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Health expectancy series

Ensuring our later years are not our lost years, but some of our best years.

Contents

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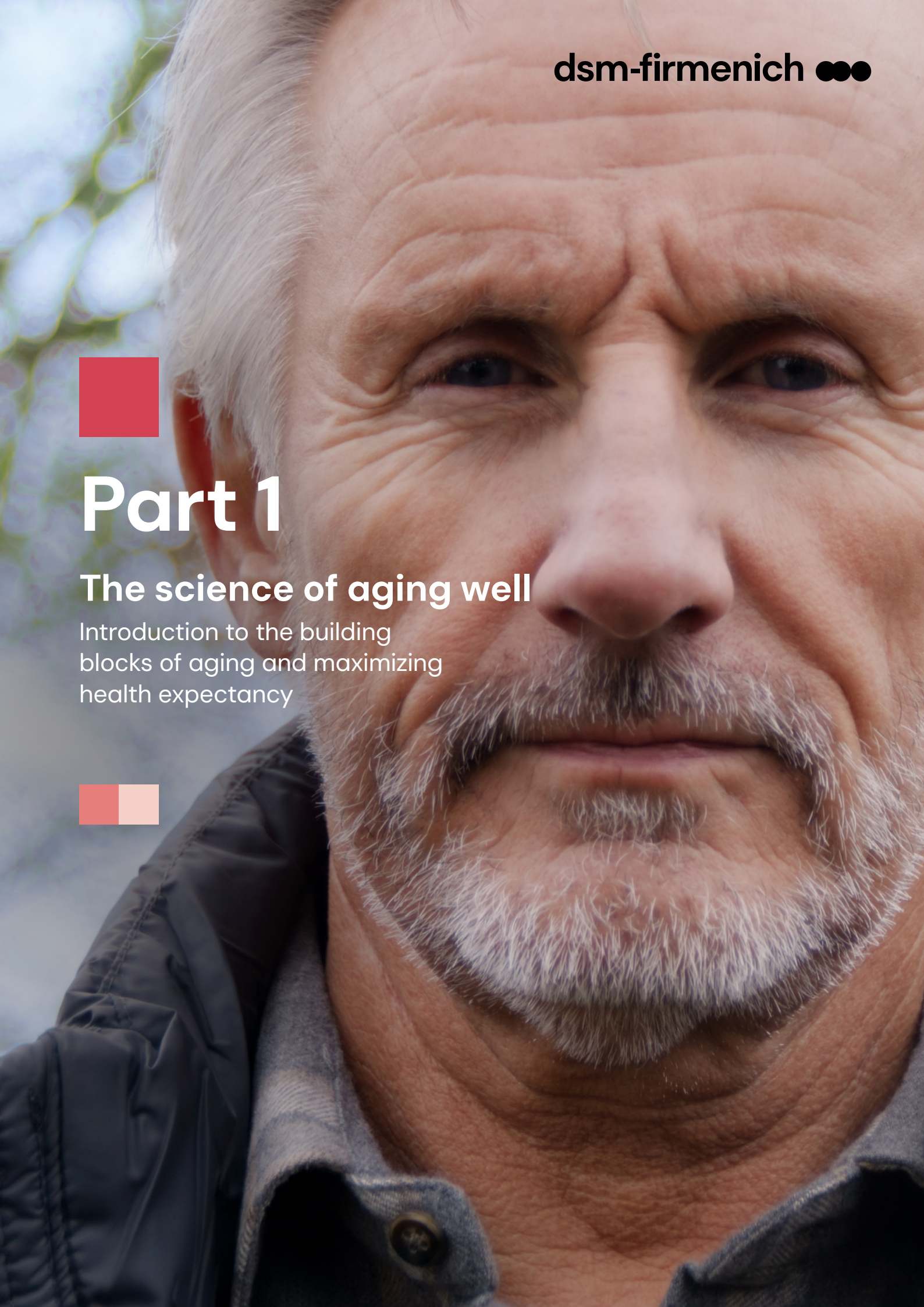


