FreezeM

Using artificial selection tools to increase neonates' survival rate in Black Soldier Fly (*Hermetia illucens*) after suspension

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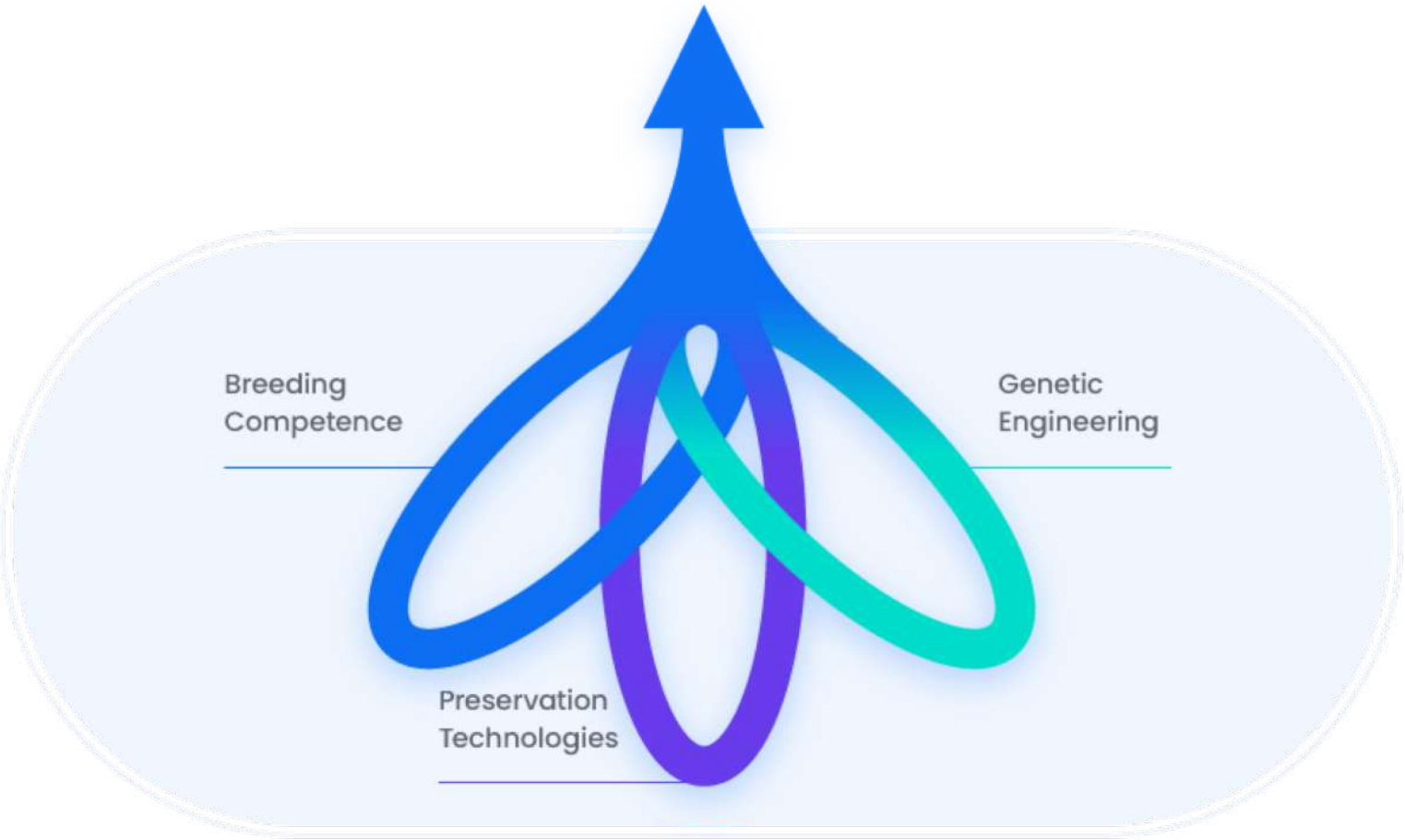
Breeding as a Service (BaaS)

