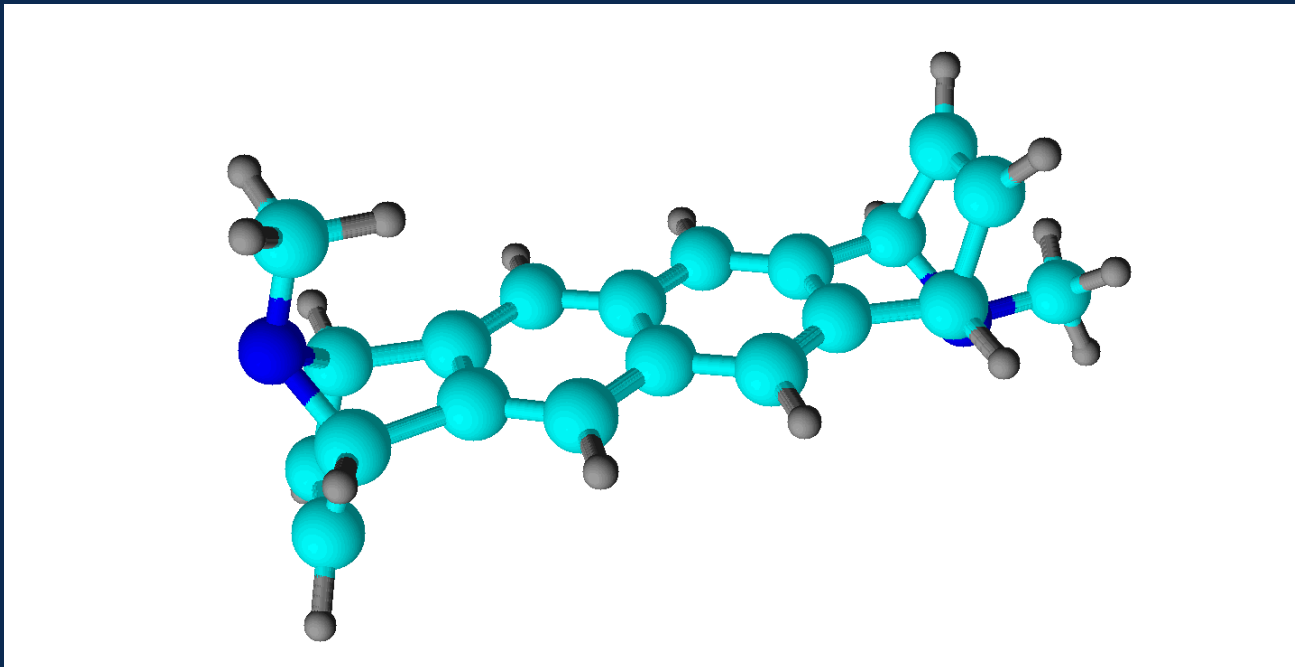
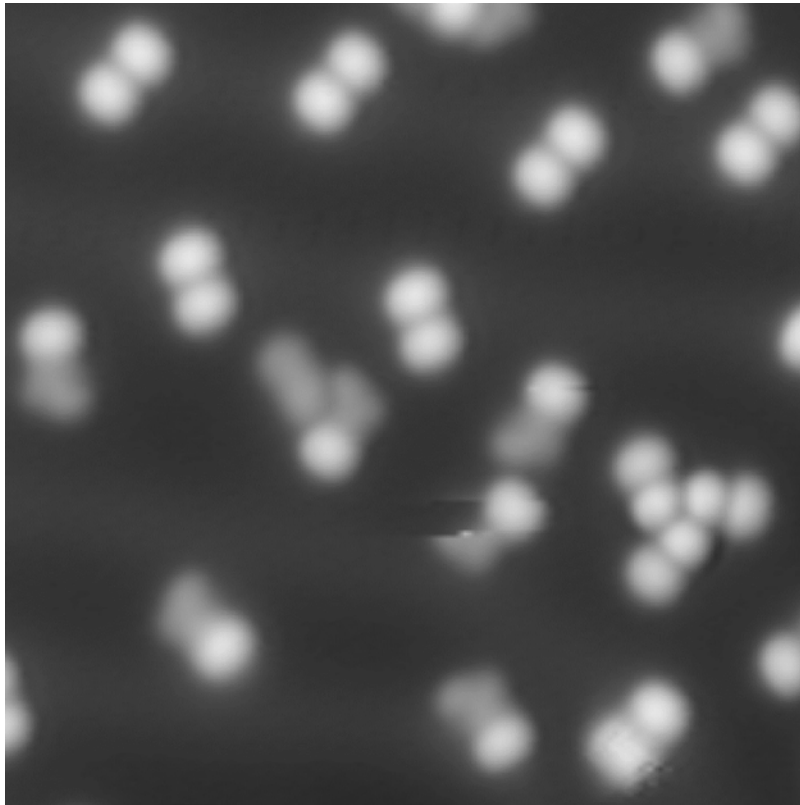




# Tetracene precursor with $\text{NCH}_3$





- dumbbell-shaped molecules visible
- other species partially flat, but with some side-part
- assuming partial scissoring of N-C-bond for flat parts of the molecule