Part 1

The science of aging well

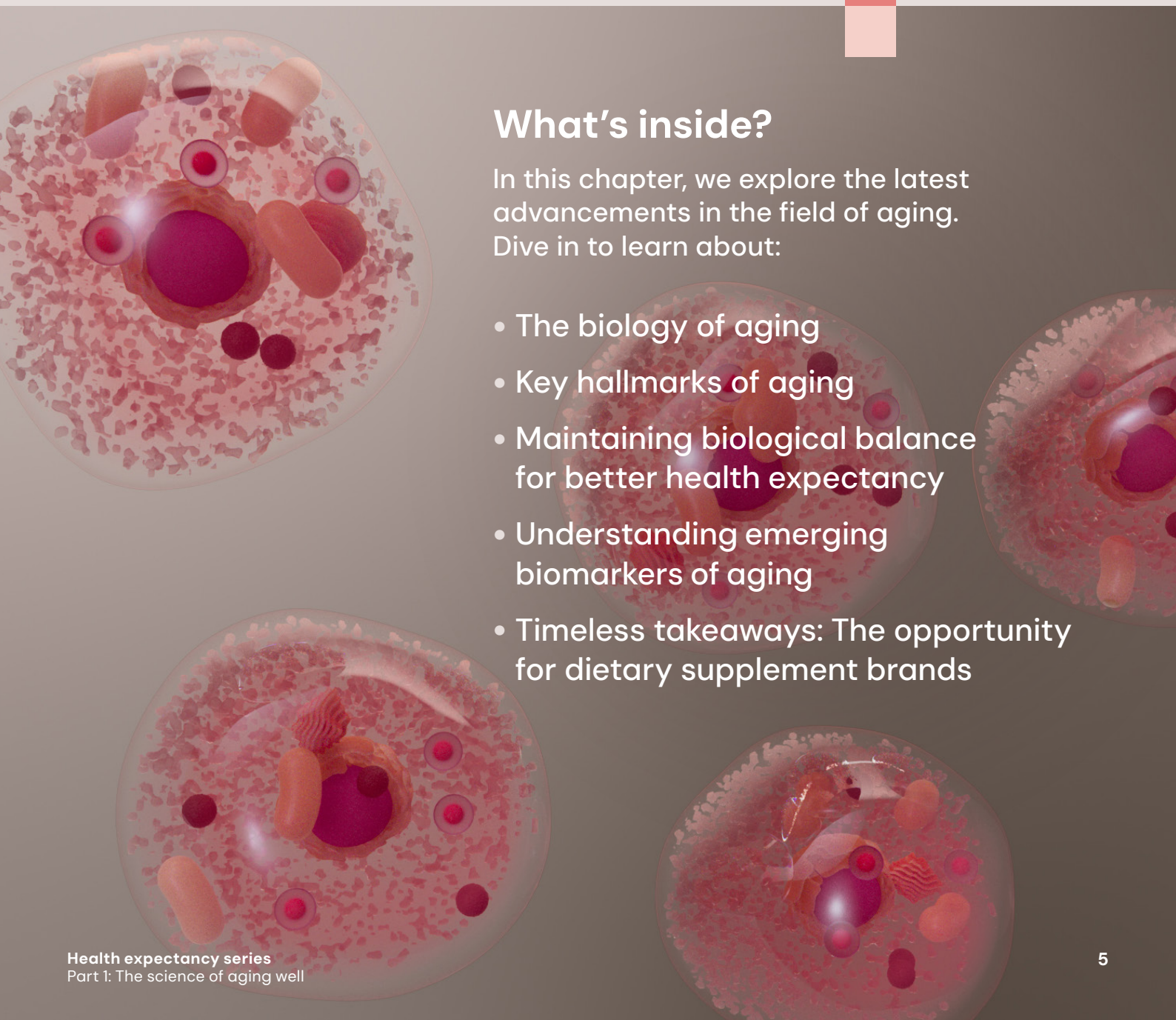
Introduction to the building blocks of aging and maximizing health expectancy

The population is living longer, but not always healthier. Today, most of us will spend our last 10 years of life battling ill health.[1] However, addressing this is key if we want to live vibrant and fulfilling lives, even into senior years.[2] Yet, as a society, we question, "How long will I live?", when we should be asking: **"How can I remain healthy for longer?"**

Enter nutritional supplements. New, cutting-edge research shows that it is possible to increase our health expectancy, i.e., the number of years we live in good health, by targeting the processes of aging at a cellular and system level—making our senior years not just longer, but some of our best.

As part of a three-part series, we dive into the challenge of aging, share breakthrough nutritional research in this field, and reveal how a new approach to innovation can support greater health expectancy. This first whitepaper explores the biological mechanisms behind aging, examines the key hallmarks of this process, and spotlights the opportunity to develop supplements for health expectancy.

10 years of life are marked by illness and disease that could be avoided



What's inside?

In this chapter, we explore the latest advancements in the field of aging. Dive in to learn about:

- The biology of aging
- Key hallmarks of aging
- Maintaining biological balance for better health expectancy
- Understanding emerging biomarkers of aging
- Timeless takeaways: The opportunity for dietary supplement brands

The biology of aging

Aging is a complex process that occurs at a biological, cellular, and systemic level. Some age-related changes are harmless, such as graying hair. Whereas others can impact us significantly, like reduced sensory function, decreased capacity for daily activities, and heightened susceptibility to frailty, disability, and chronic disease.

The link between aging and health

"Aging is not a disease, but advancing age is a major risk factor for disease. Additionally, many diseases accelerate the aging process. We see for instance that as life expectancy rises globally, there is a higher prevalence of chronic degenerative conditions, notably non-communicable diseases (NCDs) like cardiovascular disease, neurodegenerative diseases, cancer, and diabetes.

By slowing the process of aging, it may therefore be possible to reduce the burden of age-related disease and increase health expectancy—that is, living well for longer. However, to create effective interventions that support vitality with age, it is essential to first understand the aging process and factors that determine who ages 'well' or who is more susceptible to age-related disease."

Gabriele Civiletto
Associate Principal Scientist,
DS, HNC at dsm-firmenich

Benefits of health expectancy interventions

- Support health, wellbeing, and independence
- Improve quality of life in advancing years
- Reduce the burden of disease

Identifying key hallmarks of aging

Scientists have identified key mechanisms that contribute to the process of aging—and these mechanisms have now been unified under a concept known as the hallmarks of aging.

The hallmarks of aging model is a conceptual framework that describes the biochemical changes that occur in organisms as they age. Research has found that the process of aging currently involves 12 hallmarks (Figure 1), and these hallmarks interact in complex ways to drive the aging process.[3,4] However, this field is rapidly evolving, and new hallmarks continue to emerge.

