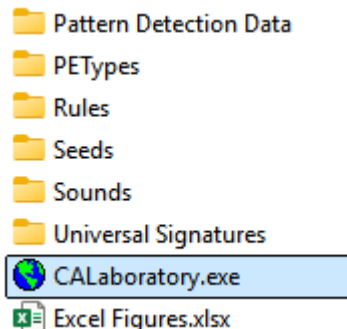**CA Laboratory Instructions**

These instructions will get you started experimenting with CA Laboratory. For additional questions contact rainwater.hank@gmail.com.
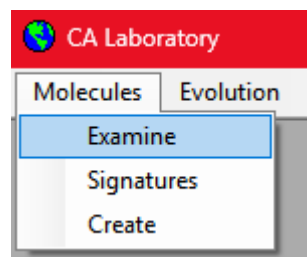
File Structure of the Software

Upon unzipping the downloaded zip file, these folders and the executable will appear within the Windows 11 desktop folder you selected for the extraction of files. Each folder contains several subfolders and none of these folders should be manually changed. The executable is highlighted to the right.	📁 Pattern Detection Data 📁 PETypes 📁 Rules 📁 Seeds 📁 Sounds 📁 Universal Signatures 🌐 CALaboratory.exe 📊 Excel Figures.xlsx

This version of the software contains only sample data because the full data version of the program displayed in the paper "Selective Morphogenesis in Driven Cellular Automata: Insights from Functional Information and Assembly Theory" is 250 MB when zipped and thus too large for conventional downloading. The full data version also represents over 2,000 hours of computational time on a high-end Windows 11 desktop computer with 64 GB of memory. However, the sample data can be expanded upon if you wish to explore the software and have patience.

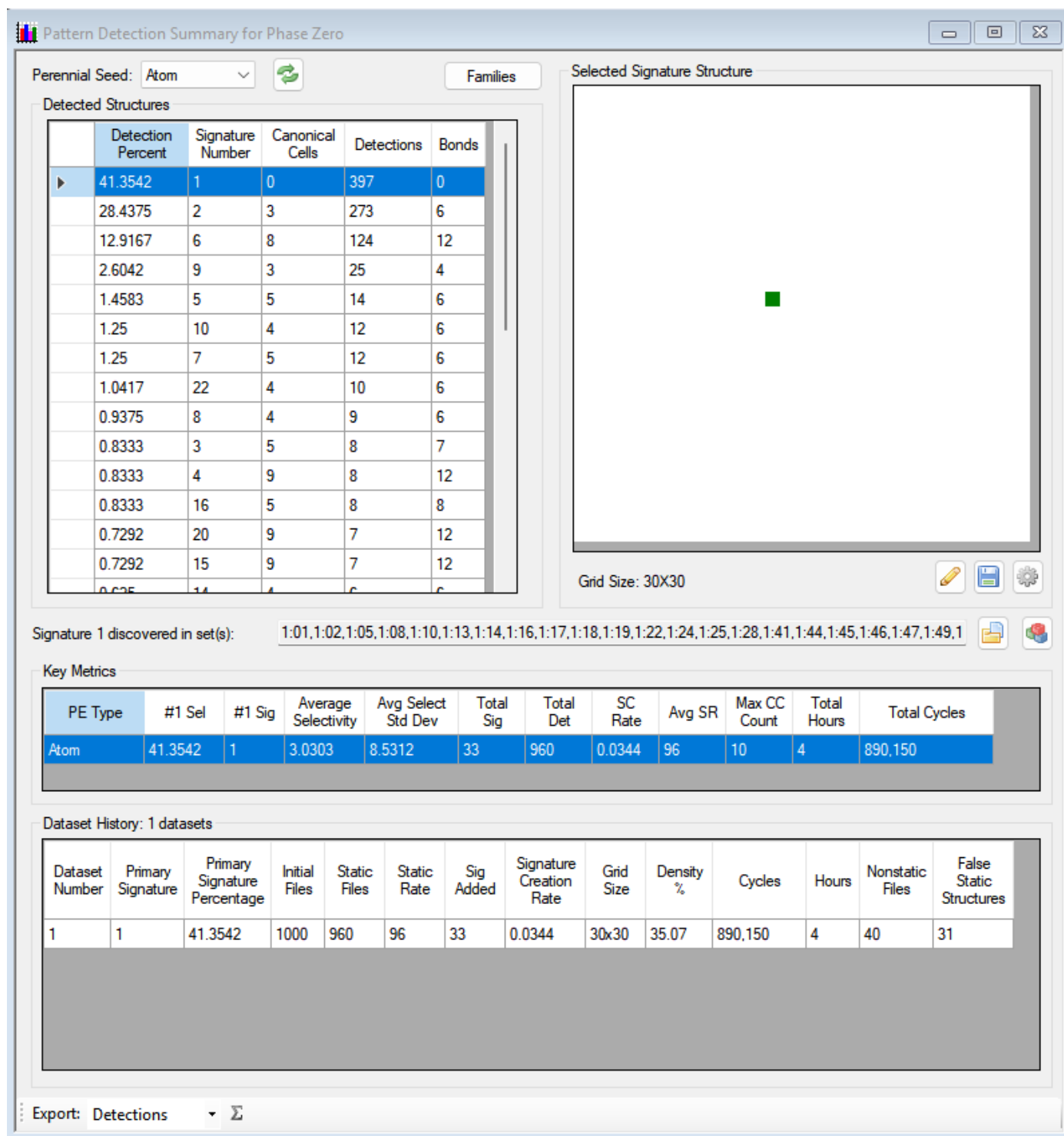The "Excel Figures" spreadsheet contains all the results from the full data version of the paper for Figures 3, 7, 9, 13, 15, 16, 18, 20, 22, 23, and 25.