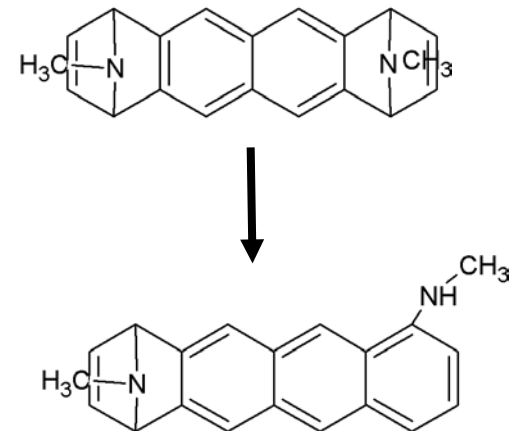
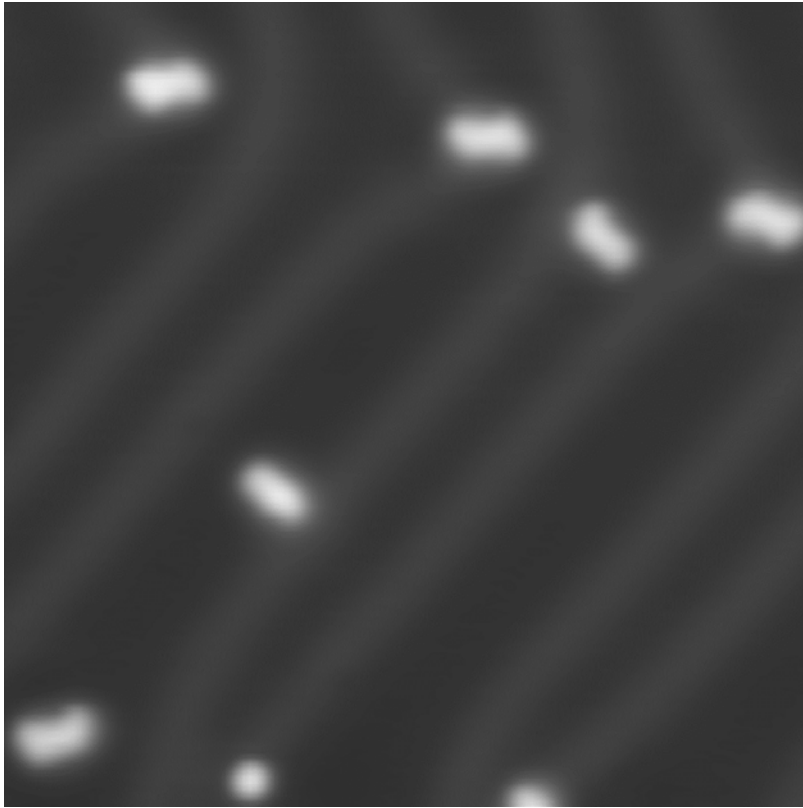


Image size 12.5 nm x 12.5 nm I = 73 pA; V = - 0.56 V

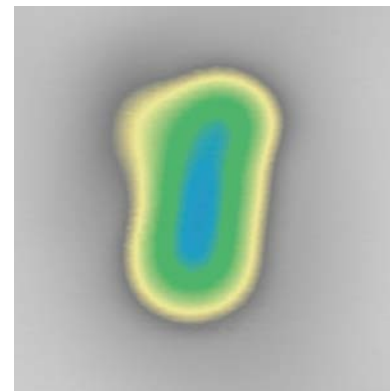
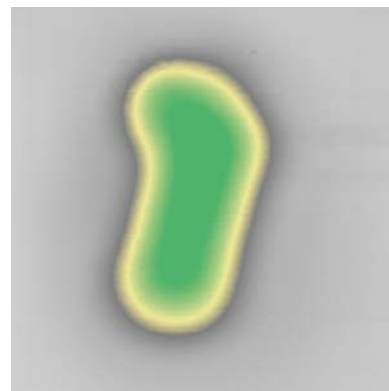
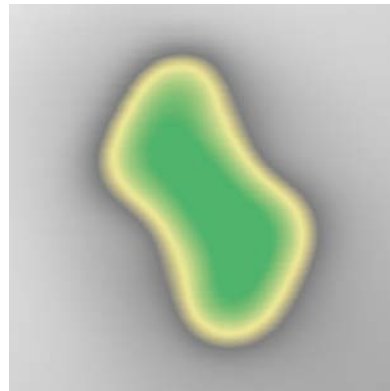
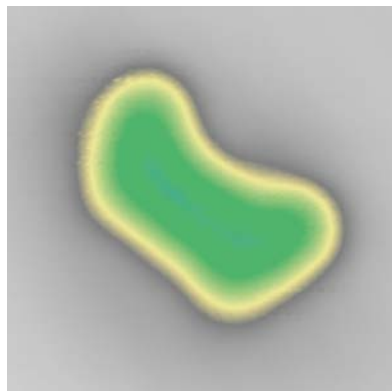


- flattened molecules after annealing
- different molecules on surface
- close-up images next slide

