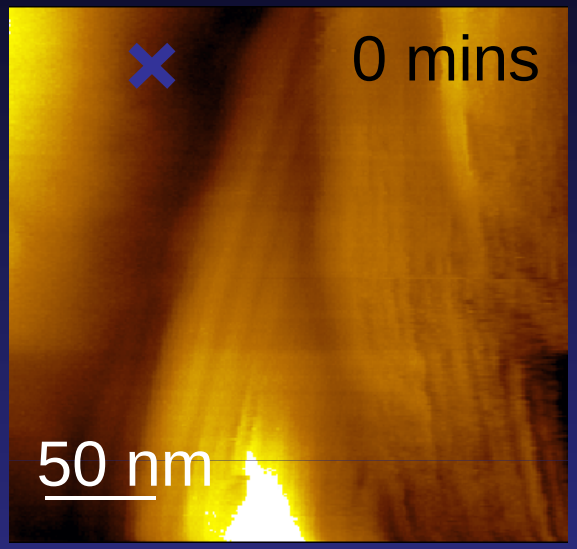
AFM imaging of cellulose

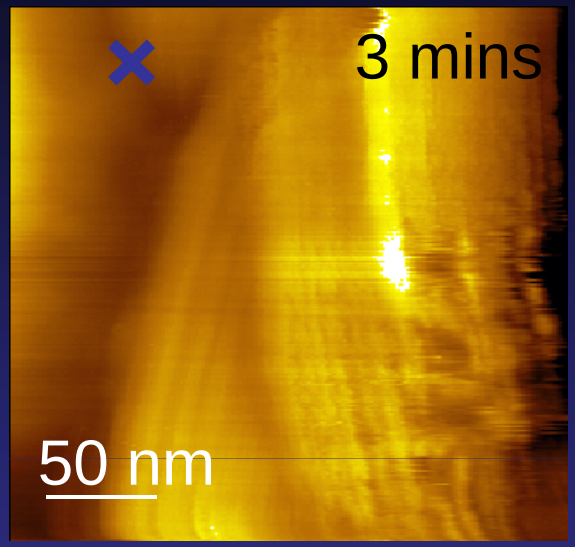


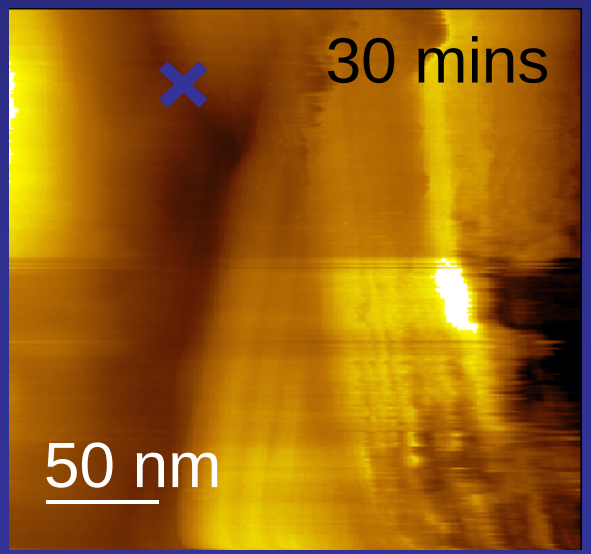


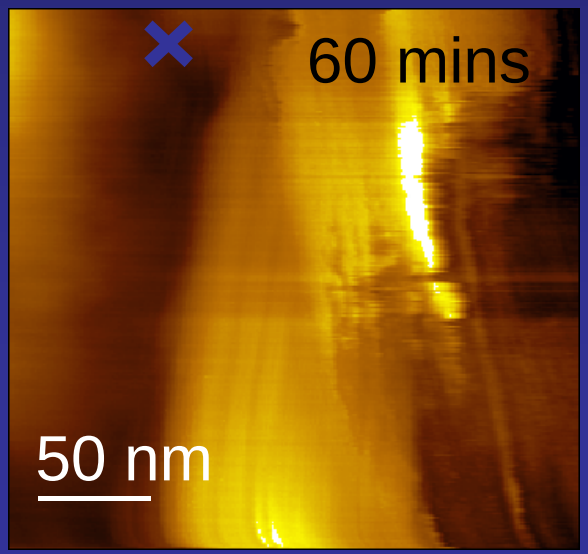


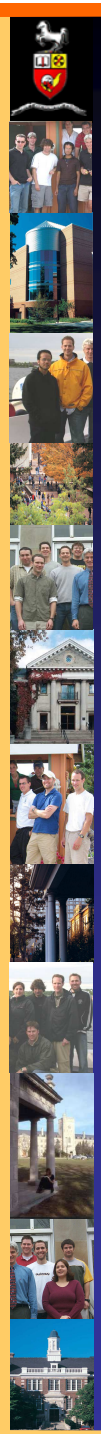
AFM imaging of cellulase activity