FreezeM- Advancing BSF reproduction and insect farming



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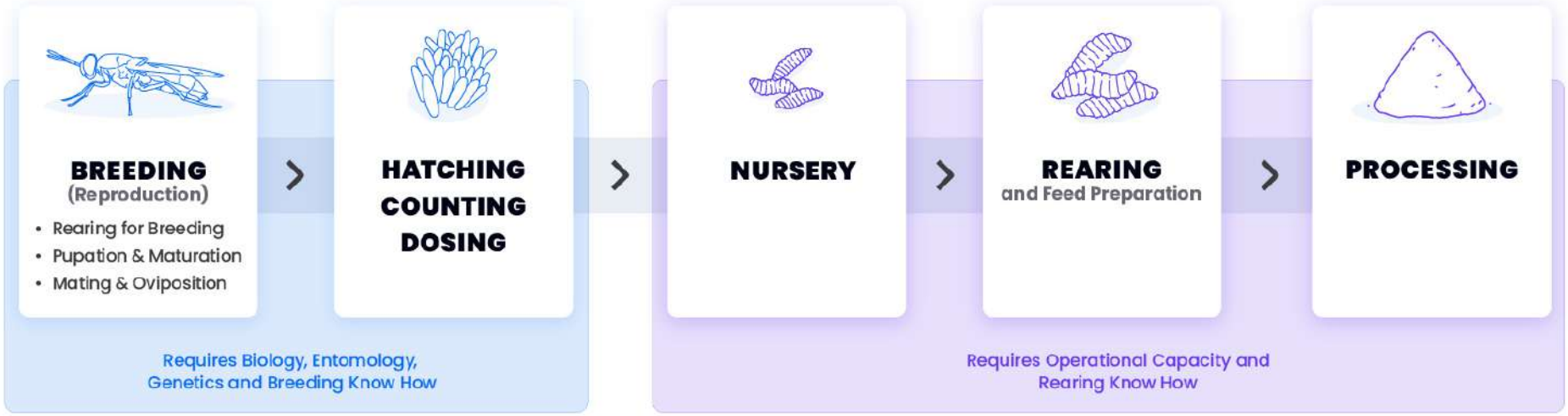
Decoupling Breeding from Rearing



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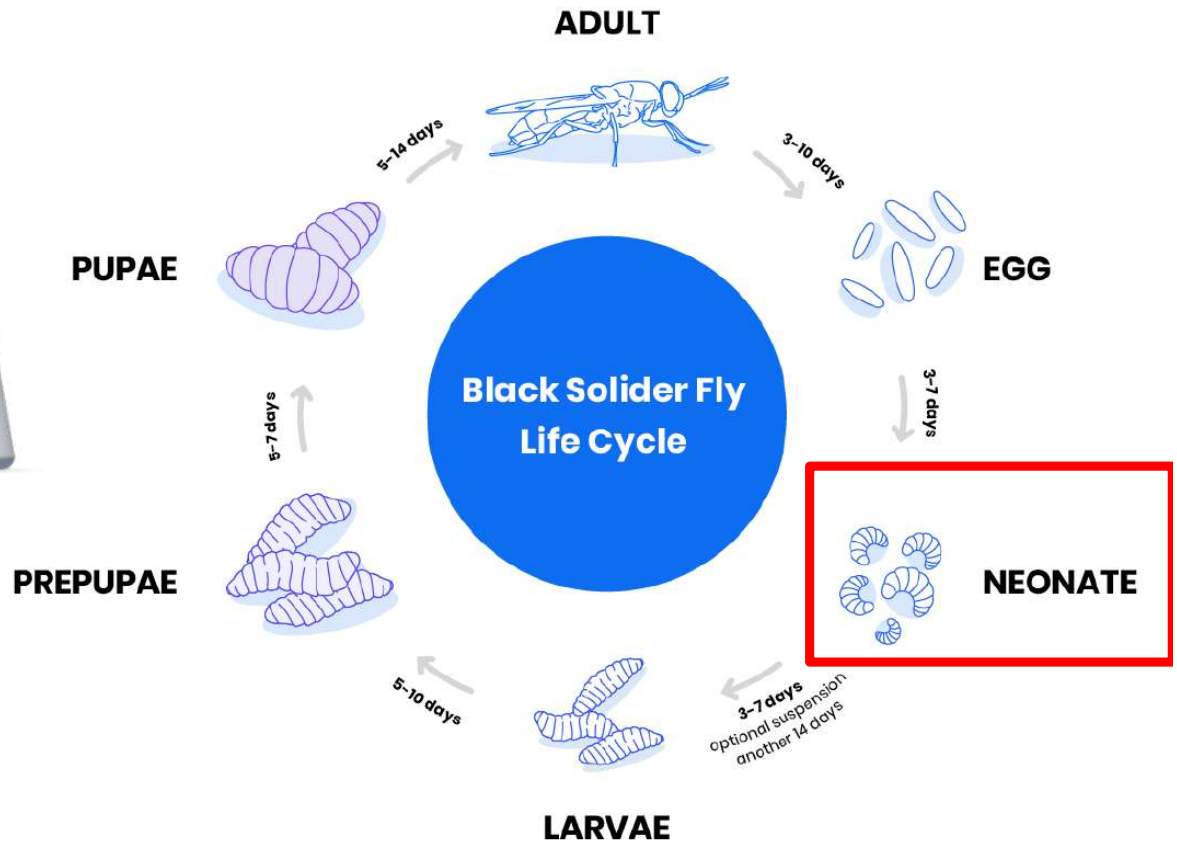
Pausing the BSF Life-Cycle