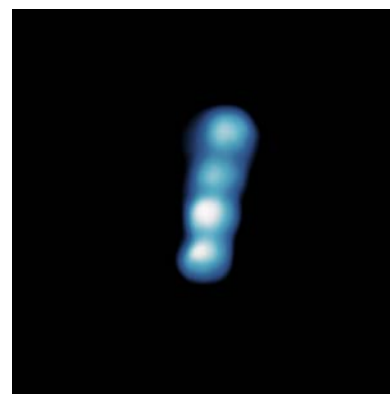
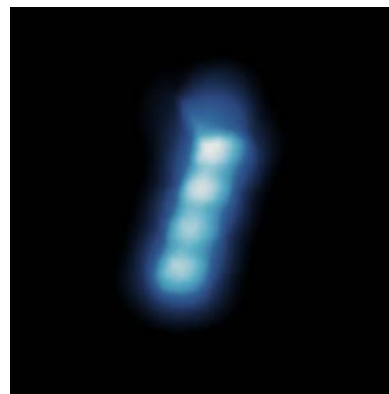
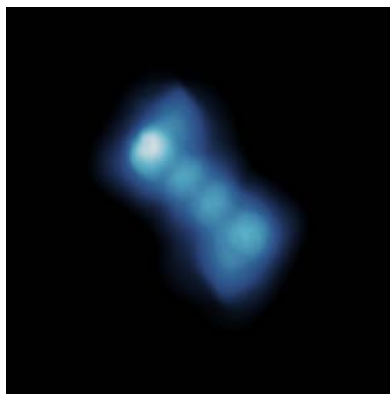
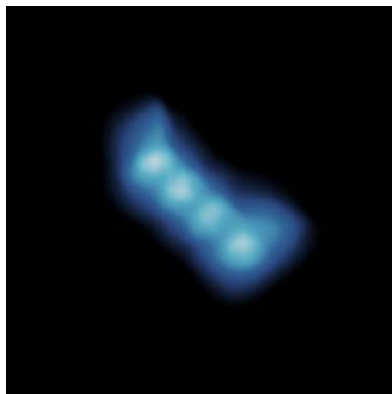
Image size 20 nm x 20 nm  $I = 100$  pA;  $V = 0.5$  V

# Species resolved with high resolution

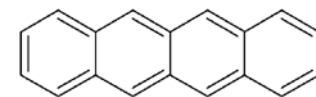
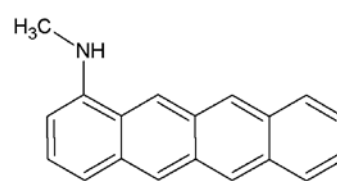
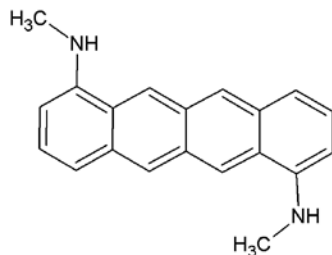
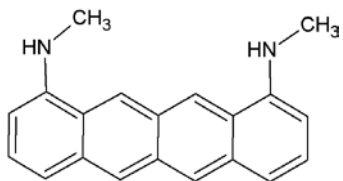
CC-image  
V = 0.5 V  
I = 100 pA



CH-image

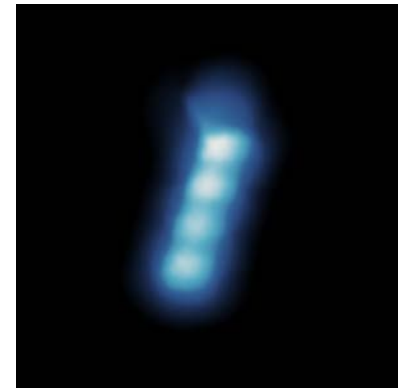
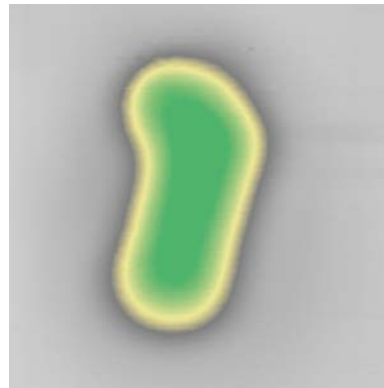
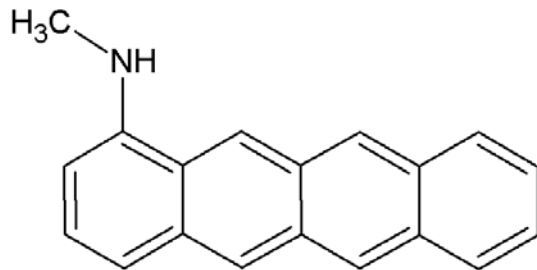


possible  
chemical  
structures



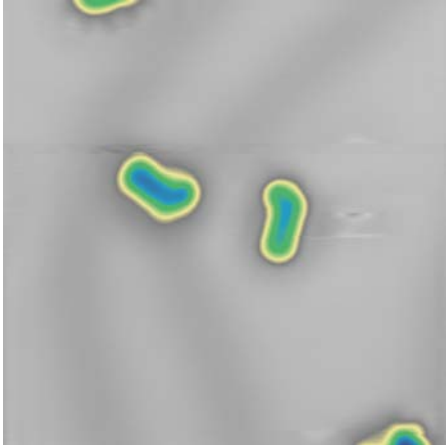
all image sizes 2.5nm x 2.5nm

- scissoring of the N-C-bonds occurs
  - resulting finally in tetracene
- species with nitrogen should interact with Au(111)
  - binding to surface after reaction

