M. WARMUTH

USING ANNEALING TO COMPUTE & BUILD DNA NANO STRUCTURES

1) ON THE COMPUTATIONAL POWER OF ANNEALING & LIGATION
   WINFREE, 96

2) UNIVERSAL COMPUTATION VIA SELF-ASSEMBLY OF DNA
   WINFREE, YANG, SEEMANN, 96

3) DESIGN & SELF-ASSEMBLY OF TWO DIMENSIONAL DNA CRYSTALS
   WINFREE, LIU, WENZLER, SEEMAN
   NATURE 98
RULE OF THUMB:
DIFFERENCE IN MELTING TEMP.
BETWEEN PERFECTLY MATCHED STRUCTURE AND AN IMPERFECTLY MATCHED STRUCTURE
IS 1 DEGREE PER 1% MISMATCH
SIMPLEST JUNCTION PROBABLY FLOPPY

NOT PARALLEL BUT SKewed

FAIRLY RIGID & PLANAR

DAE DOUBLE CROSSOVER ANTIPARALLEL HELICAL STRAND WITH EVEN H OF HALF-turnS BETWEEN CROSS OVER
BLOCKED CELLULAR AUTOMATON

AN AUTOMATON IS

- AN AUTOMATON IS GIVEN BY A SET OF RULES
- INITIAL TAPE
- BOUNDARY CONDITION

EXAMPLE:

THREE STATES OF CELL

RULES:

APPLICATION OF RULES: INTERWEAVING
IMPLEMENTATION VIA DNA

INITIALIZATION

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DNA:

Figure 4. Rule table molecules assemble into the lattice.
Figure 7. Alternative Topologies for 2D Lattice.
CAN SIMULATE TM

IF AREA RESTRICTED THEN NOT UNIVERSAL

IF AREA IS ALLOWED TO GROW AND DECREASE
THEN IN PRINCIPLE UNIVERSAL

- A SINGLE MISMATCH CAN MESS THINGS UP
  NATURE HAS CORRECTION FACILITIES

- COMPUTATION BASED ON MOVEMENT OF
  MOLECULES WHICH IS SLOW
RNA SINGLE STRAND

40-MER DNA STRAND

16-MER DNA STRAND

DNA LIGASE

DNA LIGASE

DNase

DNase

RNA CIRCLE

RNA KNOT

TOPO ?

d

LIGATE IN Z-DNA PROMOTING CONDITIONS