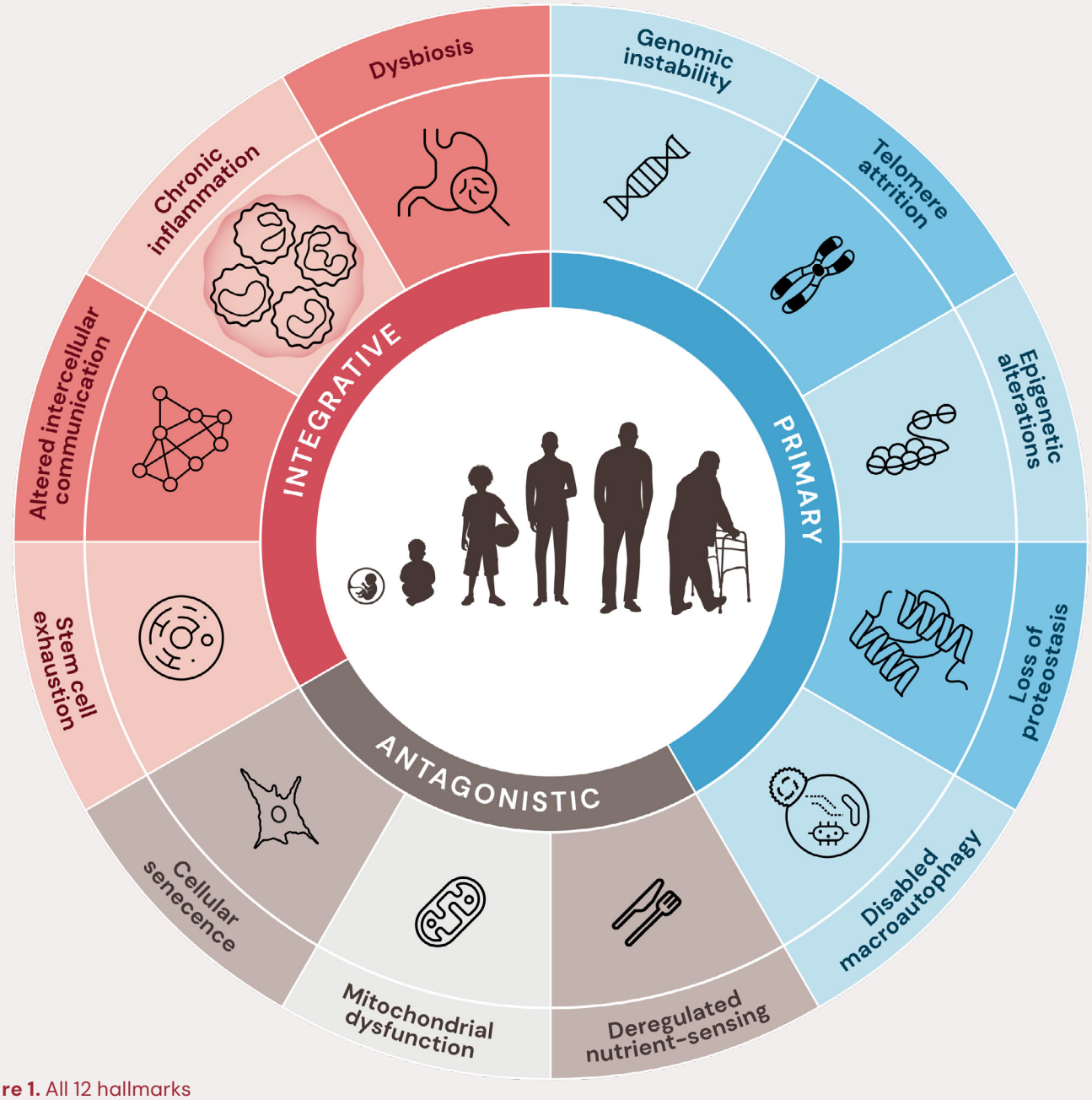


Figure 1. All 12 hallmarks are considered fundamental processes that contribute to the aging of cells and organisms.[4]

These hallmarks are split into three main categories: primary hallmarks (which cause damage), antagonistic hallmarks (the body's response to damage), and integrative hallmarks (the end results of aging).

The general aging process involves:

1. **Damage to DNA, protein and organelles** (structures inside cells that help them function, like the mitochondria or nucleus) **build up in cells over time**, initiating the aging process.
2. **The body's response to this damage**, like cellular repair and growth, is helpful when we're young but **can become harmful as we age**. For example, senescence, a process that stops damaged cells from growing, is beneficial early in life for healthy growth, but can increase the risk of age-related diseases in senior years.
3. Integrative hallmarks are the result of the earlier two stages and lead to the **decline in bodily functions** we associate with aging. These changes can affect entire systems, like the microbiome.