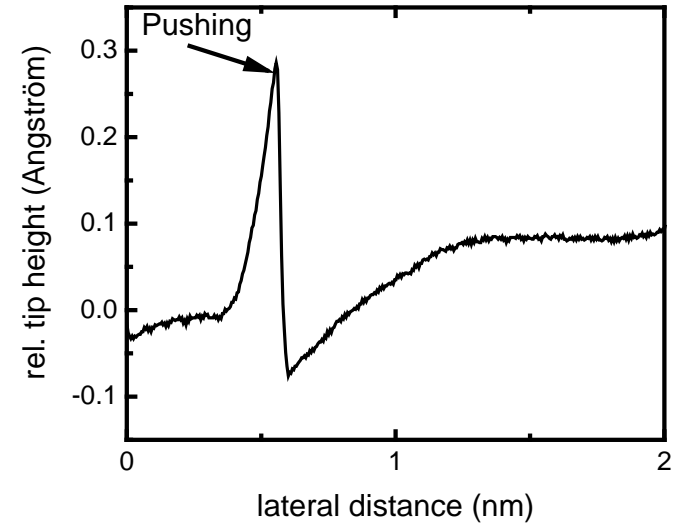
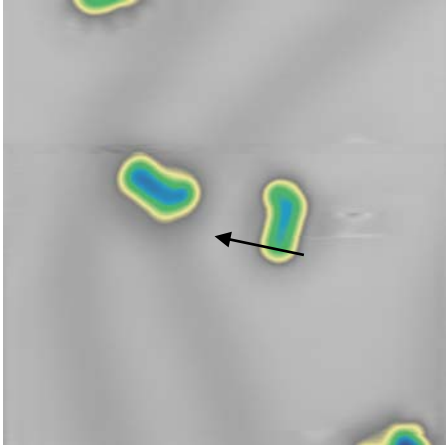


- testing now, if molecules with one nitrogen-atom left rotate
  - others should not move, as they have two anchoring points

## Full rotation of the molecule



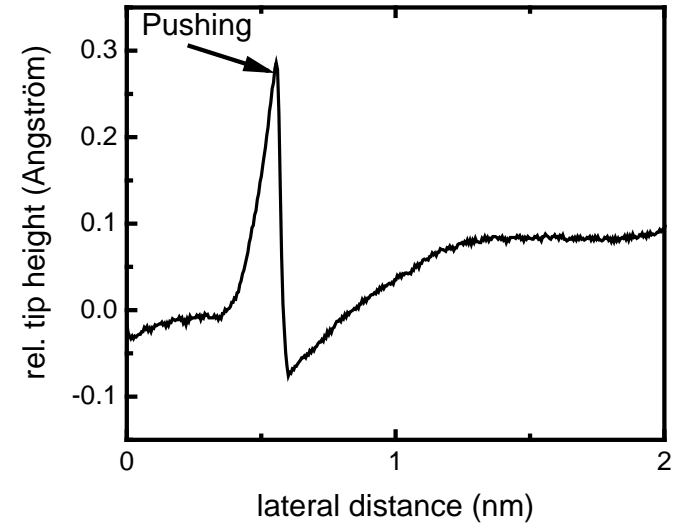
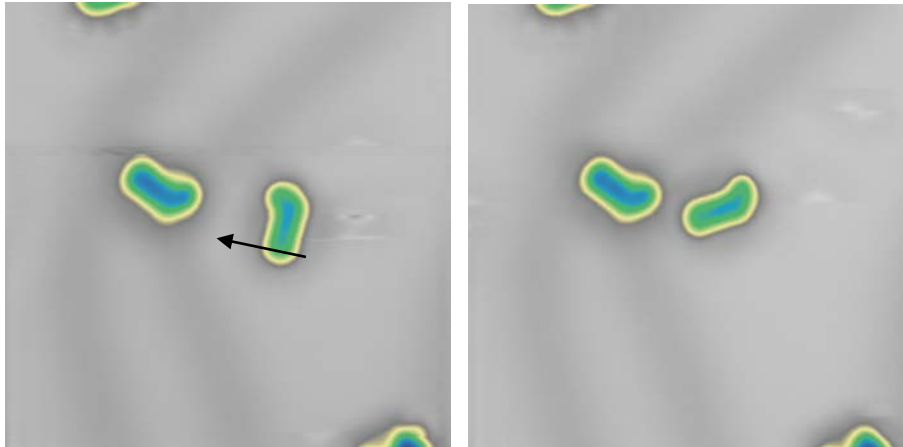
Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$