PauseM®

Pausing the neonates' life cycle usi
suspended animation.



- Accurate counting
  (max 3% error)
- 14 days shelf life (20°c 70% RH)
  90% srurvival rate

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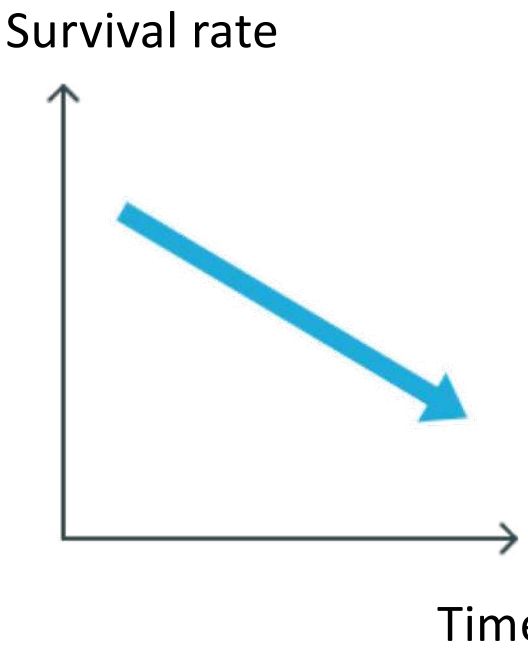
Can suspended animation be used as selection pressure in a breeding artificial selection program?

Could this artificial selection extend the shelf life and maintain the survival rate?



Key assumptions:

- Survival rate decrease over time in suspension
- Surviving neonates are more adapted to suspension
- Surviving in suspension is affected by the genetics of the individual and transferred to the next generation

