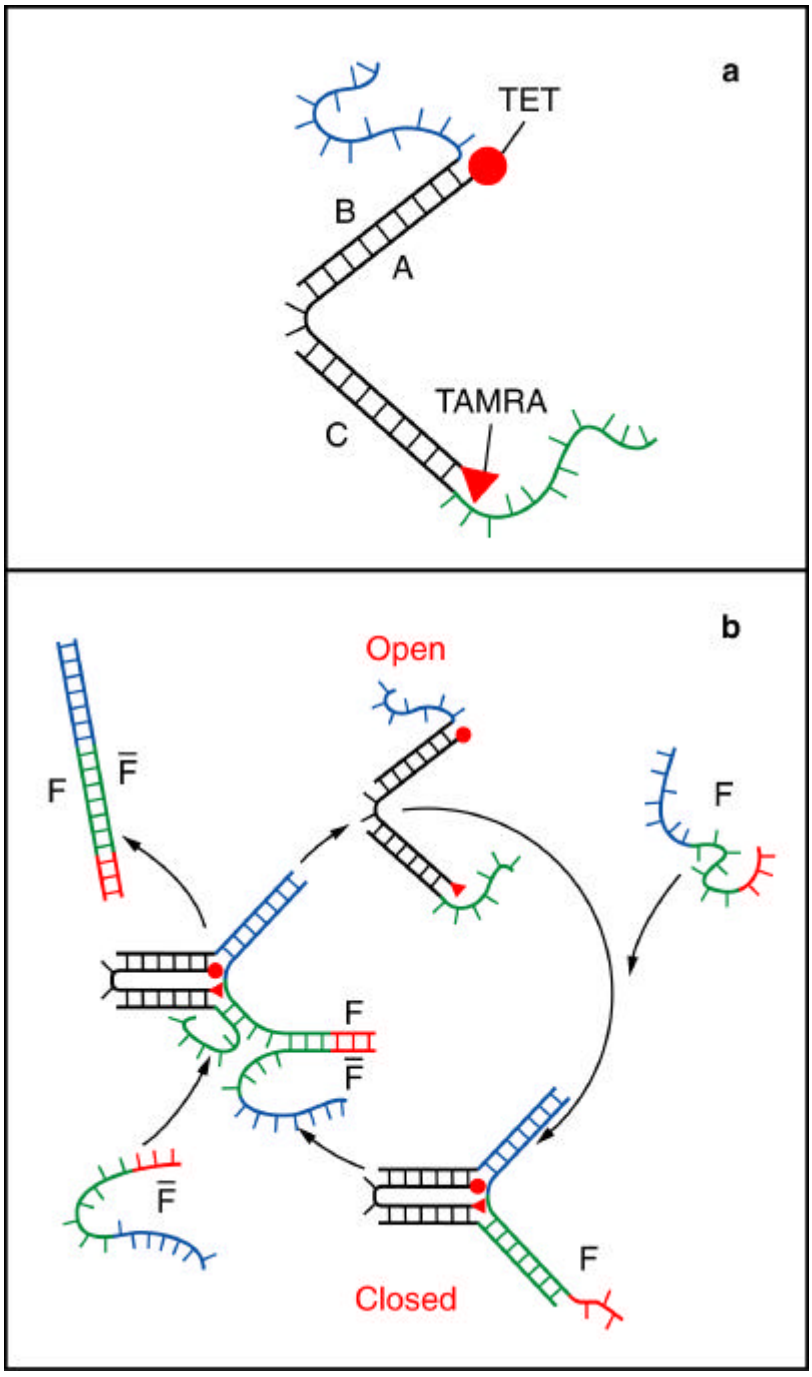
Catalytic DNA systems and molecular motors