- exemplary relative tip height - distance curve during manipulation

Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

# Full rotation of the molecule

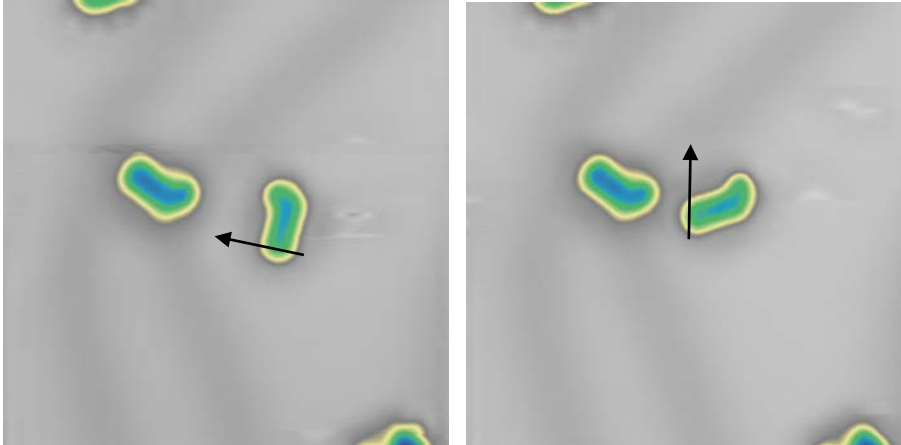


- exemplary relative tip height - distance curve during manipulation

Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

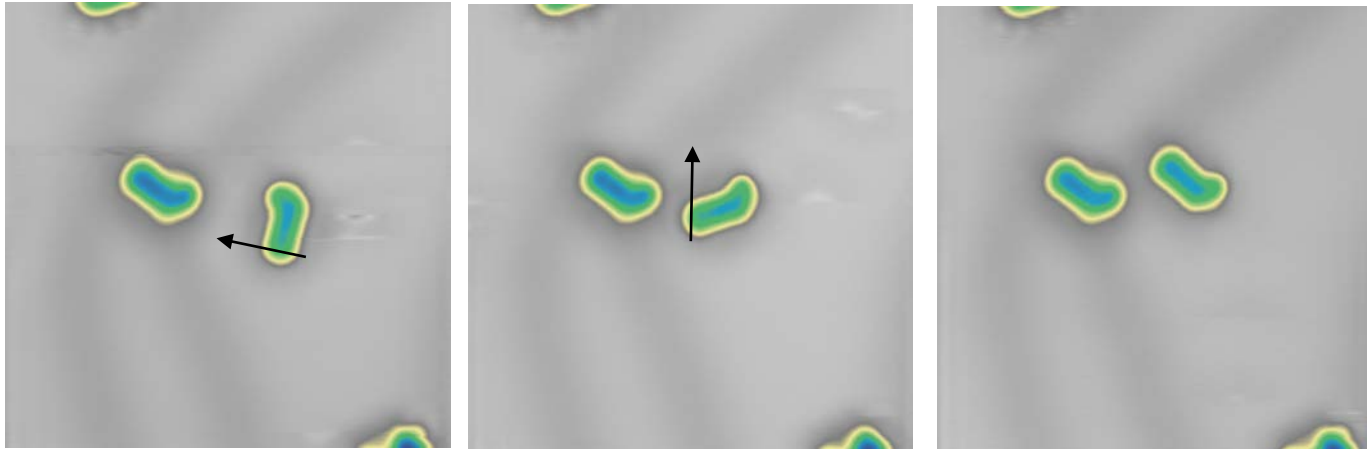


## Full rotation of the molecule



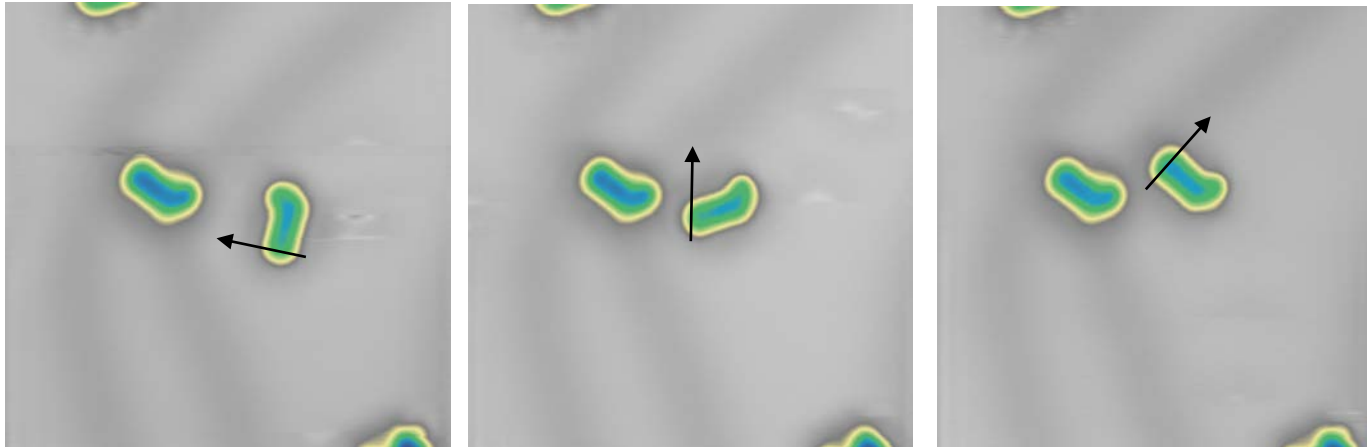
Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

