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Health expectancy series

Part 2: Redefine aging with nutrition

Harness cutting-edge nutritional research to fuel the future of health supplements

Many of us will spend the last 10 years of life struggling with chronic illness and poor health.[1,2] Yet rather than accepting this, we should ask: **“How can I make my senior years some of my best?”**

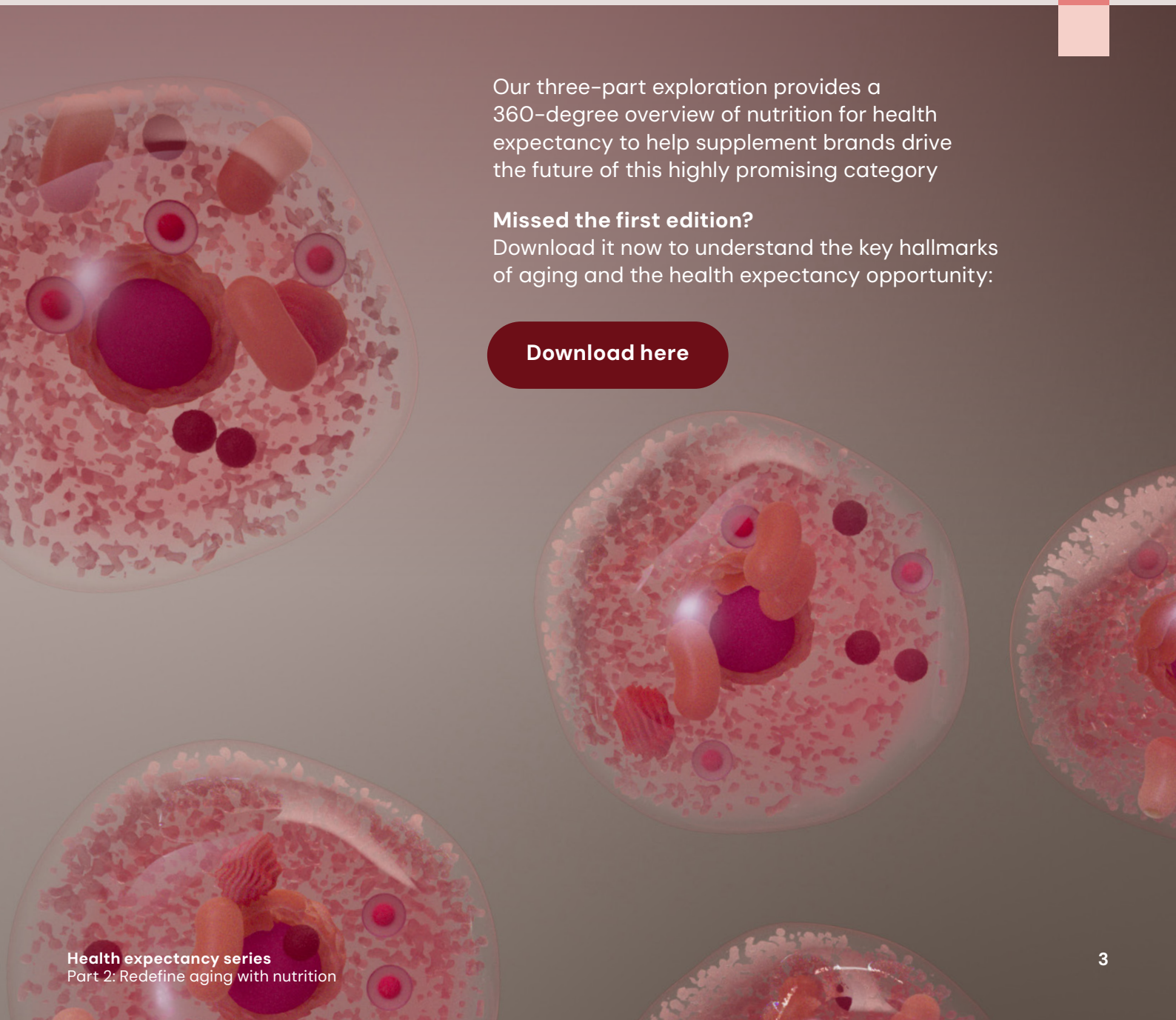
Science shows that harnessing the power of nutrients can promote health expectancy—the years we live in good health—to enjoy a more vibrant and fulfilling life, even as we age; inspiring a new generation of dietary supplement solutions.[3,4] But which ingredients hold the greatest promise?

In this second installment of our three-part series, we explore aging theories, and how supplement brands can target the processes behind aging and disease to guide innovation in the untapped health expectancy space.

What's inside?