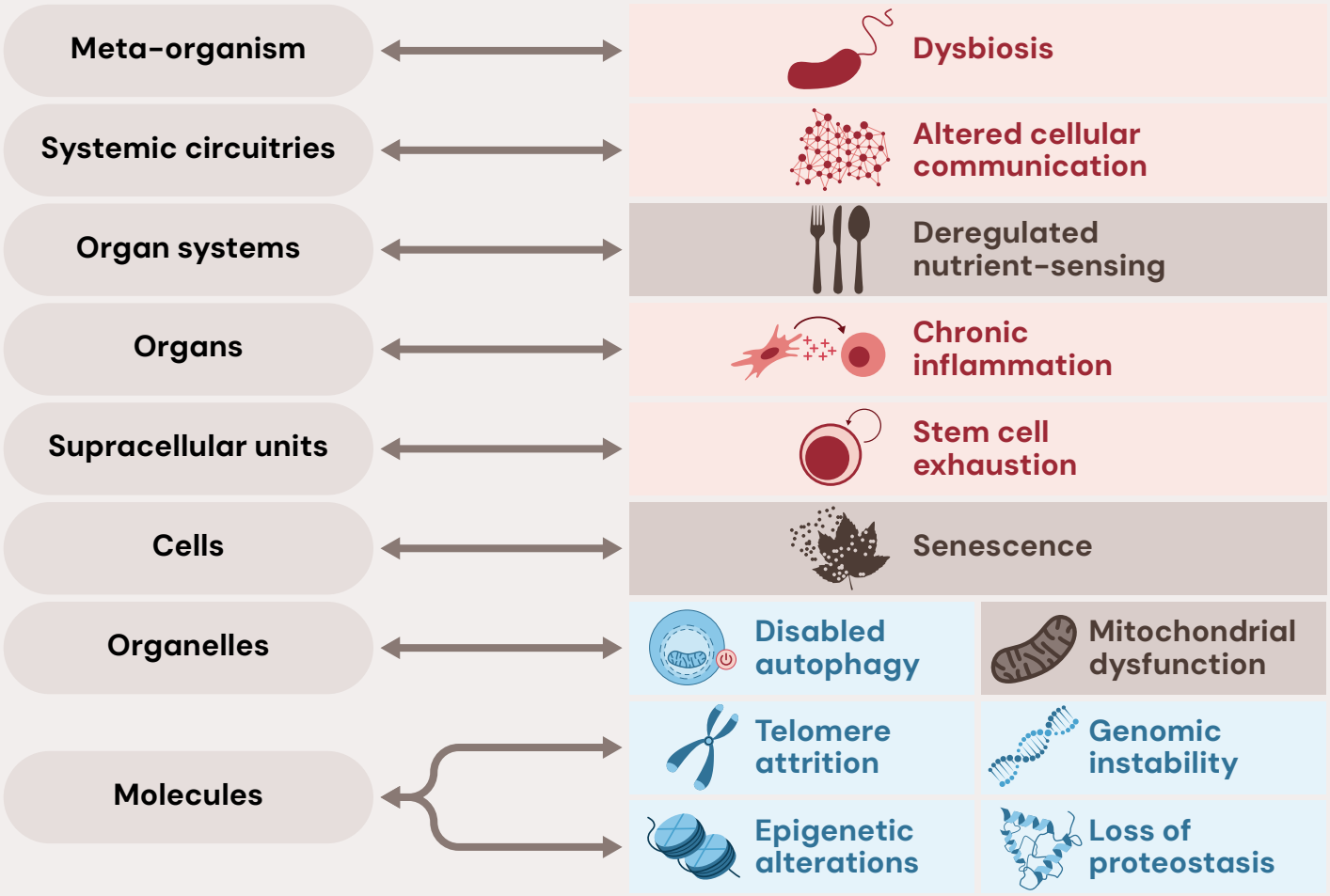
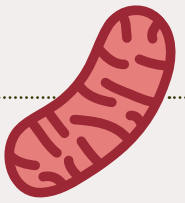


Figure 2. These hallmarks explain the various ways aging occurs at the cellular and molecular levels.[4]

A deep dive into aging hallmarks...

Of the 12 hallmarks of aging, dsm-firmenich identifies four as key for enabling effective nutritional interventions. These four hallmarks hold significant potential for promoting health expectancy—and could be targeted to develop the next generation of health expectancy solutions.

1



Mitochondrial dysfunction

The mitochondria—or 'powerhouse' of the cell—are energy-producing structures within human cells. They generate adenosine triphosphate (ATP), a molecule that cells use as a source of energy.

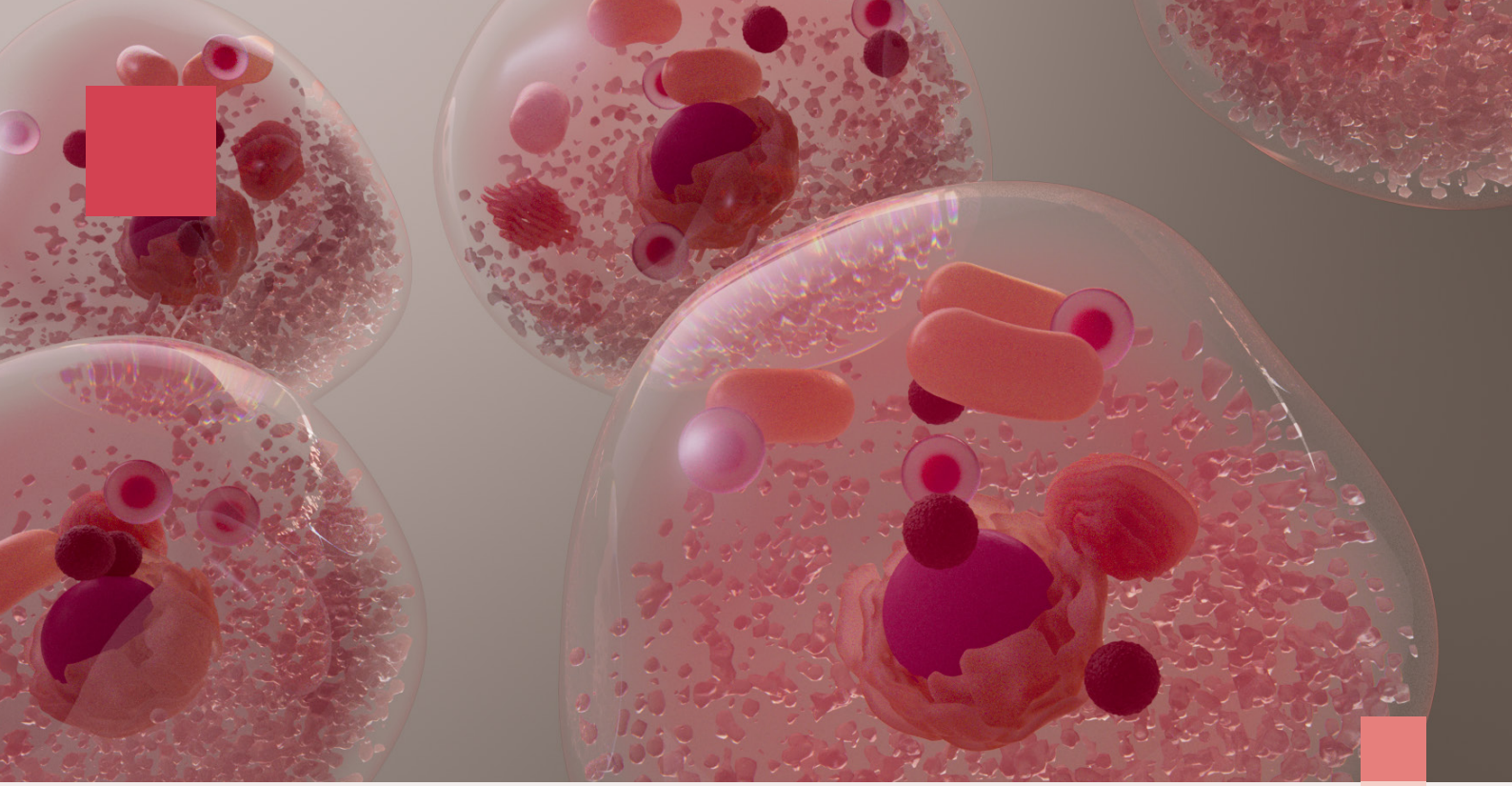
Mitochondrial dysfunction occurs when these essential organelles fail to produce enough energy, manage oxidative stress appropriately, and regulate cell function properly, leading to cellular damage, aging and various diseases.[5,6] The impact of mitochondrial dysfunction can be particularly prominent in tissues and organs that require a lot of energy, like the brain, heart, and muscles. This is why mitochondrial dysfunction often contributes to age-related diseases, like neurodegenerative disorders, cardiovascular diseases, metabolic syndrome, and some types of cancers.