To see the sample data results of Phase Zero evolution where the single perennial atom creates the primordial molecules select the 'Examine' menu item shown below.

This will bring up the 'Pattern Detection Summary for Phase Zero' shown on the next page.
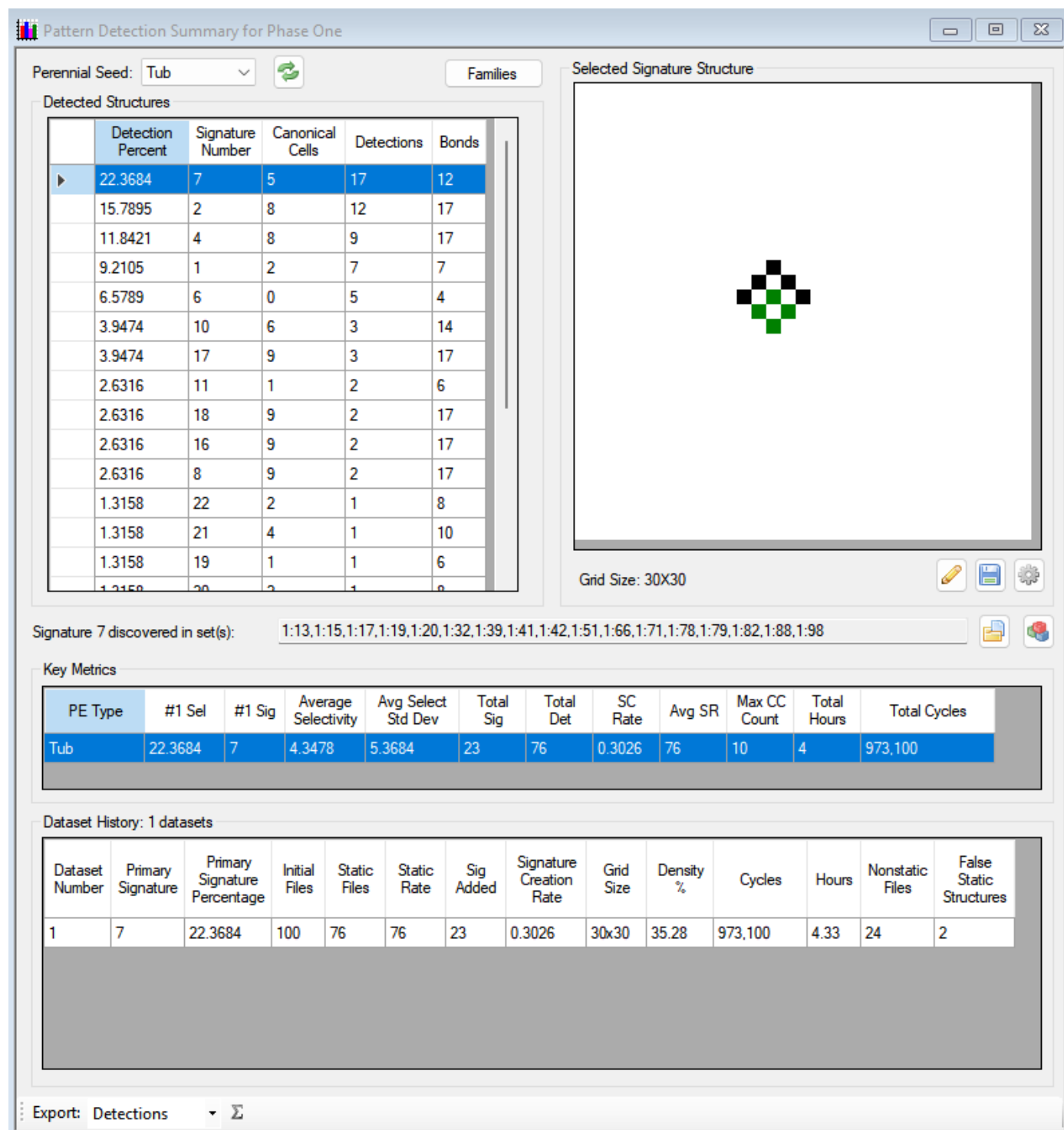
Phase Zero Results

Pattern Detection Summary for Phase Zero

Perennial Seed: Atom

Families

Selected Signature Structure

Detected Structures

	Detection Percent	Signature Number	Canonical Cells	Detections	Bonds
▶	41.3542	1	0	397	0
	28.4375	2	3	273	6
	12.9167	6	8	124	12
	2.6042	9	3	25	4
	1.4583	5	5	14	6
	1.25	10	4	12	6
	1.25	7	5	12	6
	1.0417	22	4	10	6
	0.9375	8	4	9	6
	0.8333	3	5	8	7
	0.8333	4	9	8	12
	0.8333	16	5	8	8
	0.7292	20	9	7	12
	0.7292	15	9	7	12
	0.625	14	4	6	6

Grid Size: 30X30

Signature 1 discovered in set(s): 1:01,1:02,1:05,1:08,1:10,1:13,1:14,1:16,1:17,1:18,1:19,1:22,1:24,1:25,1:28,1:41,1:44,1:45,1:46,1:47,1:49,1

Key Metrics

PE Type	#1 Sel	#1 Sig	Average Selectivity	Avg Select Std Dev	Total Sig	Total Det	SC Rate	Avg SR	Max CC Count	Total Hours	Total Cycles
Atom	41.3542	1	3.0303	8.5312	33	960	0.0344	96	10	4	890,150

Dataset History: 1 datasets

Dataset Number	Primary Signature	Primary Signature Percentage	Initial Files	Static Files	Static Rate	Sig Added	Signature Creation Rate	Grid Size	Density %	Cycles	Hours	Nonstatic Files	False Static Structures
1	1	41.3542	1000	960	96	33	0.0344	30x30	35.07	890,150	4	40	31

Export: Detections   Σ

You can compare this limited data with that in the paper and see that even a few initial configurations begin to demonstrate selective bias.