In this chapter, we reveal the most up-to-date aging theories and nutritional science, highlighting:

- The role of nutrients—
  the foundation of lifelong wellness
- The triage and hormesis theories—
  what they are and why they matter
- Scientific insights to nourish
  health expectancy



Our three-part exploration provides a 360-degree overview of nutrition for health expectancy to help supplement brands drive the future of this highly promising category

Missed the first edition?
Download it now to understand the key hallmarks of aging and the health expectancy opportunity:

Download here

Nutrients—the foundation of lifelong wellness

Nutrients support every aspect of health, from cellular repair and immune function to reducing the risk of chronic diseases. But can nutrients also impact how long—and how well—we live?

Interesting evidence from 'blue zones' suggests so.[5,6] These are regions where people live significantly longer, healthier lives than the global averages. One of the most important contributors to this is diet, particularly diets rich in vegetables, fruit, legumes and lean meats, like the Mediterranean diet.

That said, achieving optimal nutrient intake is not easy for many populations. Modern Western-style diets tend to be more energy-dense and nutrient-poor, leading to a situation where people are overfed but undernourished. This predisposes societies to chronic non-communicable diseases (NCDs), like cardiovascular disease, neurodegenerative diseases, cancer, and diabetes.

Furthermore, meeting optimal nutrient requirements becomes even more difficult in senior years due to reduced appetite, medical conditions, changes in metabolism, and cognitive decline, among other factors.

"The paradox of aging is that, as we enter our senior years, our need for nutrients increases because our natural defenses weaken. But our ability to achieve optimal nutrient status decreases for various physiological and psychological reasons. On top of that, medications, which many seniors rely on, further hinder nutrient absorption, creating a deficit of essential nutrients. Dietary supplements have the power to change this."

Szabi Péter
Senior Director Medical & Regional Science,
dsm-firmenich

Heard of the triage theory?

The triage theory, proposed by Ames in 2006,[7] explains how nutrient deficiencies impact health by prioritizing short-term survival over long-term wellbeing.

The concept suggests that during periods of micronutrient scarcity—common in modern diets—the body directs nutrients to critical functions, like energy production and reproduction. This is at the expense of processes that support health expectancy, like DNA repair. Over time, this prioritization can lead to cumulative damage and increased risk of age-related disease, like cancer, cardiovascular disease, and neurodegenerative conditions.

The theory predicts that adequate intake of around 40 essential micronutrients throughout life can help mitigate the negative long-term effects of nutrient deficiencies—supporting long-term health. This highlights the importance of addressing nutrient gaps proactively, rather than reactively.

Scientific insights to nourish health expectancy

Nutritional supplements could be a powerful tool for reducing years lost to ill health. However, to confidently innovate in this field and help increase overall health expectancy, manufacturers must first understand which cellular and system processes to target to combat the hallmarks of aging.

Here, we reveal five key processes closely tied to aging and which nutrients can support their functions.

1 Cell function, repair and maintenance

Cell health is essential for healthier aging because cells are the building blocks of tissues and organs. However, as we age, cellular processes—such as repair, regeneration, and communication—decline. Maintaining healthy cells can therefore support health expectancy. Nutrients can assist here by...

Reducing senescent cell load

Cellular senescence is a process whereby cells lose their ability to function properly, like dividing, but don't die. These cells build up, releasing harmful molecules that lead to inflammation and contribute to the ageing process. It is possible to promote health expectancy by targeting senescent cells with nutrients and bioactive ingredients in three ways:

(1) Mitigating the production of pro-inflammatory molecules with senomorphic molecules, like **resveratrol and vitamin E**[8]

(2) Boosting immune function with nutrients like **vitamins C, D, zinc, and selenium** to aid in the elimination of senescent cells[9]

(3) Selective elimination of senescent cells using senolytic compounds, like **fisetin and quercetin**[10].

Senolytics target specific survival pathways in senescent cells, inducing their programmed cell death (apoptosis) without harming healthy cells.[11] The potential of senolytics in slowing the progression of age-related conditions is currently being tested in human trials.

Supporting cellular repair and protection

Without efficient cellular repair, cells accumulate damage that can lead to cell dysfunction and death. On the other hand, cells with effective repair systems are better equipped to withstand stress and maintain function over time. Nutrients like **resveratrol and B group vitamins** activate mechanisms that can promote cellular repair.[12,13,14] In addition, antioxidant nutrients, such as **selenium, zinc, vitamin C, vitamin K, and vitamin E,** may help to limit the formation of cellular damage, promoting health expectancy.[15]

Enhancing mitochondrial function

Mitochondria play a central role in energy production and cellular metabolism. However, mitochondrial function declines with age. Many nutrients and other bioactive compounds can help to maintain mitochondrial function and energy production with age, including **B group vitamins, vitamin C, K, and E, zinc, selenium, omega-3s, and coenzyme Q10.**[16,17]

2 Stress and inflammatory responses

To stay healthy, the body must effectively manage stress. Stressors, such as physical injuries, chemical toxins, or harmful microorganisms, are usually kept in check by protective barriers in the gut, skin, and brain. However, if these barriers are compromised in any way, this can trigger a stress response within the body.