2

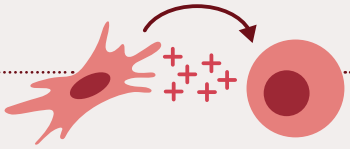
Cellular senescence

Cellular senescence is a process in which cells lose function—including the ability to divide and replicate—but continue to secrete molecules that damage neighboring cells.[7,8] This process is a natural part of aging and acts as a protective mechanism to prevent damaged or stressed cells from proliferating, which could lead to cancer.

However, as these senescent cells accumulate and build up over time, they can contribute to aging and age-related diseases. This is because senescent cells create a pro-inflammatory environment—leading to chronic inflammation. Damaging secretions from these cells can also affect the surrounding tissue microenvironment, leading to tissue dysfunction, impaired regeneration and ultimately, the deterioration of organ systems.



3

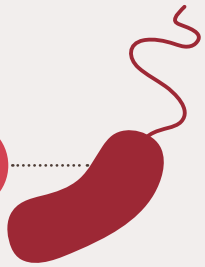


Chronic inflammation

Chronic inflammation—often referred to as inflammaging—is a prolonged and persistent inflammatory response in the body. Unlike acute inflammation, which is a short-term and beneficial response to injury or infection, chronic inflammation is a slow, ongoing process that can damage tissues and organs.

Chronic inflammation accelerates cellular aging because it increases oxidative stress, which can damage cellular components (like DNA, proteins, and lipids) and disrupt normal cell processes, thus influencing decline in tissue function.[9] It is also linked to the development and progression of age-related diseases, like Alzheimer's disease, type 2 diabetes, cancer, arthritis, and cardiovascular diseases.

4



Gut microbial dysbiosis

A normal gut microbiota is essential for various bodily functions, including digestion, immune system regulation, and even mood and cognitive function. Microbial dysbiosis occurs when there is an imbalance or disruption in the normal composition and function of the gut microbiota.[10]

Several factors, such as aging, poor diet, chronic stress, antibiotic use, and lack of physical activity, disrupt the balance and diversity of the gut microbiota. This microbial dysbiosis has significant implications for aging, not only accelerating the aging process but also contributing to the onset of age-related diseases. This happens because dysbiosis triggers chronic, low-grade inflammation in the body, impairing immune function and causing metabolic dysfunctions, like insulin resistance, obesity, and type 2 diabetes.[11]

Maintaining biological balance for healthier aging

Health depends on the body's ability to maintain internal balance (homeostasis) while dealing with stress and recovering afterward.

Throughout our lives, stressors—like poor diet, smoking, infection, environmental toxins, sleep deprivation, physical inactivity, and chronic psychological stress—contribute to oxidative stress and inflammation, which cause cellular damage. However, as we age, homeostasis is disrupted across all levels—molecular, cellular, tissue, and whole organism—and there is a breakdown of processes that usually regulate our response to environmental changes.

With this breakdown, the ability to recover from stresses decreases and the capacity to adapt and return to a balanced state weakens as we get older. This leads to an increased vulnerability towards diseases associated with aging.

Understanding emerging biomarkers of aging

The goal of aging research is to find and test ways to extend health expectancy in humans. To help with this, developing new biomarkers that can measure biological age and the speed of aging is crucial. These biomarkers should ideally track age-related changes from the cellular level to the whole body, providing a reliable measure of biological age that can predict when someone might develop a disease.

Traditional biomarkers, like fitness levels, gait speed, and cognitive function, measure physical performance but often lack predictive power for aging. However, advances in big data and machine learning have led to the creation of more complex biomarkers, like 'aging clocks', which measure biological age using data from epigenetics, gene expression, proteins, and metabolism.

Among modern biomarkers, epigenetic clocks are the most advanced and can even predict overall mortality risk. These clocks have shown that certain lifestyle changes, like diet and exercise, can reduce biological age. Why does this matter to supplement brands? It means that we can now accurately measure the effectiveness of health expectancy solutions—including nutritional supplements.

