

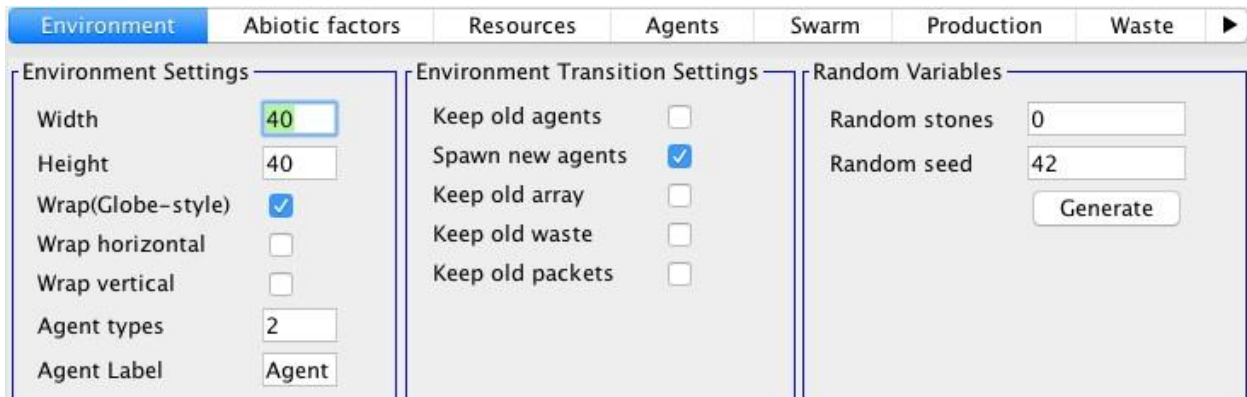
Instructions for using SARS-CoV-2 variants model

For the experimental scenario...

Start with default COBWEB settings

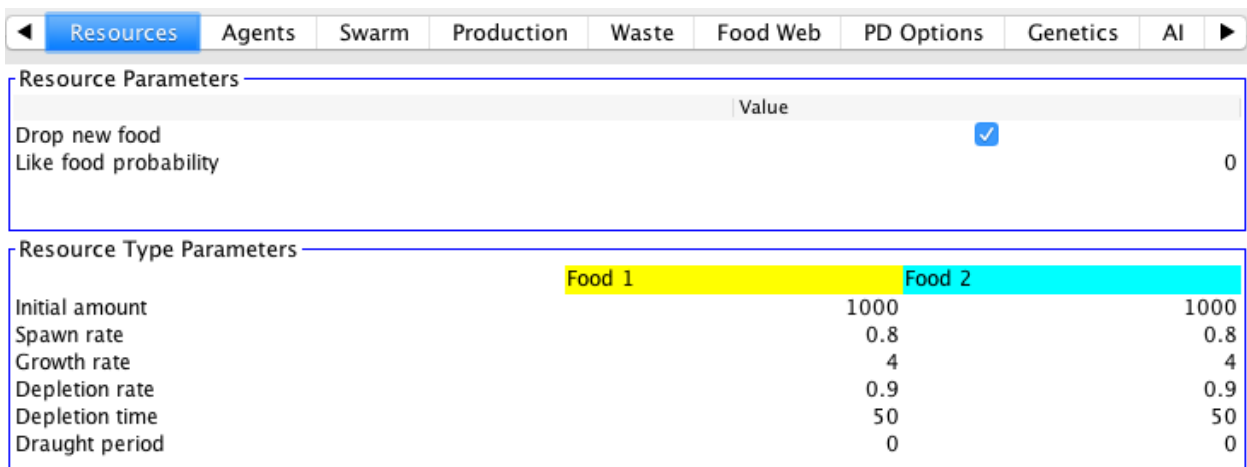
Environment tab:

1. Create a 40 by 40 grid
2. Generate 2 agent types
3. Generate 0 random stones



Resources tab:

1. Set initial amount of each food to 1000
2. Set spawn rate to 0.8
3. Set depletion time to 50



	Food 1	Food 2
Initial amount	1000	1000
Spawn rate	0.8	0.8
Growth rate	4	4
Depletion rate	0.9	0.9
Depletion time	50	50
Draught period	0	0

Agents tab:

1. Set initial count of agent 1 to 100, agent 2 to 20
2. Set favourite food energy to 200 for both agents
3. Set breed energy of agent 1 to 0, agent 2 to 60