## Full rotation of the molecule



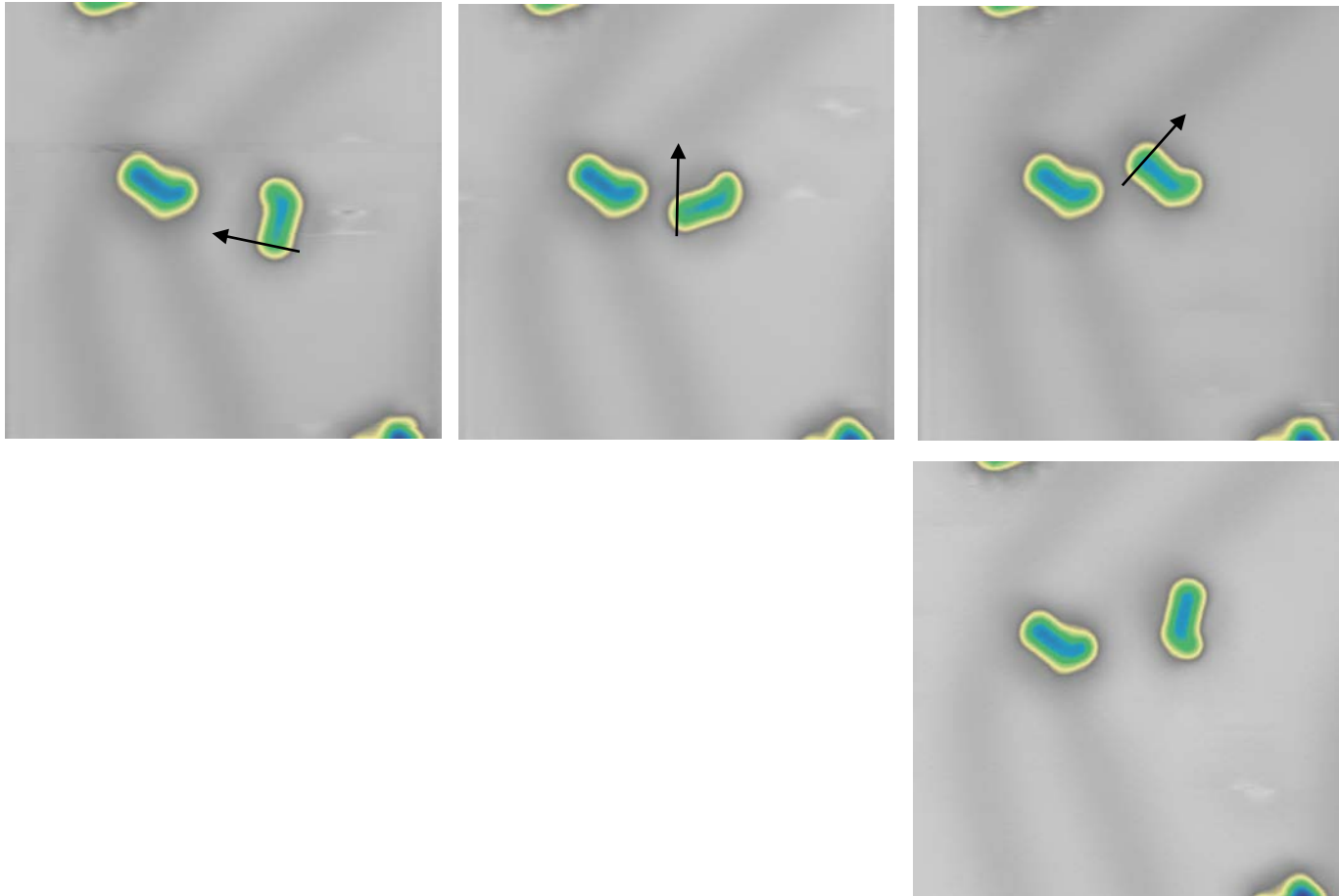
Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