Timeless takeaways:
The health expectancy opportunity for nutrition brands

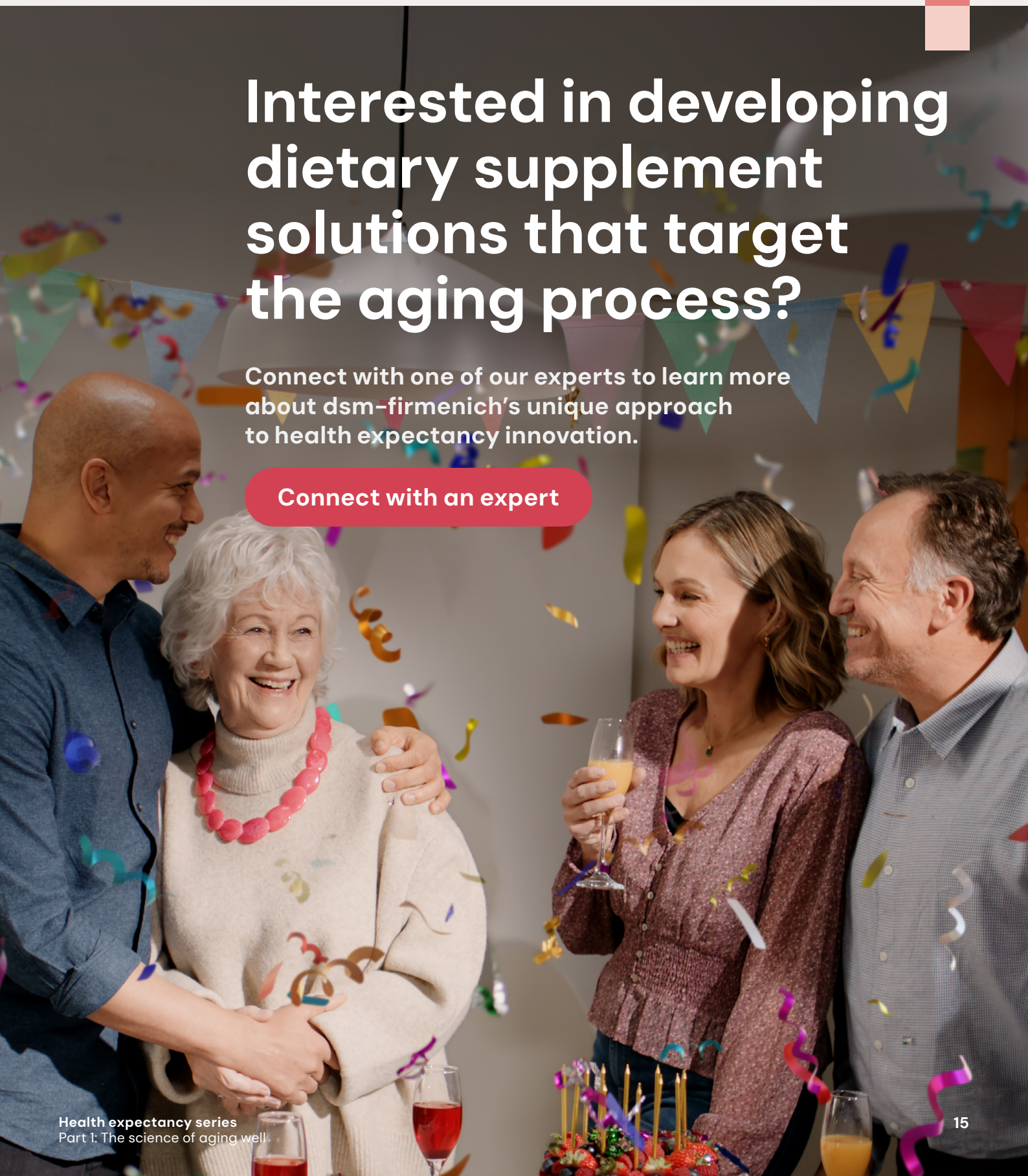
1. The current medical system treats each age-related disease separately. While this is helpful, new research is focused on reducing chronic diseases by addressing the underlying mechanisms of the aging process.

2. However, aging is complex. It has become clear that addressing just one aspect of the aging process is unlikely to be effective.

3. To effectively slow aging and increase health expectancy, it is critical to understand how the different aspects of aging are connected and address them in a unified way.

4. Due to the preventable nature of NCDs and their strong connection with aging, one approach is to understand how nutrients and bio-actives can modulate homeostasis and the hallmarks of aging—tapping into this knowledge to inform supplement innovation.

In the next chapter of this three-part series, we will delve into the influence of nutrition on aging processes and how dietary supplement brands can harness the power of nutrients and other compounds, like phytochemicals, to increase quality of life and function in advancing years.



Interested in developing dietary supplement solutions that target the aging process?

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

Connect with an expert

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

Together, we can elevate health expectancy and transform the lives of billions of people globally.

Our health expectancy offering is rooted in foundational scientific aging theories and bolstered by a multifaceted approach to evidence generation—with a portfolio of cutting-edge ingredients at the core to deliver life-enhancing benefits.

dsm-firmenich

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.[12,13] Yet rather than accepting this, we should ask: **“How can I make my senior years some of my best?”**