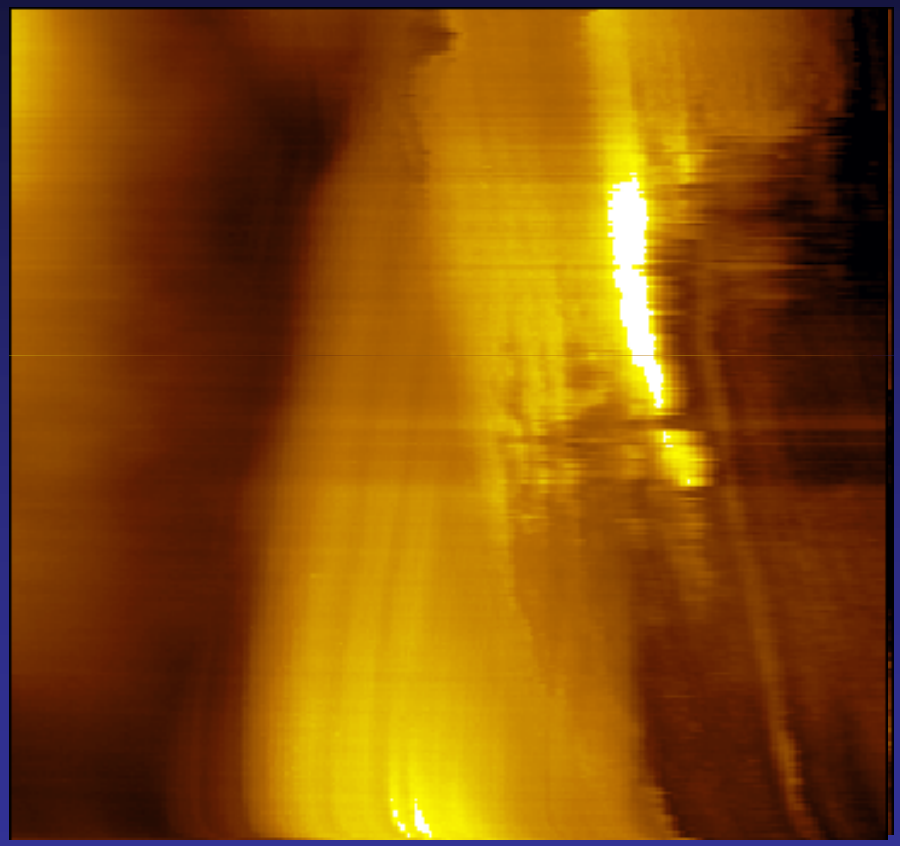


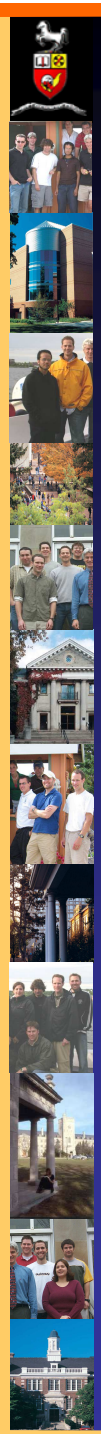




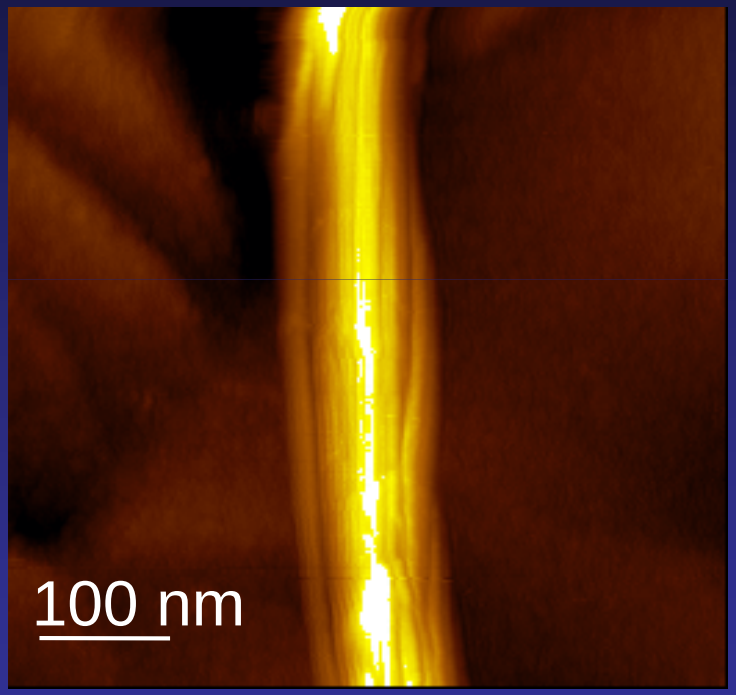


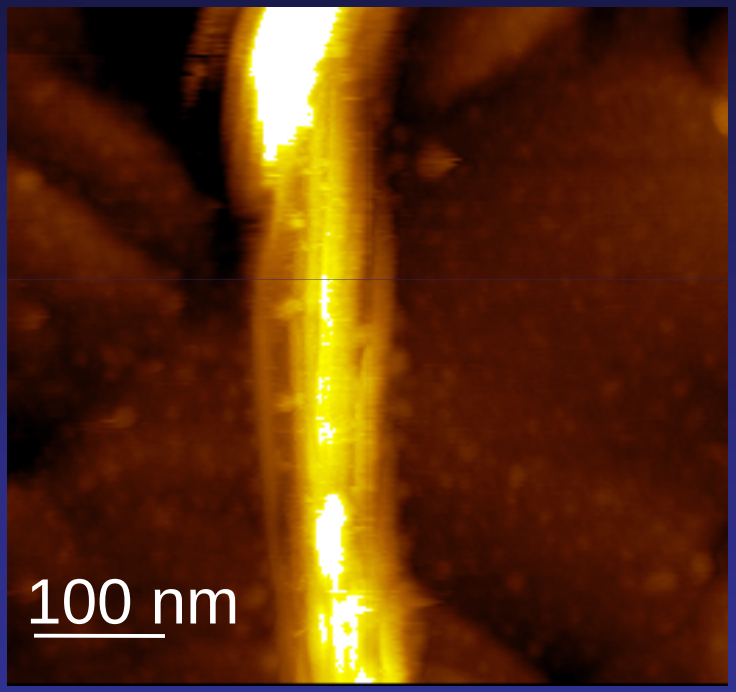
AFM imaging of cellulase activity





AFM imaging of cellulase binding