Close this window, and set the 'Phase' to Phase One with the icon on the lower right of the bottom tool bar and this will bring up a new view.
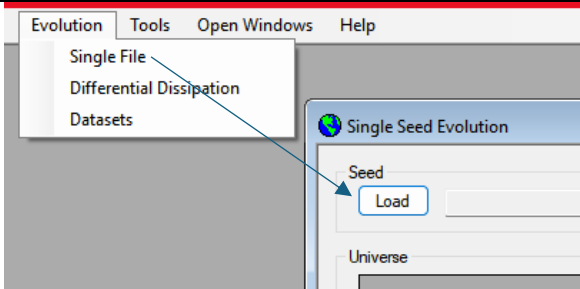
Phase One Results

Pattern Detection Summary for Phase One

Perennial Seed: Tub

Selected Signature Structure

Detected Structures

	Detection Percent	Signature Number	Canonical Cells	Detections	Bonds
▶	22.3684	7	5	17	12
	15.7895	2	8	12	17
	11.8421	4	8	9	17
	9.2105	1	2	7	7
	6.5789	6	0	5	4
	3.9474	10	6	3	14
	3.9474	17	9	3	17
	2.6316	11	1	2	6
	2.6316	18	9	2	17
	2.6316	16	9	2	17
	2.6316	8	9	2	17
	1.3158	22	2	1	8
	1.3158	21	4	1	10
	1.3158	19	1	1	6
	1.3158	20	2	1	0

Grid Size: 30X30

Signature 7 discovered in set(s):   1:13,1:15,1:17,1:19,1:20,1:32,1:39,1:41,1:42,1:51,1:66,1:71,1:78,1:79,1:82,1:88,1:98

Key Metrics

PE Type	#1 Sel	#1 Sig	Average Selectivity	Avg Select Std Dev	Total Sig	Total Det	SC Rate	Avg SR	Max CC Count	Total Hours	Total Cycles
Tub	22.3684	7	4.3478	5.3684	23	76	0.3026	76	10	4	973,100

Dataset History: 1 datasets

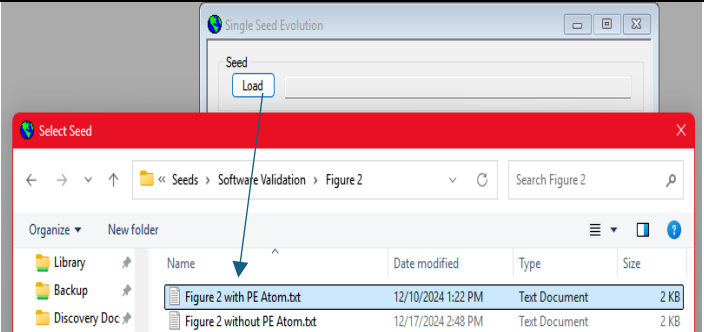| Dataset Number	Primary Signature	Primary Signature Percentage	Initial Files	Static Files	Static Rate	Sig Added	Signature Creation Rate	Grid Size	Density %	Cycles	Hours	Nonstatic Files	False Static Structures
1	7	22.3684	100	76	76	23	0.3026	30x30	35.28	973,100	4.33	24	2