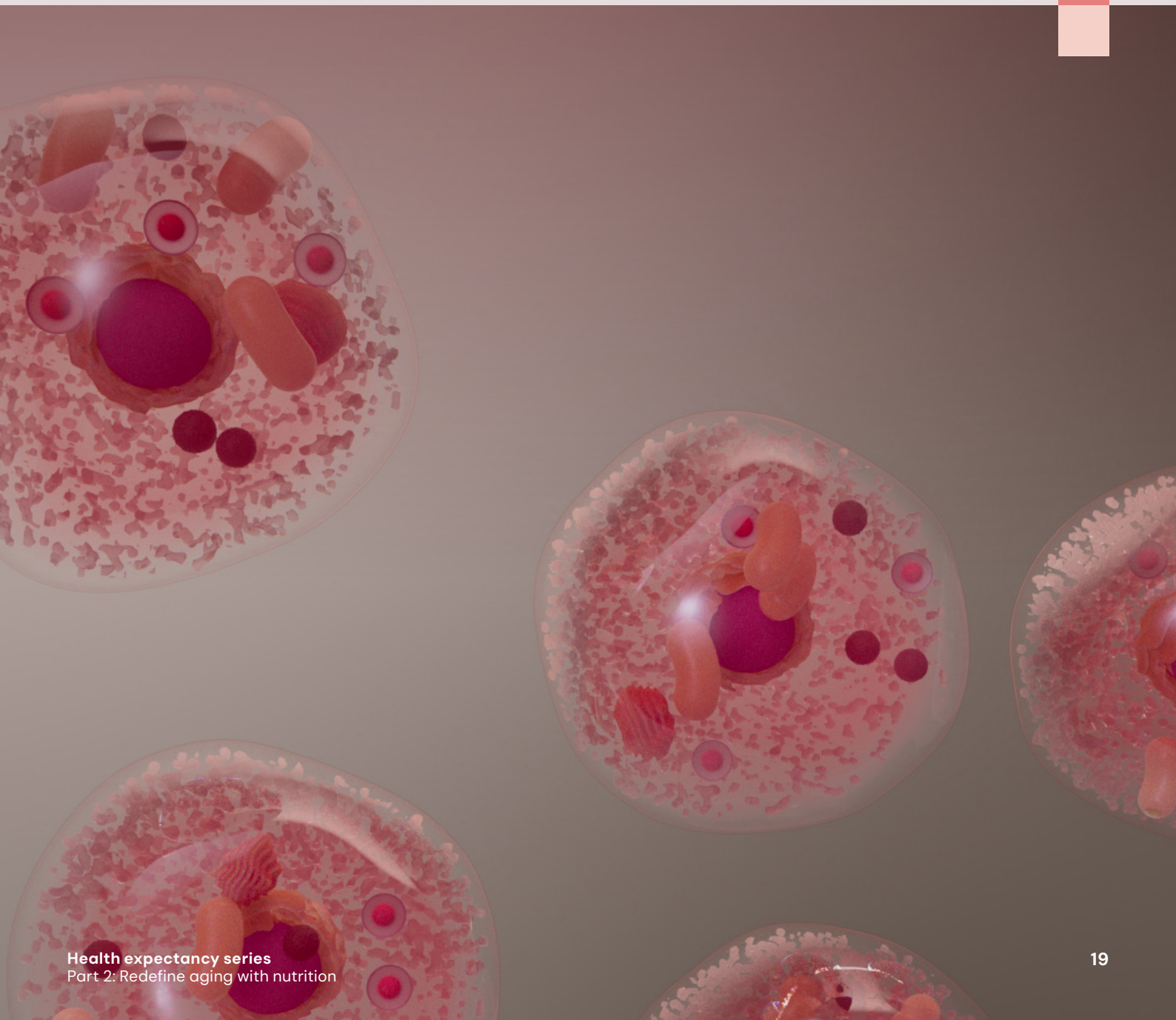
Science shows that harnessing the power of nutrients can promote health expectancy—the years we live in good health—to enjoy a more vibrant and fulfilling life, even as we age; inspiring a new generation of dietary supplement solutions.[14,15] But which ingredients hold the greatest promise?

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



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.[16,17] 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,[18] 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**[19]

(2) Boosting immune function with nutrients like **vitamins C, D, zinc, and selenium** to aid in the elimination of senescent cells[20]

(3) Selective elimination of senescent cells using senolytic compounds, like **fisetin and quercetin**[21].

Senolytics target specific survival pathways in senescent cells, inducing their programmed cell death (apoptosis) without harming healthy cells.[22] 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.[23,24,25] 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.[26]

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.**[27,28]

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.[29]

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.[30]

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.[31,32]

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.[33,34]

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.[35] For example, lutein (a carotenoid) protects cells from cellular senescence induced by oxidative stress via upregulation of antioxidant effectors.[36]

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.[37,38] 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.[38]

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.[29,39,40]