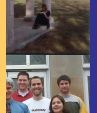











Photodetector

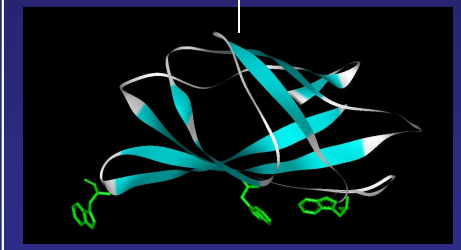
Laser

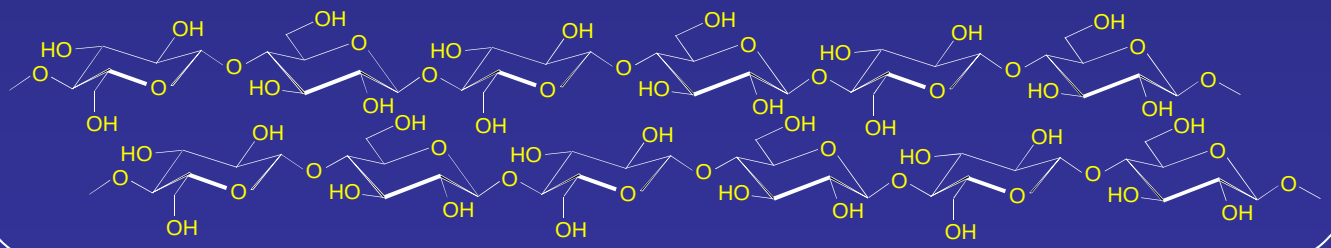
Cantilever

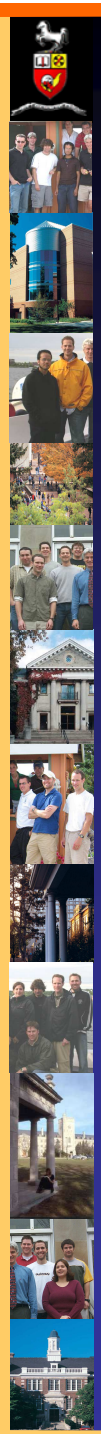
Probe

Cellulose

S







Amanda Quirk

Dr. Jacek Lipkowski, Chemistry

Dr. John Dutcher, Physics

NSERC CRSNG

Canada Foundation for Innovation
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Ontario

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ADVANCED FOODS & MATERIALS NETWORK
Inspiration from the ground up