<u>Desire trait:</u> Higher tolerance for suspension

21 days in suspension & 90% survival rate

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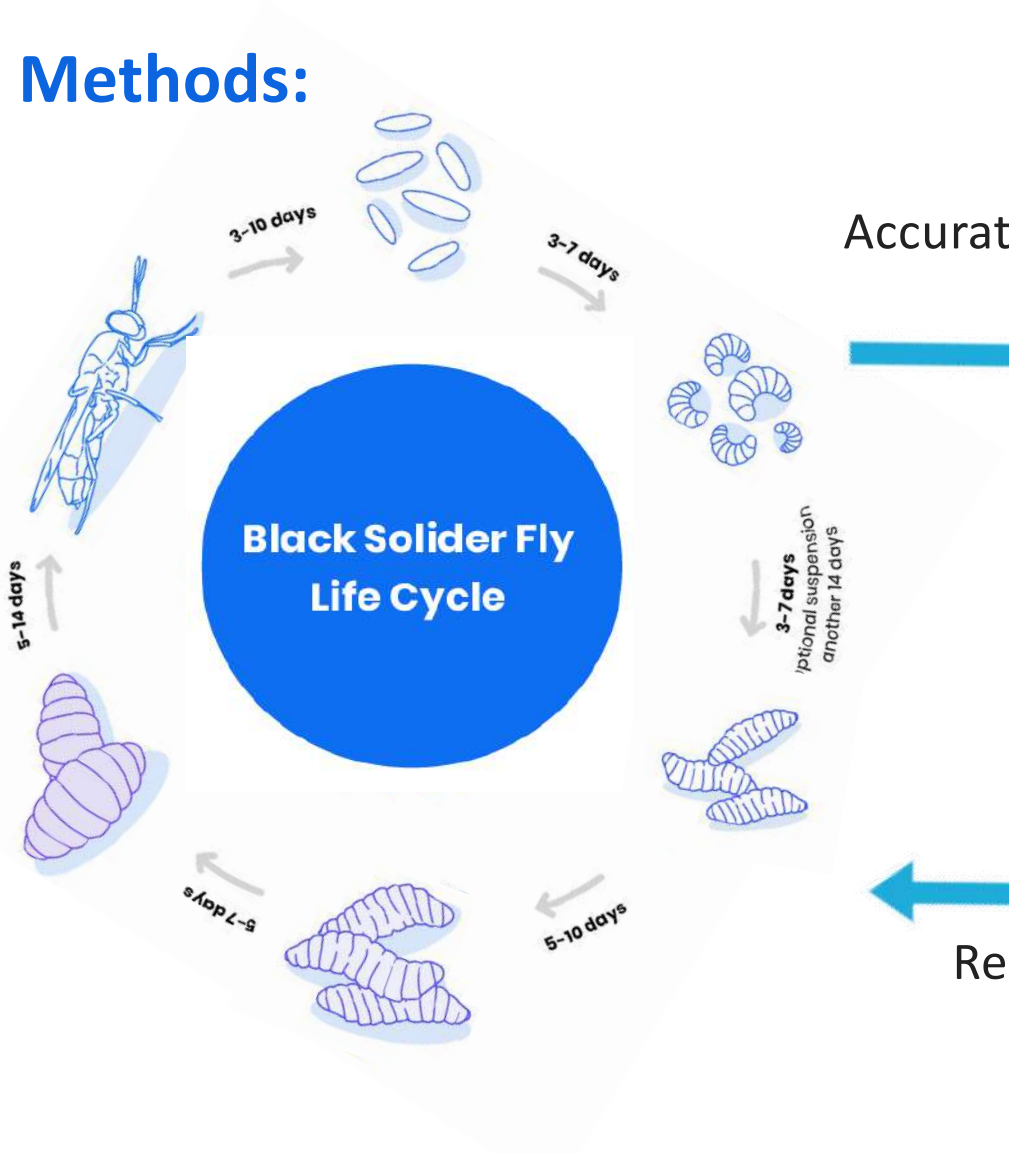
Methods:



Accurate counting – 50K

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Long period in suspension (d=?)
(20°c 70% RH)