## Full rotation of the molecule



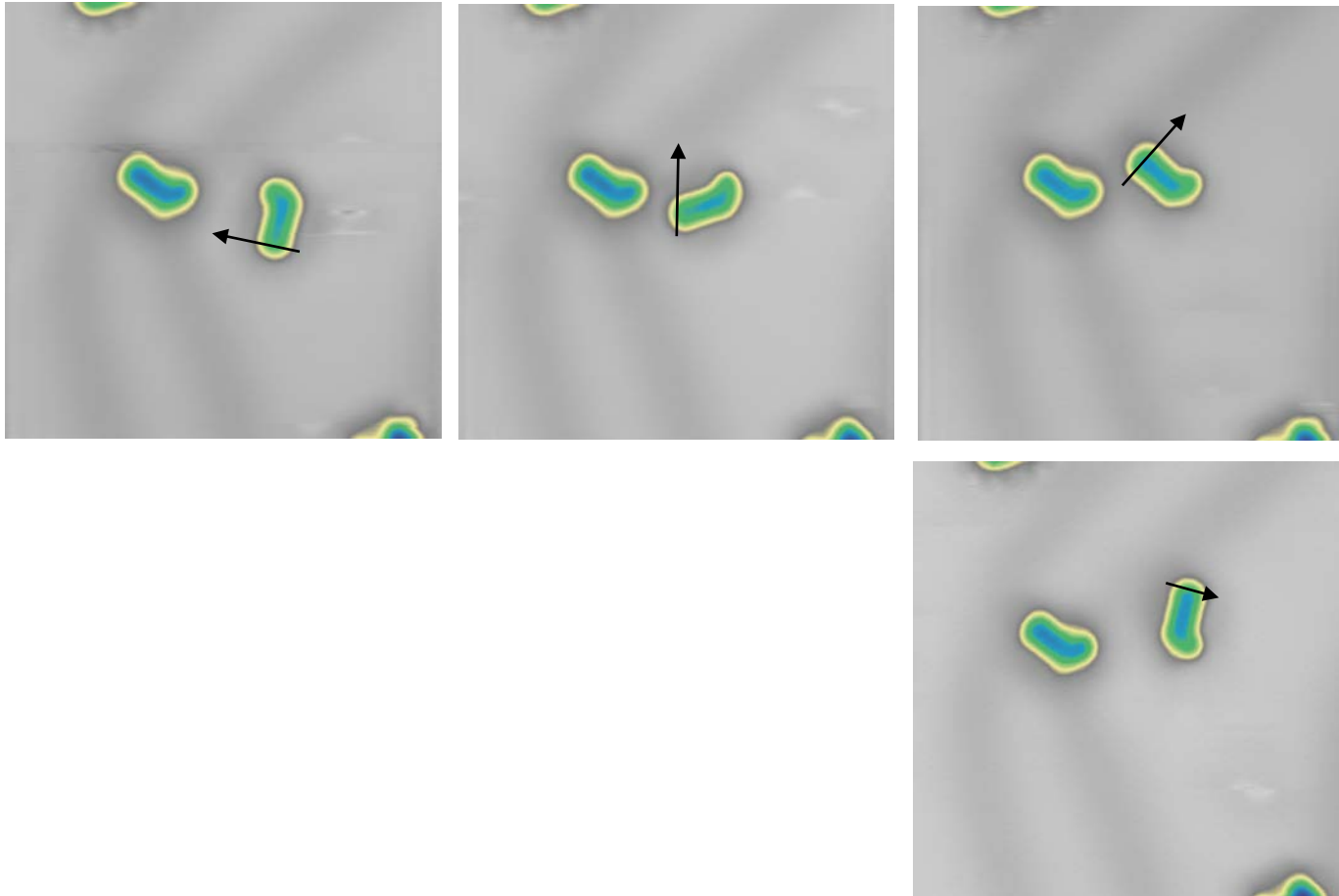
Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

## Full rotation of the molecule



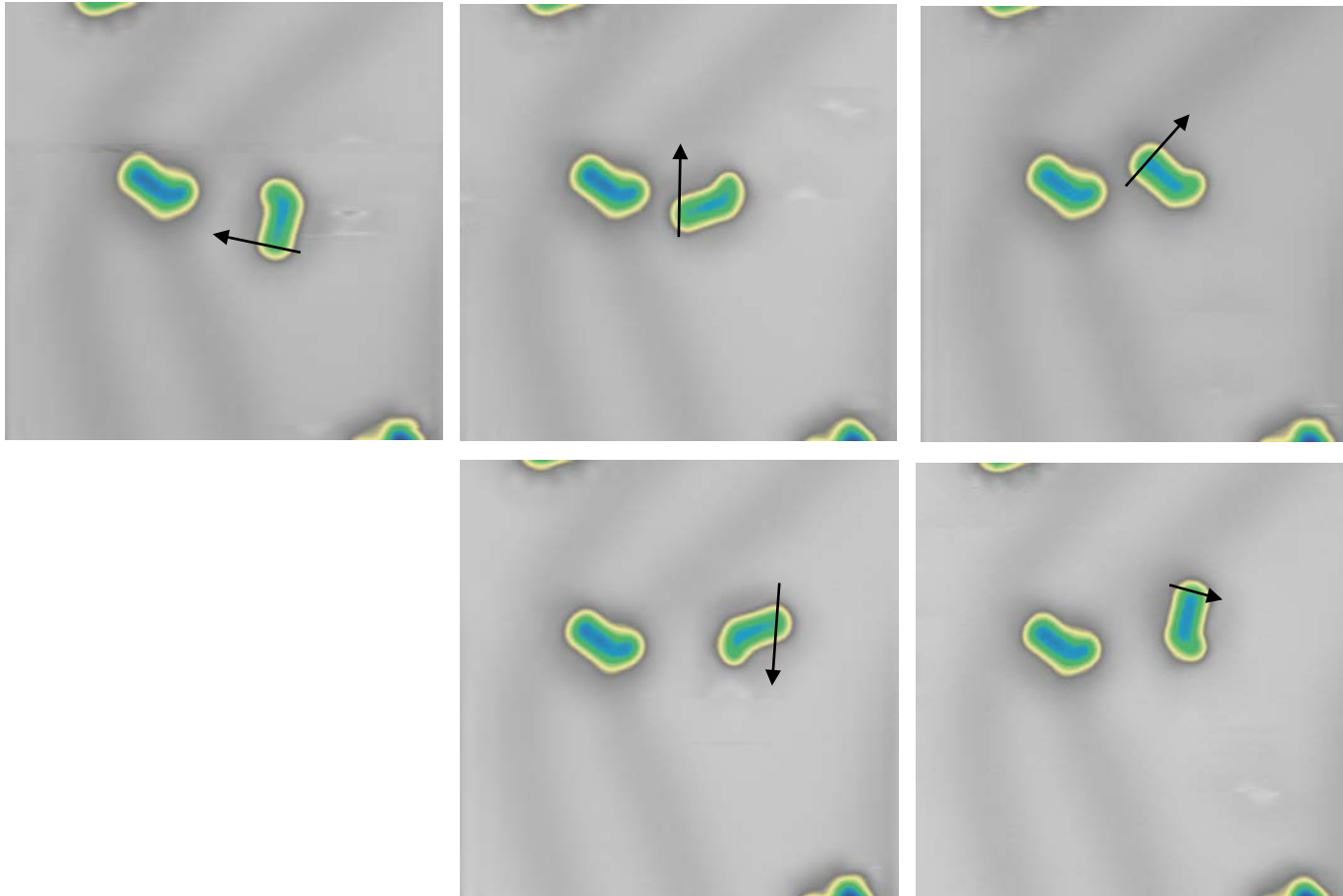
Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