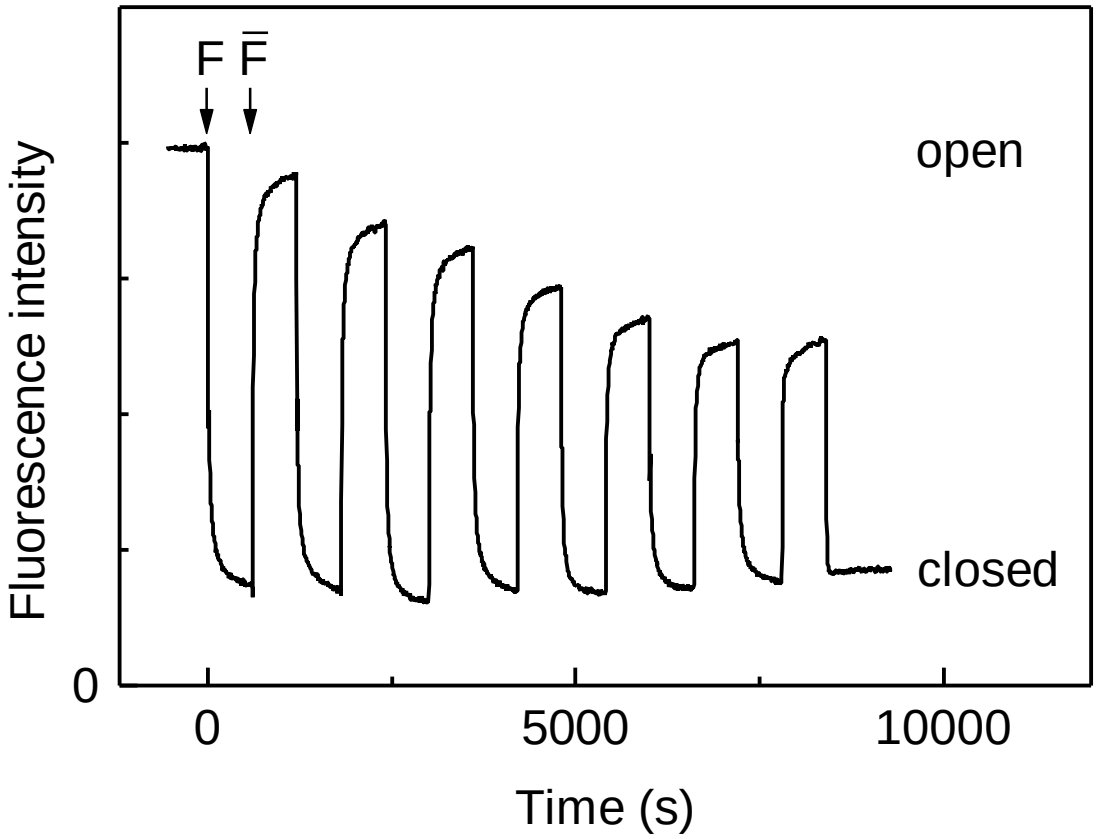
Bernard Yurke
Bell Laboratories, Lucent Technologies
Collaborators:
Allen P. Mills, Jr.
Andrew J Turberfield
Jennifer L. Neumann

Long term goal: Devise an assembly technology using molecular recognition that will allow construction of VLSI structures with molecular scale features.

Outline:

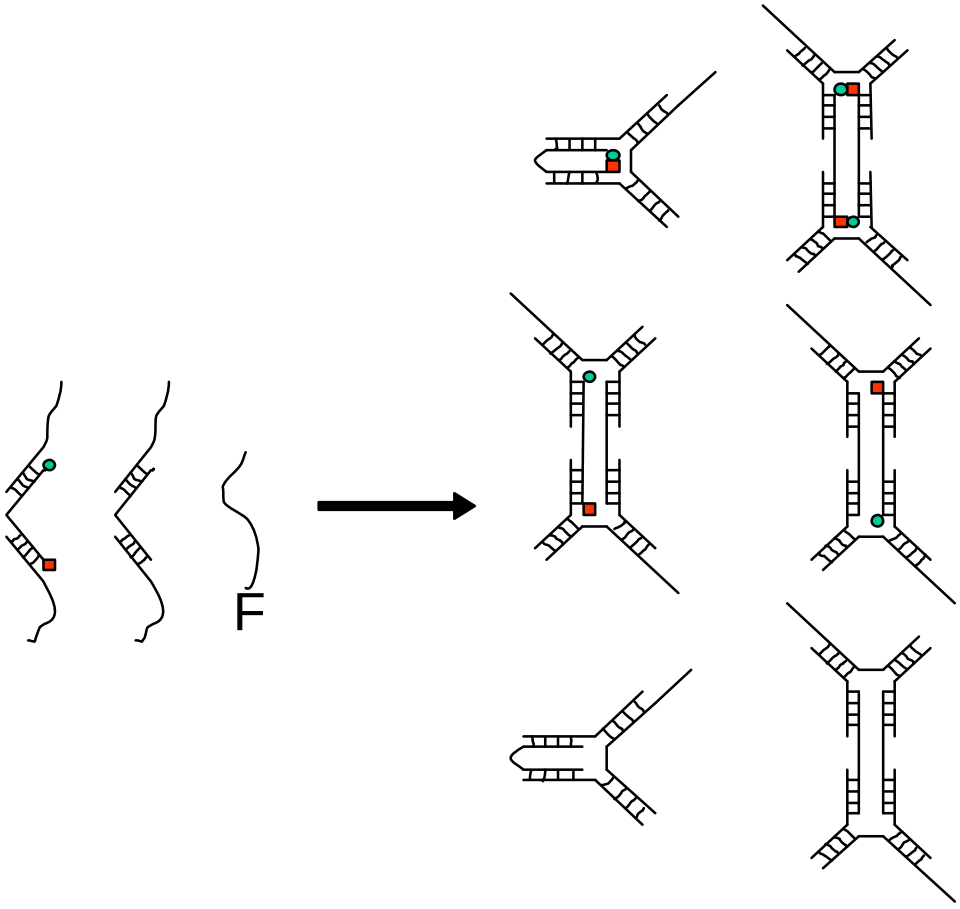
DNA tweezers - a DNA controllable molecular actuator.
A catalytic DNA system.
Self-guided self-assembly.