Rearing

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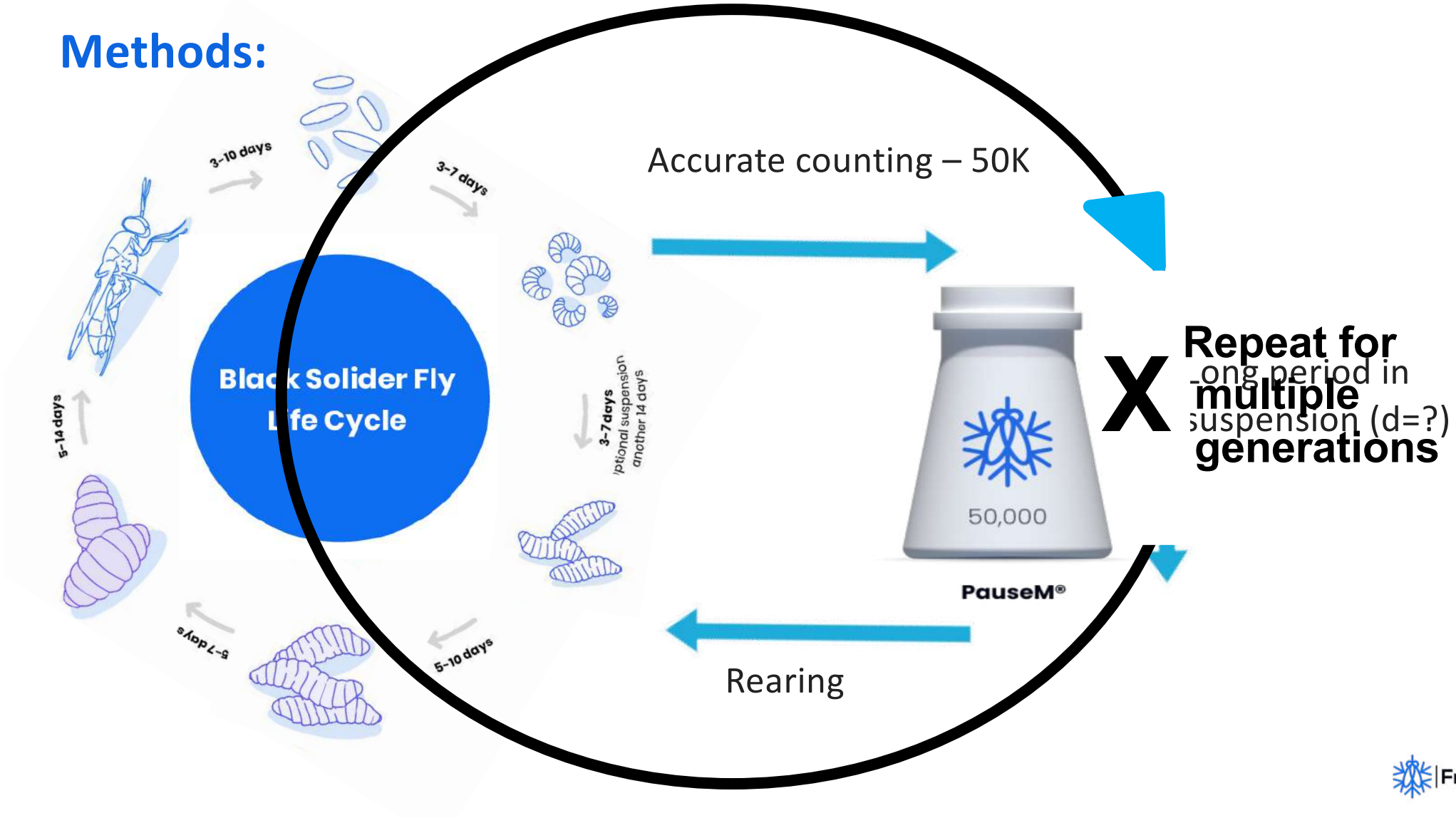
Methods:



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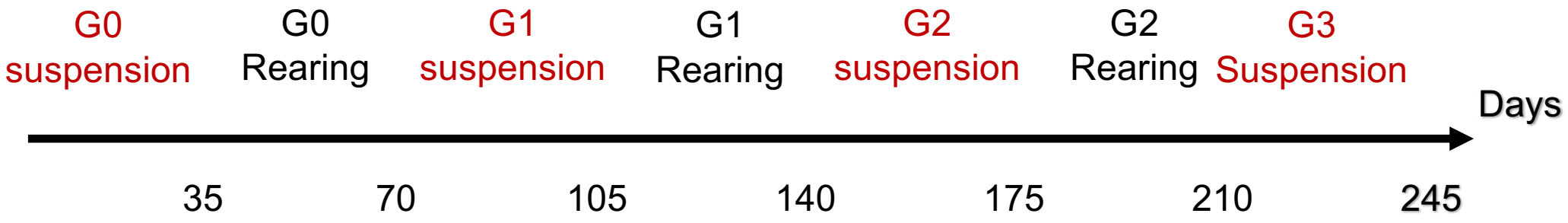
Methods: Rearing for multiple generations – Theoretical Timeline