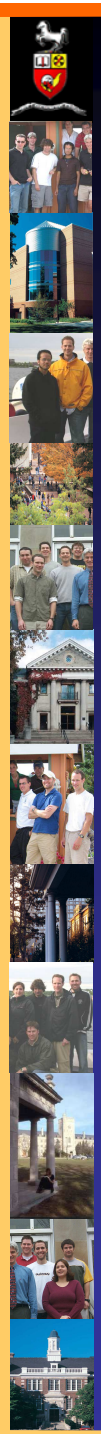






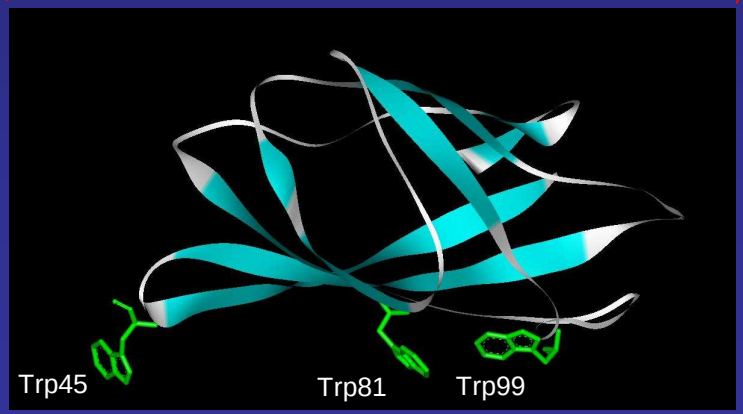


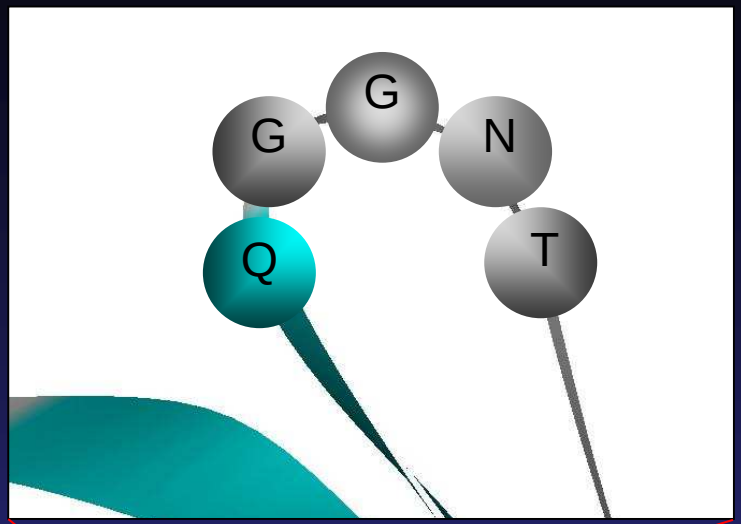




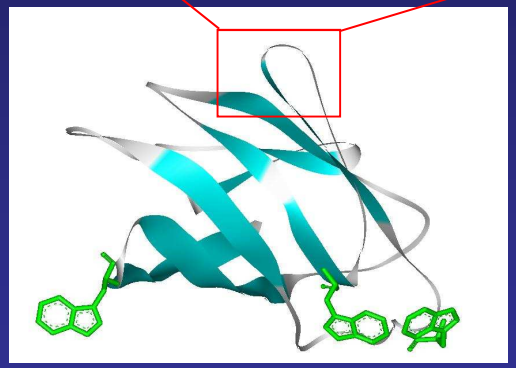
Cellulomonas fimi cellulase A (Cen A)

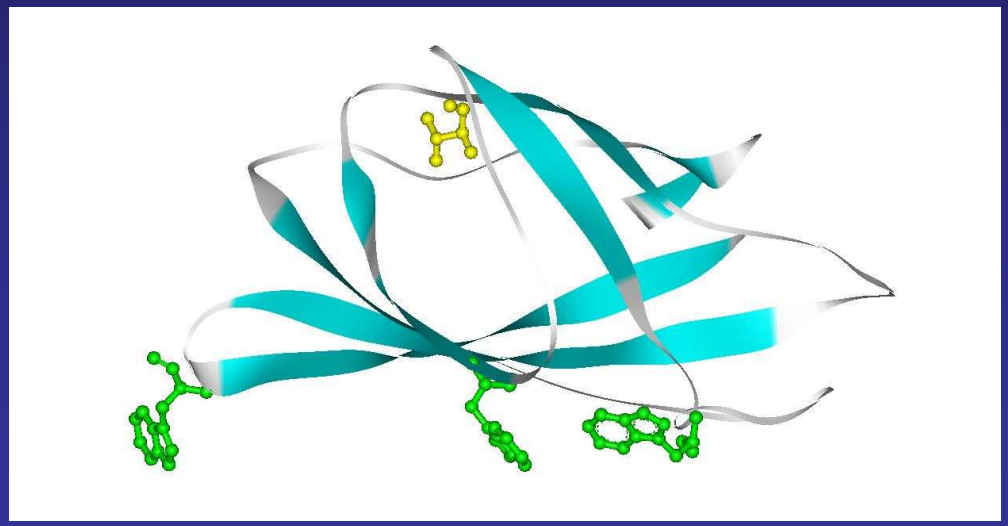

```
32          40          50          60          70
APGCRVDYA   VTNQWPGGFG  ANVTITNLGD  PVSSWKLDWT

            80          90          100         110
YTAGQRIQQL  WNGTASTNGG  QVSVTSLPWN  GSIPTGGTAS

            120         130
FGFNGSWAGS  NPTPASFSLN  GTTCTGT
```

