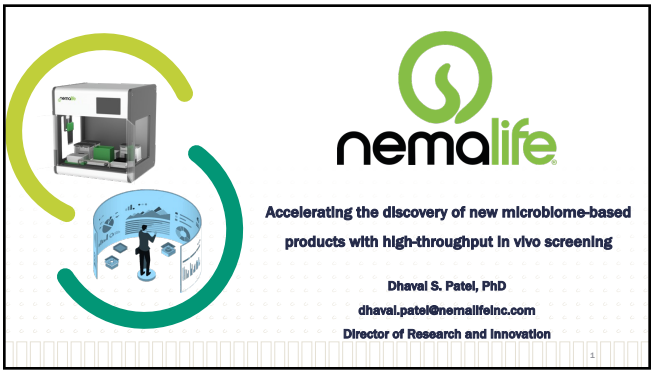

nemalife

Accelerating the discovery of new microbiome-based products with high-throughput in vivo screening

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Director of Research and Innovation

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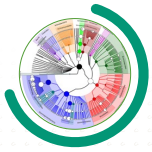
CHALLENGES IN IDENTIFYING NEW PROBIOTICS

Competitive edge comes from discovery and validation of beneficial strains

Deep sequencing is rapidly identifying novel bacteria in microbiome



Functional characterization of these new microbes is becoming a bottleneck

Functional characterization relies on slow and costly use of gnotobiotic mice

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CHALLENGES IN DEVELOPING PROBIOTIC CONSORTIA

Combining strains into a consortia based on targeted functional benefits

Supplement Facts

Serving Size 1 Veggie Capsule
Servings Per Container 30

Amount Per Serving	% DV
Probiotic Blend 220 mg	†
Total Probiotic Activity 60 Billion CFU	
Lactobacillus casei	
Lactobacillus acidophilus	
Lactobacillus paracasei	
Lactobacillus salivarius	
Lactobacillus plantarum	
Bifidobacterium lactis	
Bifidobacterium bifidum	
Bifidobacterium longum	
Bifidobacterium breve	
Lactobacillus bulgaricus	

- Identifying beneficial strains is only the beginning of the product development cycle
- Next step is to group strains into consortia that have a synergistic effect on a particular health condition
- Combination testing with rodents is challenging
- If you have 20 strains and want to combine 5 into a consortia that creates 15,504 possible combinations to test
- There is a need for a platform that can enable high-throughput testing at this scale

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CHALLENGES IN CREATING SYNBIOTICS

Combining prebiotics and probiotics increases the complexity of formulation testing

Supplement Facts

Serving Size 1 Veggie Capsule
Servings Per Container 30

	Amount Per Serving	% DV
Probiotic Blend	220 mg	†
Total Probiotic Activity	60 Billion CFU	
Lactobacillus casei		
Lactobacillus acidophilus		
Lactobacillus paracasei		
Lactobacillus salivarius		
Lactobacillus plantarum		
Bifidobacterium lactis		
Bifidobacterium bifidum		
Bifidobacterium longum		
Bifidobacterium breve		
Lactobacillus bulgaricus		
Prebiotic Blend	150 mg	†
Organic Jerusalem Artichoke Root	50 mg	†
Organic Acacia Senegal	50 mg	†
Organic Chicory Root	50 mg	†

† Daily Value (DV) not established

Other Ingredients: Rice Flour, Vegetable Capsule (Hypromellose, Gellan Gum), Rice Hull Extract, Gum Arabic, and Sunflower Oil.

SUGGESTED USE:
As a dietary supplement, take one (1) veggie capsule once daily.

- Once a promising consortia is identified the next challenge is to identify the best mix of prebiotics to support these bacteria in vivo
- The chemical diversity of prebiotic compounds is vast which creates an entirely new challenge in product development
- This further underscores the need for a scalable platform that help identify the best product formulation for a given health condition as rapidly as possible

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OUR INNOVATIVE SOLUTION

Functional Ingredient trials on a chip – Combining three innovative technologies provides scale

Tractable organism

- 1 mm long, lives for 3 weeks
- 100K+ worms processed/week
- Some companies use at low-throughput

Microfluidic automation

- Miniaturized technology controls animal environment
- Scalable platform runs thousands of experiments

AI computation

- Machine vision & AI automates video analysis
- Collecting and digitizing animal data

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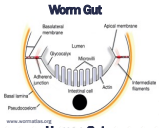
TRACTABLE ORGANISM

C. elegans – A powerful tool for human microbiome therapeutic discovery

Worm Gut



Human Gut

http://www.doctorc.net/Level_Basic/

- Transparent microscopic worm
- Short life-cycle enables scalable animal culture
- Simple gut but functionally similar to humans
- Able to host complex microbiome
- Gut microbiome has similar role as human
- Simple gnotobiotic handling compared to rodents
- Many human-relevant assay readouts

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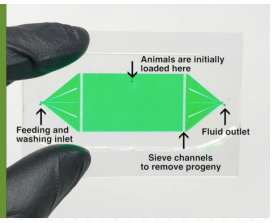
MICROFLUIDICS + AI COMPUTATION

NemaLife can obtain quantitative phenotypic data at scale

- NemaLife's platforms collect images and videos at scale
- Our cloud-based annotation and analysis pipeline uses AI to process this data
- Automated analyses allows extraction of even subtle phenotypes
- This pipeline is elastic and built to scale as assay volume grows

Our proprietary microfluidic chip is transforming in vivo screening



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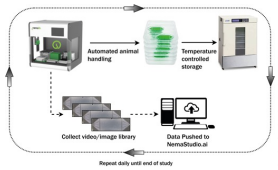
NEMALIFE WORKFLOW