Export: Detections   ▾ Σ

Here you'll see even with limited data that the Tub reproduces several of the cornerstone molecules shown on the paper.
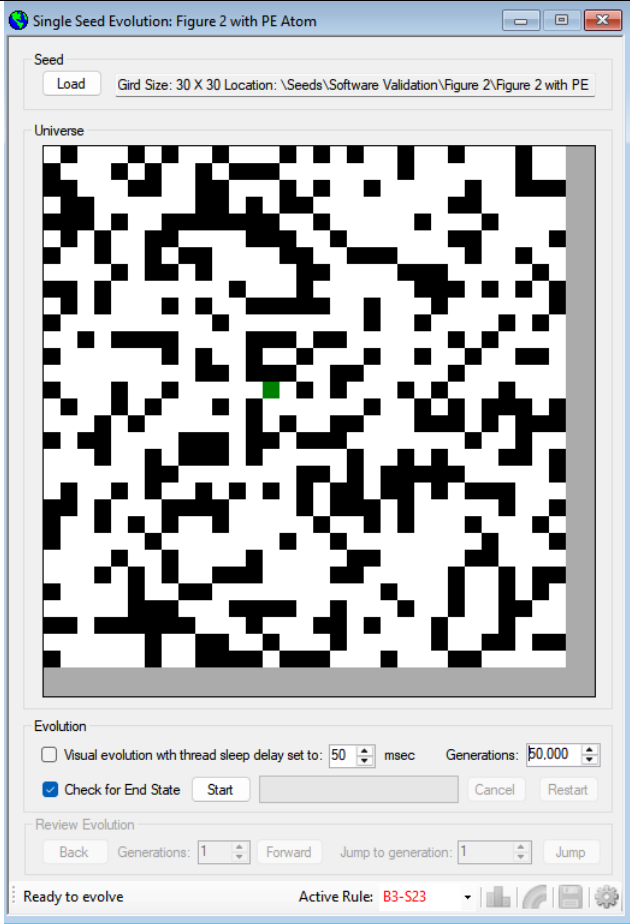
Phase Two, which may be an area for future research, close this window and change the 'Phase' setting.

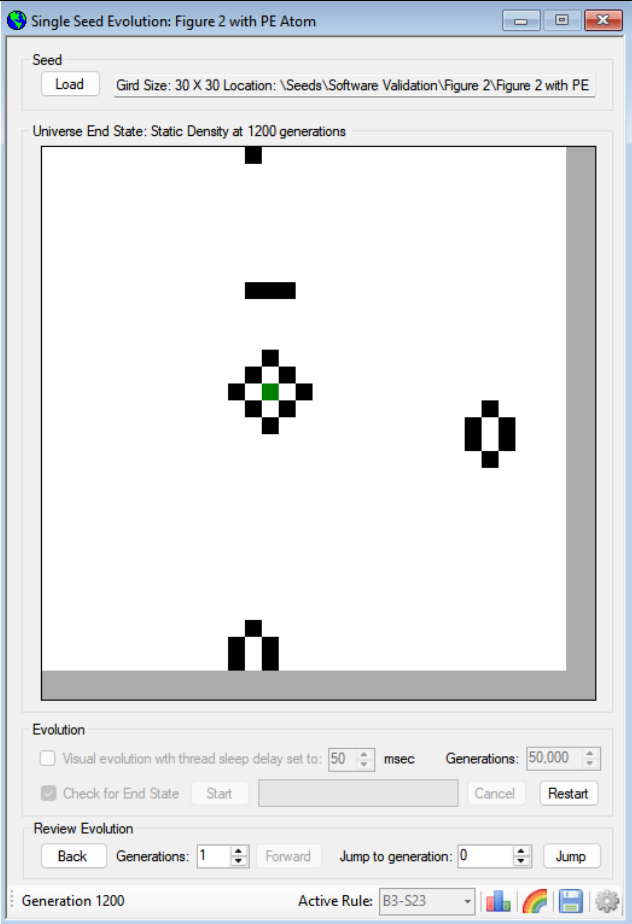**Running an Evolution Example: Figure 2 from the paper.**

Click 'Start'	Results after Evolution

To see the actual generation when the Diamond occurred, set the 'Jump to generation' numerical control to 1,031 and press 'Jump'. You'll see the display configured for 1 generation prior to the Diamond forming. Press 'Forward' and the Diamond will appear in generation 1,032.