Suspension time 35 days
Rearing time 35 days
Total time per generation: 70 days



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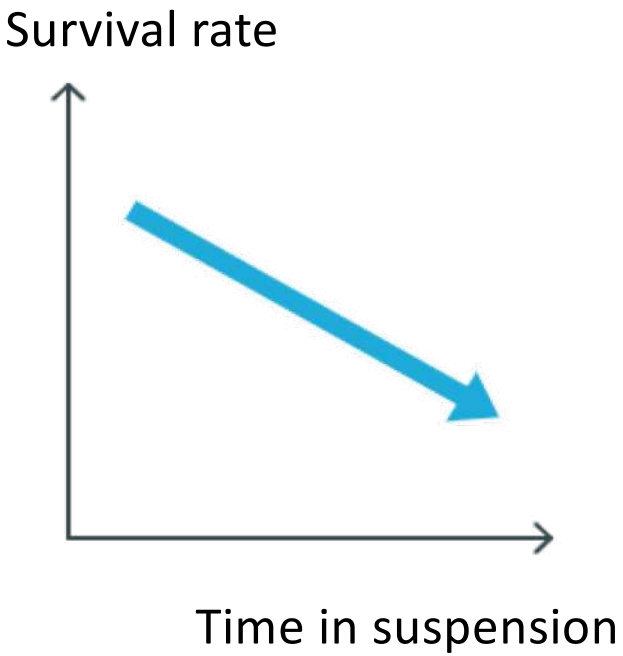
Methods: Rearing the surviving neonates
Avoiding inbreeding



Selection pressure goals:
Surviving rate = ~10%
~5000 surviving individuals
for further rearing

The frequency of the trait
will increase within the population
without causing inbreeding dpression

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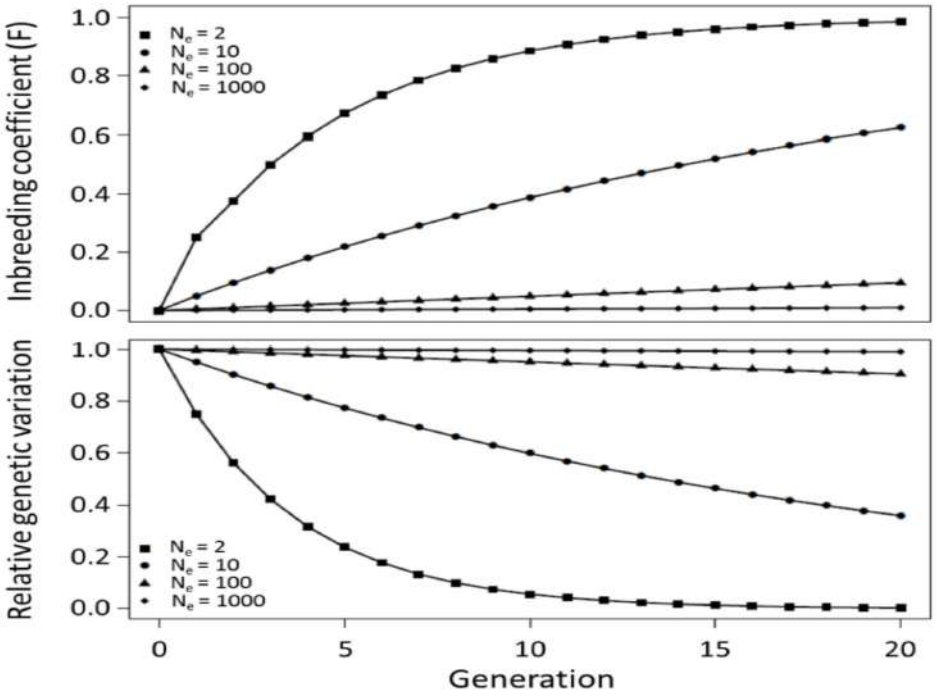
Methods: Rearing the surviving neonates

Avoiding inbreeding

numbers are debated in the literature, but current estimates suggest that N_e of a few hundred are needed to avoid negative impacts of inbreeding and at least one thousand to maintain enough genetic variation to allow for evolutionary adaptation (Jamieson and Allendorf 2012, Frankham



Jensen, Kim, et al. "Breeding and maintaining high-quality insects." *Insects as food and feed: from production to consumption. Wageningen Academic Publishers, Wageningen, the Netherlands* (2017): 175-198.