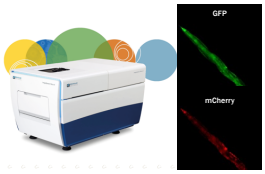
AI-assisted microfluidic automation enables industrial-scale screening

Whole-Life Behavior Platform



1000 healthspan conditions in 100 days

Fluorescent Imaging Platform



3000 animals per day per biomarker

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AN INDUSTRY EXAMPLE

Translatability from worm to human

ADM Biopolis' Weight-Management Probiotic BPL1 Product Development Roadmap

C. elegans	Rodent	Humans
2016	2018	2019
C. elegans screen of 36 novel isolates for fat loss identifies BPL1	Confirm BPL1 weight-loss effects in rats fed obesogenic diet	Clinical trial confirms BPL1 tackles obesity

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AN INDUSTRY EXAMPLE

Translatability from worm to human

Amazentis – A nutritional supplement company
MitoPure/Urolithin A Product Development Roadmap

C. elegans | Rodent | Humans

2016

Amazentis-sponsored academic studies show that urolithin A improves muscle function with age

2022

Clinical trial confirms MitoPure/Urolithin A improves muscle function in elderly

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ASSAY READOUTS

NemaLife can rapidly screen for a variety of functional benefits + MoA

FUNCTIONAL BENEFITS

ANTI-OBESITY

STRESS RESISTANCE

COGNITIVE HEALTH

GUT HEALTH

MUSCLE HEALTH

HEALTHY AGING

MoA

BIOMARKERS

TRANSCRIPTOMICS

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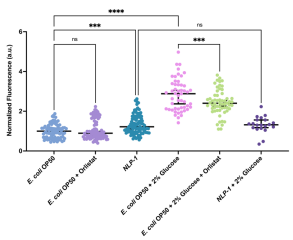
ANTI-OBESITY STUDIES

Identifying probiotics that target obesity

Screening for probiotics that fight obesity

- Feed worms an obesogenic diet
- Then identify bacteria that prevent fat accumulation
- Readout uses fluorescent Nile Red staining to quantify fat levels



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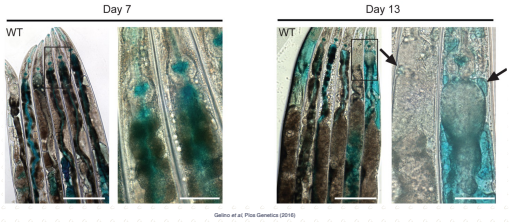
GUT BARRIER INTEGRITY

C. elegans develops leaky gut with age or dysbiosis



Galino et al, Plos Genetics (2016)

In healthy animals, a non-absorbable dye stays in gut lumen. However, aging or dysbiosis cause dye to leak into peripheral tissue

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STRESS STUDIES

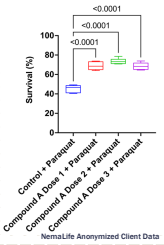
Paraquat-induced oxidative stress to test antioxidant properties of a pre-/probiotics

We can screen for pre-/probiotics that increase stress resistance in *C. elegans*

We can test for antioxidant properties of test material in vivo

Animals were fed client's Compound A, a prebiotic, along with standard bacterial diet

Animals fed Compound A have increased survival at 12-hours post-Paraquat addition compared to untreated control



NematoLife Anonymized Client Data

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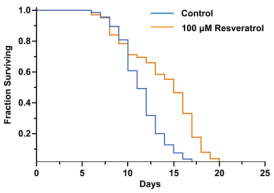
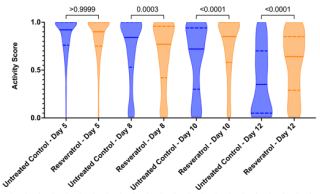
HEALTHY AGING

Pro-longevity phytochemicals improve healthspan and lifespan





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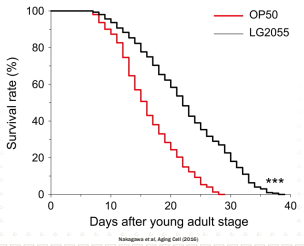
HEALTHY AGING

Probiotics can improve healthspan and lifespan



Nakagawa et al, Aging Cell (2016)

Screening for probiotics that promote healthy aging

- We can measure the healthspan and lifespan of worms treated with different probiotics
- We can screen a 1000 isolates in 100 days for whole-life health benefits

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DE-RISKING PROBIOTIC DEVELOPMENT

Evaluating functional benefits along the value chain increases confidence

- NemaLife can evaluate effectiveness of product at every step of the value chain
- The platform enables discovery of new probiotics, formulation of probiotic consortia and synbiotics
- Our testing allows clients to know that their product is not altered or adulterated during scale-up
- We can also provide a rapid way of checking batch/lot variability

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Integrate multiple engineering solutions to achieve scale

NemaLife is a TechBio Company

Tractable and scalable in vivo biology

Founded in 2018, A spin-off from Texas Tech University

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A PASSIONATE CREW

An interdisciplinary team of engineers, biologists and physicists

35+ years of microfluidics and engineering expertise, 40+ years of worm biology expertise

50+ years of R&D project management experience

8 PhDs
15 full-time employees

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FLEXIBLE MODES OF ENGAGEMENT

NemaLife caters to a wide range of customer needs offering value, innovation, and competitive edge

Research Data as a Service

Preferred Partnership

Strategic R&D Partner

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marton.toth@nemalifeinc.com

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NemaLife is a TechBio Company

- Deep Knowledge Experts
- Deep Phenotyping & Discovery
- Deep Value & Commitment

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