4. Set mutation rate of agent 1 to 0, agent 2 to 0.05
5. Set sexual breed chance for both agents to 0
6. Set asexual breed chance for agent 1 to 0, agent 2 to 0.3
7. Set sexual pregnancy period for agent 1 to 0, agent 2 to 5

Agents			
Swarm			
Production			
Waste			
Food Web			
PD Options			
Genetics			
AI			
Learning			
Agent Parameters			
	Agent 1	Agent 2	
Initial count	100	20	
Favourite food energy	200	200	
Other food energy	25	25	
Agent eating efficiency	1	1	
Breed energy	0	60	
Asexual pregnancy period	0	0	
Initial energy	500	500	
Step energy	1	1	
Rock bump energy	2	2	
Agent bump energy	2	2	
Turn right energy	1	1	
Turn left energy	1	1	
Mutation rate	0	0.05	
Communication minimum similarity	0	0	
Sexual breed chance	0	0	
Asexual breed chance	0	0.3	
Breeding minimum similarity	0	0	
Sexual pregnancy period	0	5	
Aging	<input type="checkbox"/>	<input type="checkbox"/>	
Age limit	300	300	
Aging rate	10	10	
PD memory size	10	10	
Broadcast	<input type="checkbox"/>	<input type="checkbox"/>	
Broadcast energy-based	<input type="checkbox"/>	<input type="checkbox"/>	
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Genetics tab:

1. Select breed energy as a phenotype
2. Set mode of meiosis to colour averaging

Genetic Algorithm Parameters

Agent Parameter Selection

- [Null]
- Favourite food energy
- Other food energy
- Agent eating efficiency
- Asexual pregnancy period
- Initial energy
- Step energy
- Rock bump energy
- Agent bump energy
- Turn right energy
- Turn left energy
- Mutation rate
- Communication minimum similarity
- Sexual breed chance
- Asexual breed chance
- Breeding minimum similarity
- Sexual pregnancy period
- Age limit
- Aging rate
- Broadcast fixed range
- Broadcast minimum energy
- Broadcast cost

Selected Phenotypes

Phenotype	Agent 1	Agent 2
Breed energy	00011110	00011110

Add ^ Remove <

Tracking

Mode of Meiosis

Colour Averaging

AI tab:

1. Set AI random seed for agent 1 to 42
2. Generate a new AI random seed for agent 2 every trial using “new seed” on the right side

Waste Food Web PD Options Genetics **AI** Learning Disease Fusion Toxin

GeneticController

Agent Parameters

	Agent 1	Agent 2
AI Random Seed	42	27309
Mutation Rate	0.05	0.05
Memory bits	2	2
Communication bits	2	2
Production Value bits	0	0
Swarm 1 Benefit bits	0	0
Swarm 2 Benefit bits	0	0

New Seed New Seed

Save Matrix Save Matrix

Disease tab:

1. Set initially infected fraction of agent 1 to 0.02, agent 2 to 0

2. Set contact transmission rate for both agents to 1
3. Set parameter for agent 1 to step energy with a factor of 5
4. Tick the boxes so agent 1 can only transmit to 2, agent 2 can only transmit to 1

Disease Parameters				
	Agent 1	Agent 2		
Initially infected fraction		0.02		0
Contact transmission rate		1		1
Child transmission rate		0.9		0.9
Parameter	Step energy	[Null]		
Factor		5		0
Vaccinator	<input type="checkbox"/>		<input type="checkbox"/>	
Vaccine Effectiveness		1		1
Healer	<input type="checkbox"/>		<input type="checkbox"/>	
Healing Effectiveness		1		1
Recovery time		0		0
Transmit to 1	<input type="checkbox"/>		<input checked="" type="checkbox"/>	
Transmit to 2	<input checked="" type="checkbox"/>		<input type="checkbox"/>	

For the control scenario...

Keep the same settings as the experimental scenario except for the following:

1. Set mutation rate of agent 2 to 0 in the agents tab
2. Remove breed energy from selected phenotypes in the genetics tab

Running the model:

For the experimental scenario:

File → Modify Simulation → AI tab → click “New Seed” below agent 2 to generate a new AI seed

Record the AI seed number

For the control scenario...

Use the same AI seed number as the corresponding experimental trial

1. Click File → Log
2. Run for 30 000 ticks
3. In the saved Excel log file, look at column C “Agent Count 1”. The first instance Agent Count 1 is 0, record the corresponding tick as the “tick for human population to become extinct”
4. Repeat for a total of 20 trials for each scenario