Estimated Ne after selection:
~5000 indviduals

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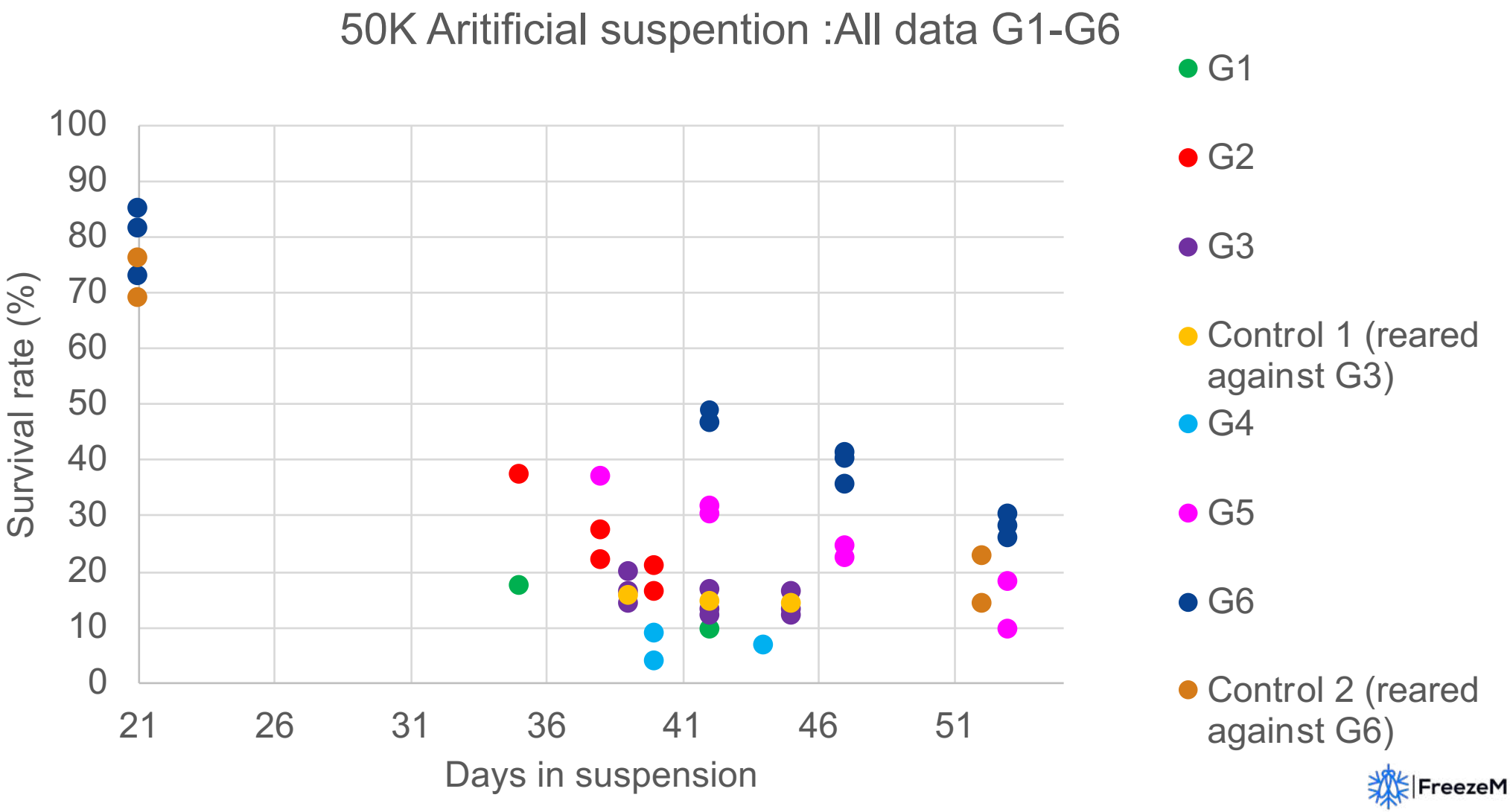
50K Aritificial suspention :All data G1-G6
Survival rate (%)
100
90
80
70
60
50
40
30
20
10
0
21
26
31
36
41
46
51
Days in suspension
G1
G2
G3
Control 1 (reared against G3)
G4
G5
G6
Control 2 (reared against G6)
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Discussion:

- **Tolerance for Suspended animation can be enhanced by artificial selection**
- **The effect of the artificial selection was shown only after the survival rate went below survival rate 10% (G4)**
- **Because every generation enhance its tolerance to suspension, there is a need to increase the selective pressure, hence, to extended the neonates time in suspension**

Further plans:

- **SNP analysis to assess how the selection affected the genetic diversity**

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THANK YOU

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