This usually involves inflammation, which can disrupt the body's natural balance (homeostasis). If uncontrolled, inflammation can accelerate aging and increase the risk of age-related diseases. To help individuals become more resilient and live better for longer, nutritional supplementation featuring a combination of nutrients can help. Here's how:

Strengthen barriers

Several micronutrients, like **vitamins A, D, C, E, and B vitamins,** as well as **minerals, like iron and zinc,** help to maintain barrier integrity in the skin and gut.[18]

Promote immune homeostasis

The ability to maintain the body's inflammatory balance diminishes with age. However, vitamins, like the **B group vitamins,** can help because they are essential for immune system homeostasis.[19]

Anti-inflammatory compounds—like **antioxidant vitamins, polyphenols, and omega-3 fatty acids**—and minerals, like **zinc and magnesium,** also help to manage inflammation, support tissue repair, and return the body back to its homeostasis state.[20,21]

Leveraging the benefits of controlled stress

Did you know that some stress is okay?

Hormesis describes a biological phenomenon where exposure to a low or moderate dose of a stressor (such as toxins, heat, or exercise) stimulates the body's repair and defense mechanisms—ultimately strengthening cells and systems over time to become more resilient.

Plant-sourced phytochemicals, like **resveratrol and quercetin** found in the Mediterranean diet, can act in a hormesis-like manner to lower the risk of diseases (such as diabetes and cardiovascular issues), while also promoting anti-aging effects, like reducing oxidative stress and inhibiting cell senescence.[22,23]

3 Oxidative stress

The development of several diseases is strongly linked to increased production of reactive oxygen species (ROS), which can be generated by mitochondria, medications, and chemicals. ROS cause oxidative stress and inflammaging (chronic, low-grade inflammation), which significantly contribute to cellular damage (senescence) and acceleration of aging.

Antioxidants, like **vitamins C, K, and E, selenium, and carotenoids,** help to neutralize harmful ROS. This protects cells from oxidative stress, helping to maintain cellular function, and slow aging.[24] For example, lutein (a carotenoid) protects cells from cellular senescence induced by oxidative stress via upregulation of antioxidant effectors.[25]

4 A healthy gut microbiome

A balanced gut microbiome is key to health expectancy because it is strongly linked to immune function, homeostasis in the body, and nutrient absorption. However, as people age, their gut microbiota composition changes significantly, affecting health in senior years.

Emerging science suggests that targeting the gut microbiome is a promising avenue for health expectancy innovation. Several nutrients known to support the gut microbiome could be key tools for supplement development, such as **human milk oligosaccharides (HMOs),** microbiome-targeting vitamins **(e.g. vitamin B2 and vitamin C), and pre-/pro-/postbiotics**.

For example, centenarians (individuals who live exceptionally long lives) have been shown to exhibit unique gut microbiomes with anti-aging properties (involving anti-inflammatory and antioxidant processes) and higher microbial diversity, versus non-centenarian elderly.[26,27] The authors revealed that the microbiome plays a key role in managing oxidative damage, and found that vitamin C, naturally produced by microbes like *Lactobacillus* in centenarians, helps drive this effect.[27]

5 Immune function

The immune system undergoes changes with age, leading to a gradual decline in immune function known as immunosenescence. Key features of immunosenescence include reduced immune response, decreased production of immune cells, increased chronic inflammation (inflammaging), and reduced vaccine responses, among others. This makes older adults more susceptible to infection and disease.

Consuming adequate amounts of **vitamins A, C, D and E, omega-3 fatty acids, and selenium and zinc** has been shown to support proper immune function—highlighting a possible role in health expectancy.[18,28,29]

"Getting old is a fact of life; but getting old healthily is a fact of science. By addressing the hallmarks of aging at a cellular level, it is possible to create a future where aging means thriving.

"We can help customers push the boundaries of what's possible in the health expectancy market—and truly redefine what it means to age with a pioneering approach to innovation. Guided by the latest aging theories and proprietary scientific insights, we've built a portfolio of research-backed nutritional ingredients, powered by a team of experts.

"And we're only just getting started. Our mission is to enable customers to unlock the full potential of health expectancy supplements by advancing nutritional science in this space and exploring novel ingredient combinations."

Taichi Inui
Head of Regional Science,
dsm-firmenich

It's time to increase the health expectancy of the human race.

Together, we can make health expectancy solutions a reality, and transform the lives of billions of people globally.
Our offering includes:

High-quality ingredients

- A portfolio of cutting-edge ingredients that support health expectancy

Customized solutions

- Premix Solutions
- Market-ready Solutions

Expert services

- Unmatched formulation, technical and regulatory knowledge
- Best-in-class flavor and masking expertise
- Scientific services

Your end-to-end partner

Products – Customized solutions – Expert services

Interested in realizing the potential of health expectancy supplements?

Connect with one of our experts to learn more about dsm-firmenich's unique approach to health expectancy innovation.

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