a
TET
B
A
TAMRA
C
b
Open
F
F̄
F
F̄
F
F̄
F
Closed

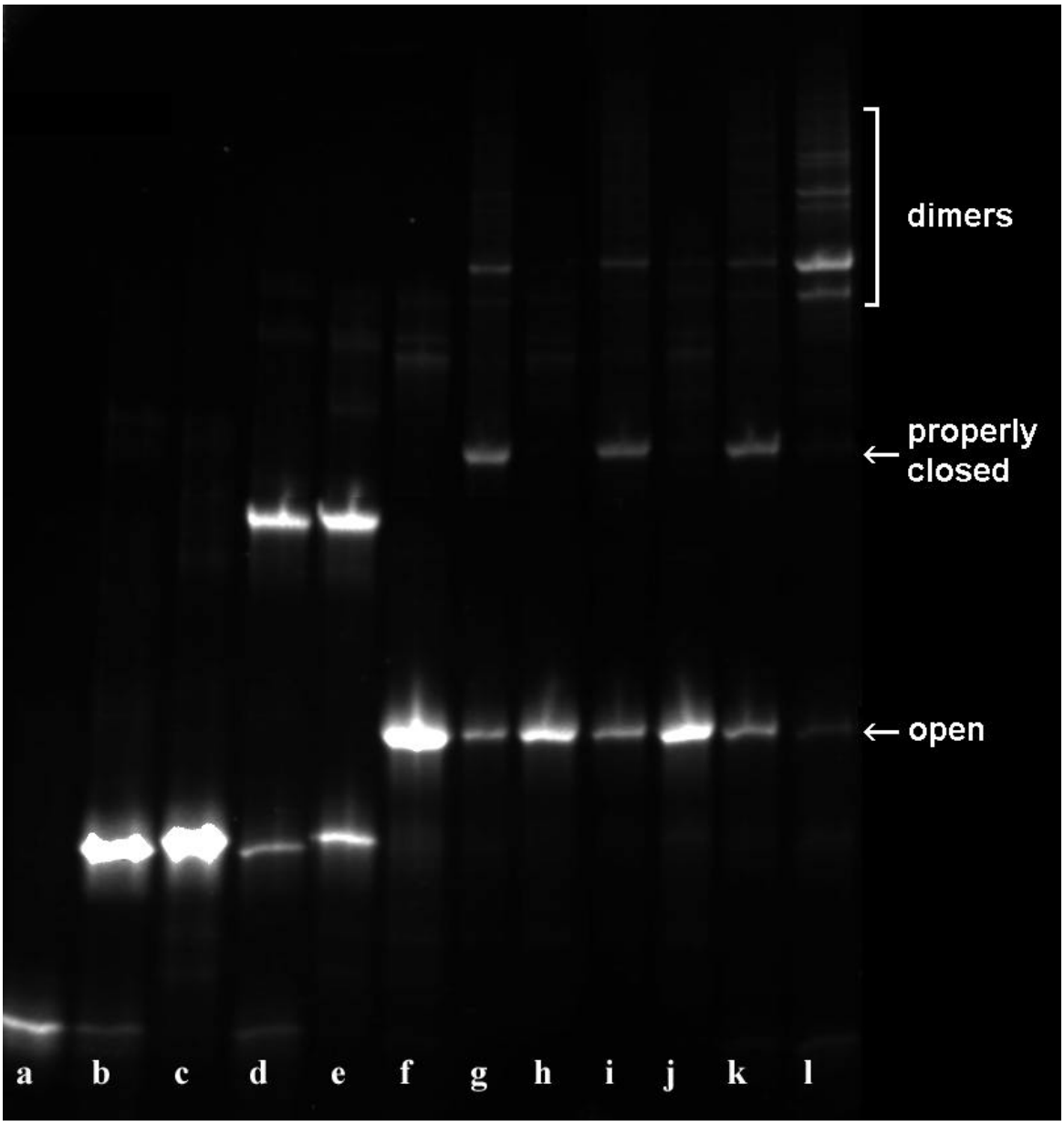

F
F̄
open
closed
Fluorescence intensity
0
0
5000
10000
Time (s)