## Full rotation of the molecule



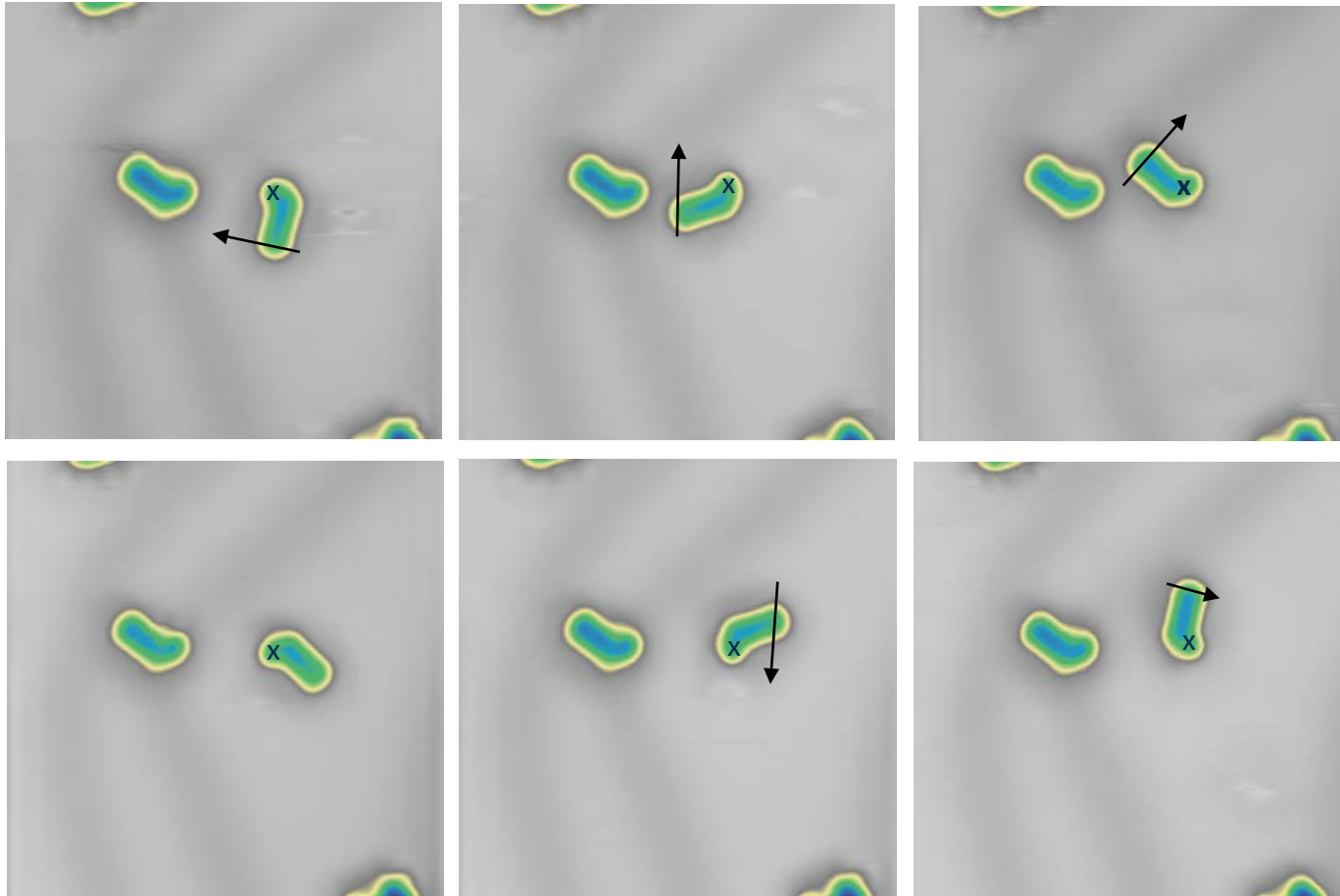
Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

## Full rotation of the molecule



Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$

## Full rotation of the molecule



- molecule binds  
to Au(111)

- can fulfill a full  
rotation about  
axle point x

- other species with  
two nitrogen cannot  
be moved

Imaging conditions:  $I = 100 \text{ pA}$ ;  $V = 0.5 \text{ V}$ ; Image sizes:  $10 \text{ nm} \times 10 \text{ nm}$ ; Manipulation parameters:  $I = 2.0 \text{ nA}$ ;  $V = 10 \text{ mV}$