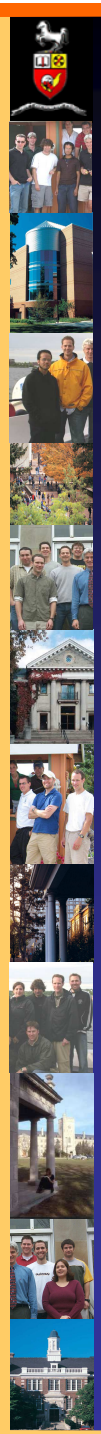




A.A.	P(α)	P(β)	P(turn)
Cys	70	119	119
Thr	83	119	96
Asn	67	89	156
Gly	57	75	156
Gln	111	110	98







Cellulomonas fimi cellulase A CBM2a

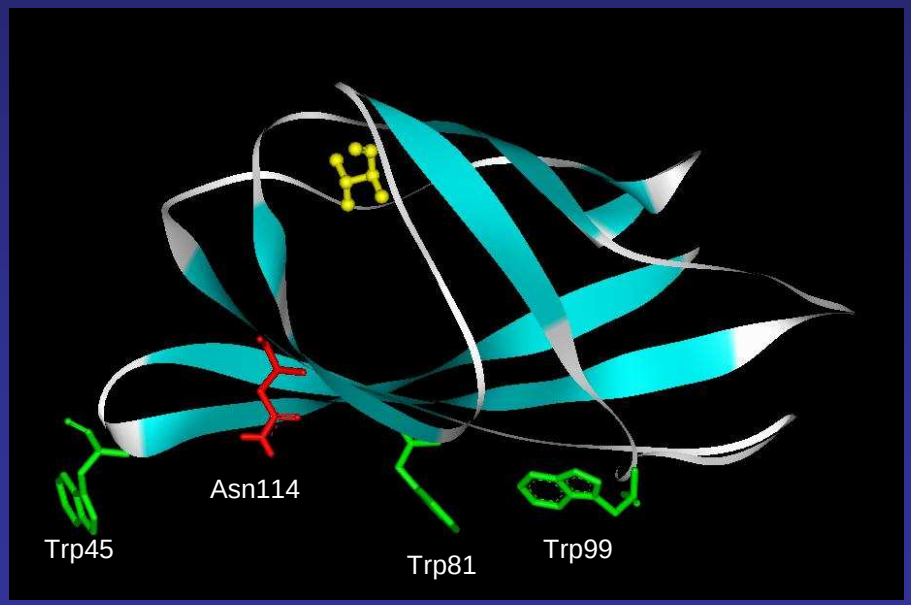
```
32        40        50        60        70
APGCRVDYA VTNQWPGGFG ANVTITNLGD PVSSWKLDWT

          80        90        100       110
YTAGQRIQQL WNGTASTNGG QVSVTSLPWN GSIPTGGTAS

          120       130
FGFNGSWAGS NPTPASFSLN GTTCTGT
```

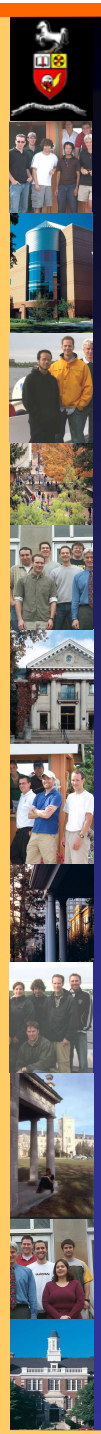
Double mutants of T87→C mutant

N114→Y

N114→F

N114→W





Cellulomonas fimi cellulase A CBM2a

```
32        40        50        60        70
APGCRVDYA VTNQWPGGFG ANVTITNLGD PVSSWKLDWT

          80        90        100       110
YTAGQRIQQL WNGTASTNGG QVSVTSLPWN GSIPTGGTAS

          120       130
FGFNGSWAGS NPTPASFSLN GTTCTGT
```