Test for Dimer Formation

1. Unlabeled A Strand



2. Gell electrophoresis against a dimer standard

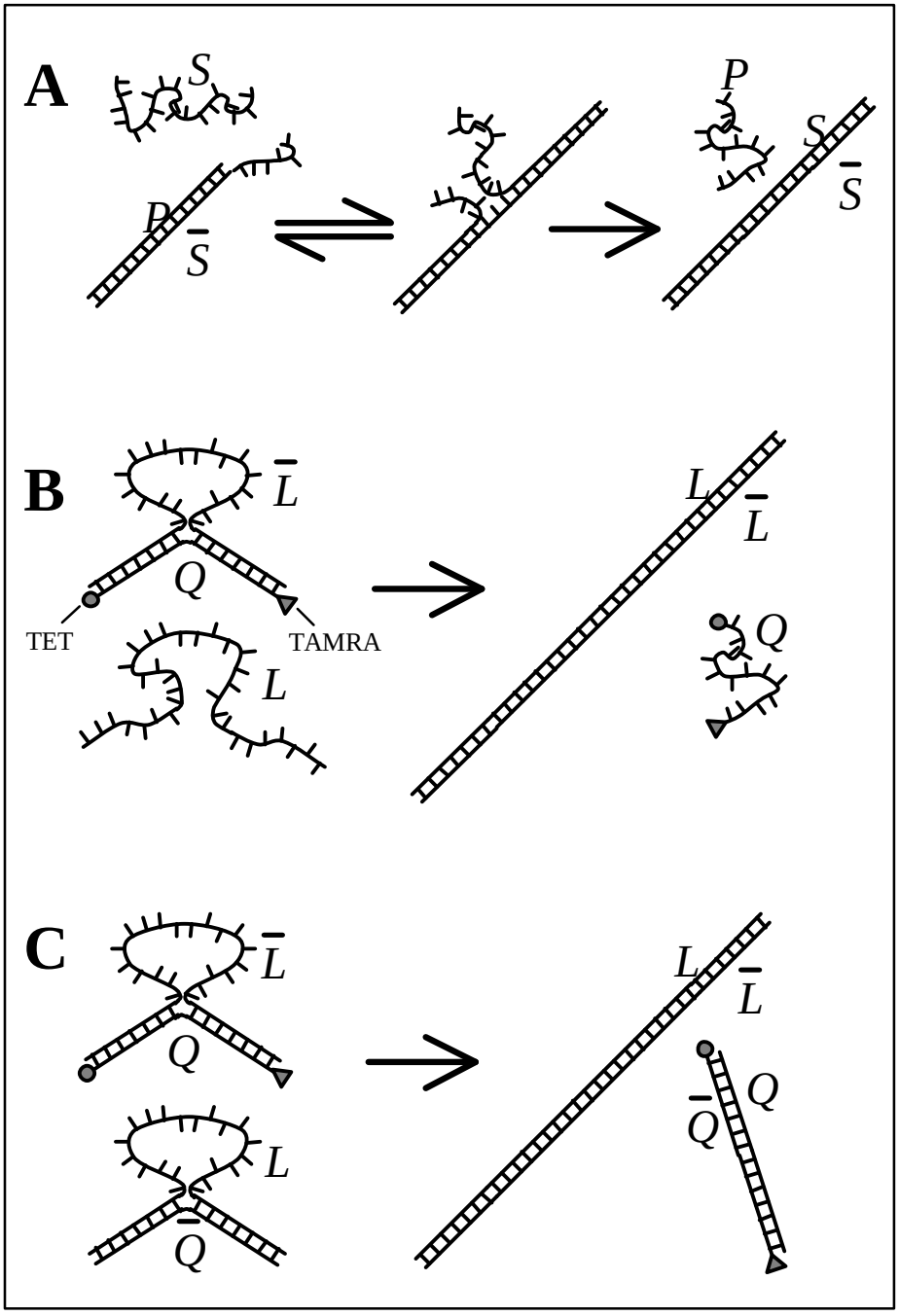

dimers
properly closed
open
a b c d e f g h i j k l

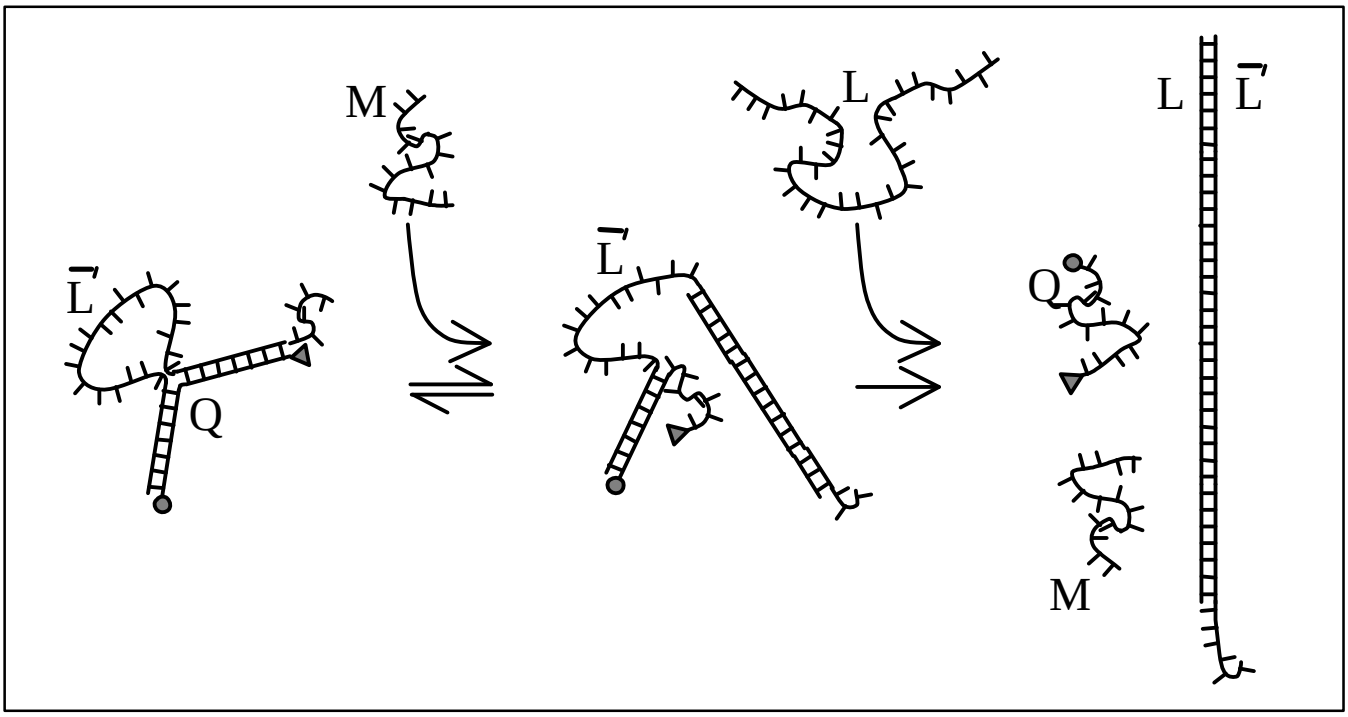
•Because the thermodynamic paths for opening and closing the molecular tweezers are different it is a thermodynamic engine.

•It is a clocked molecular motor.

•Biological molecular motors are catalysts that convert fuel to waist product.

•Hence, DNA systems in which interactions are catalytically controlled are of interest in devising free running DNA motors.


A
S
P
S
P
S
B
L
Q
TET
TAMRA
L
L
L
Q
C
L
Q
L
Q
L
Q
Q


M
L
L
Q
L
L
Q
M

Self-Guided Self-Assembly