"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

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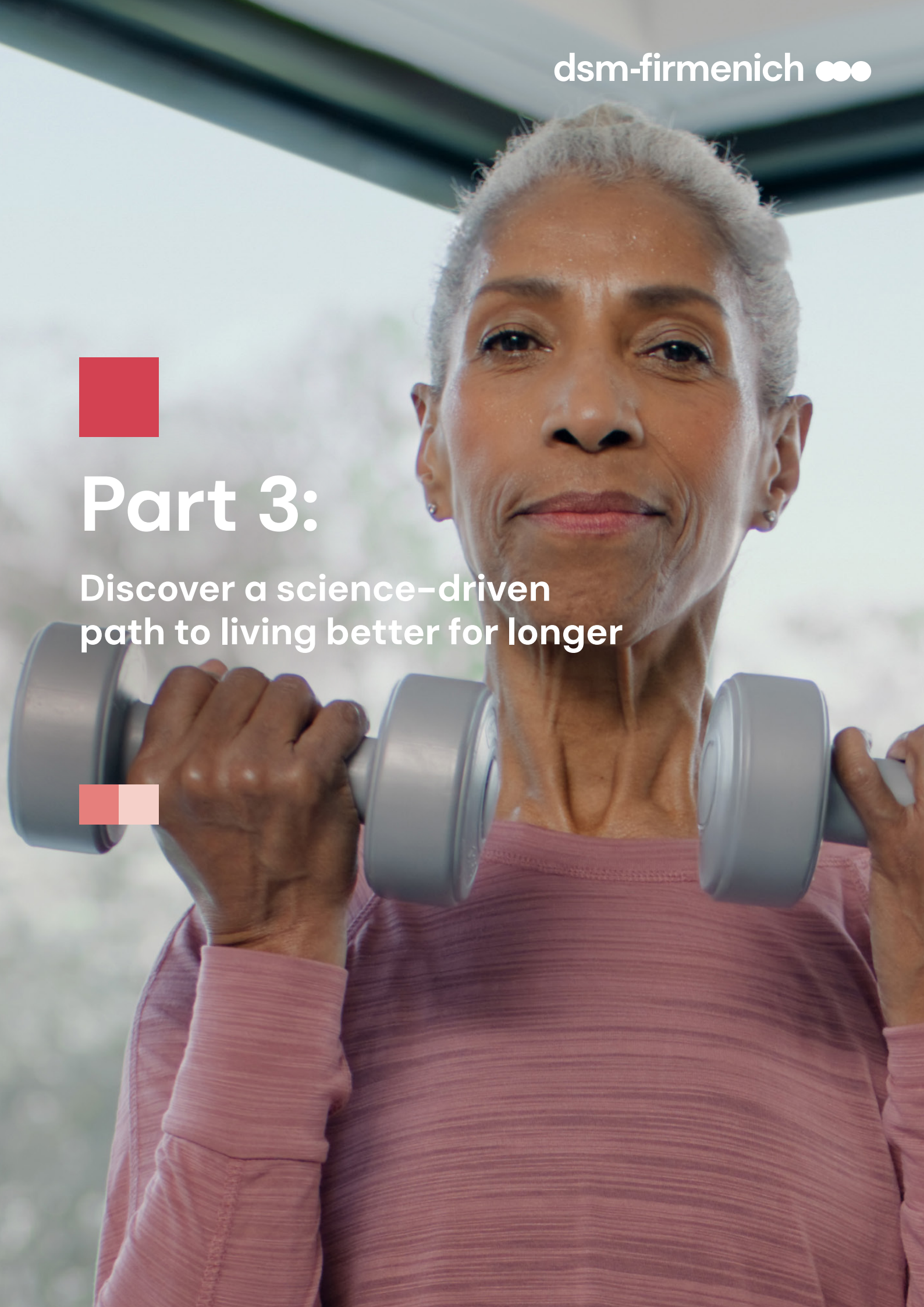
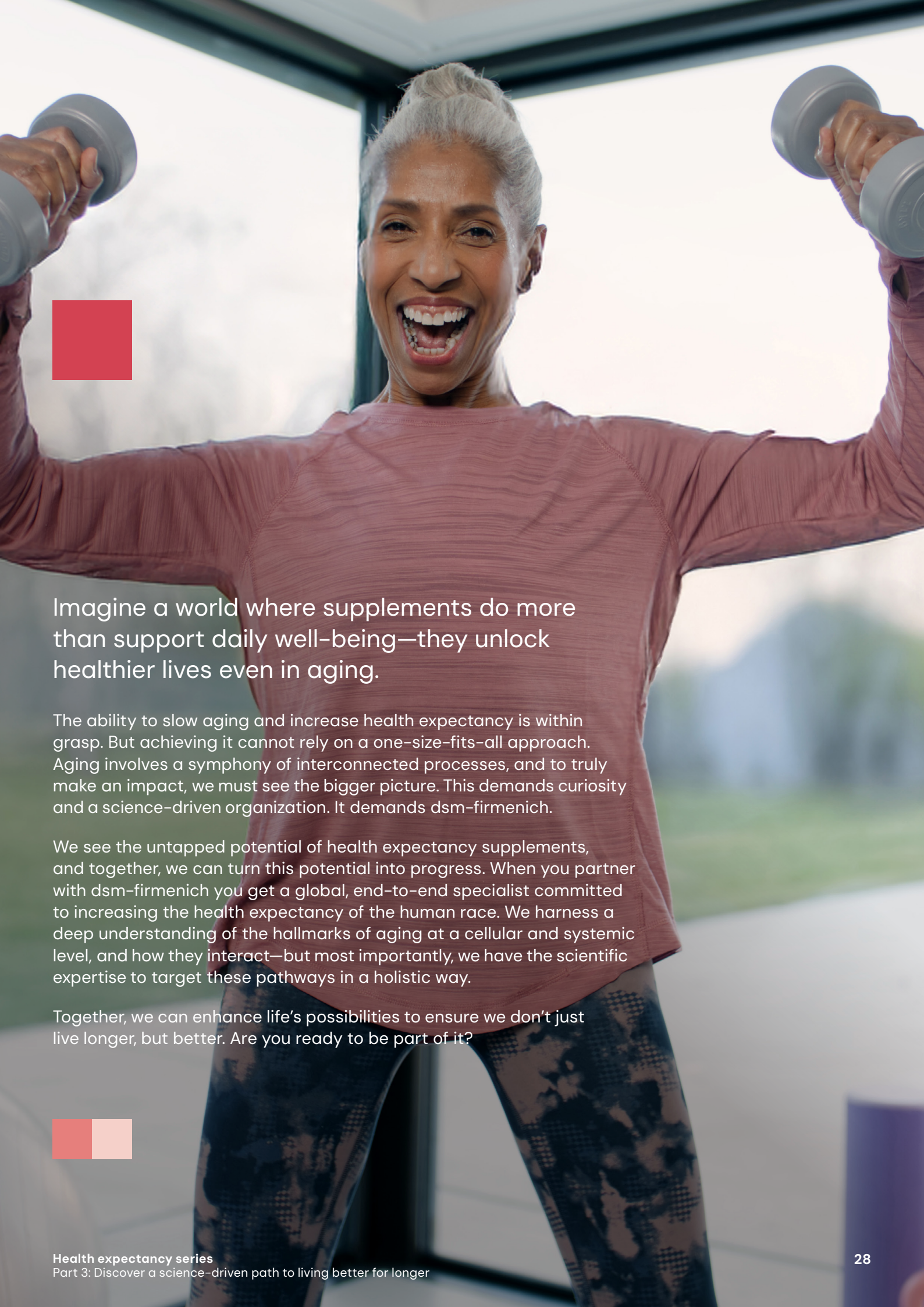


Part 3:

Discover a science-driven path to living better for longer



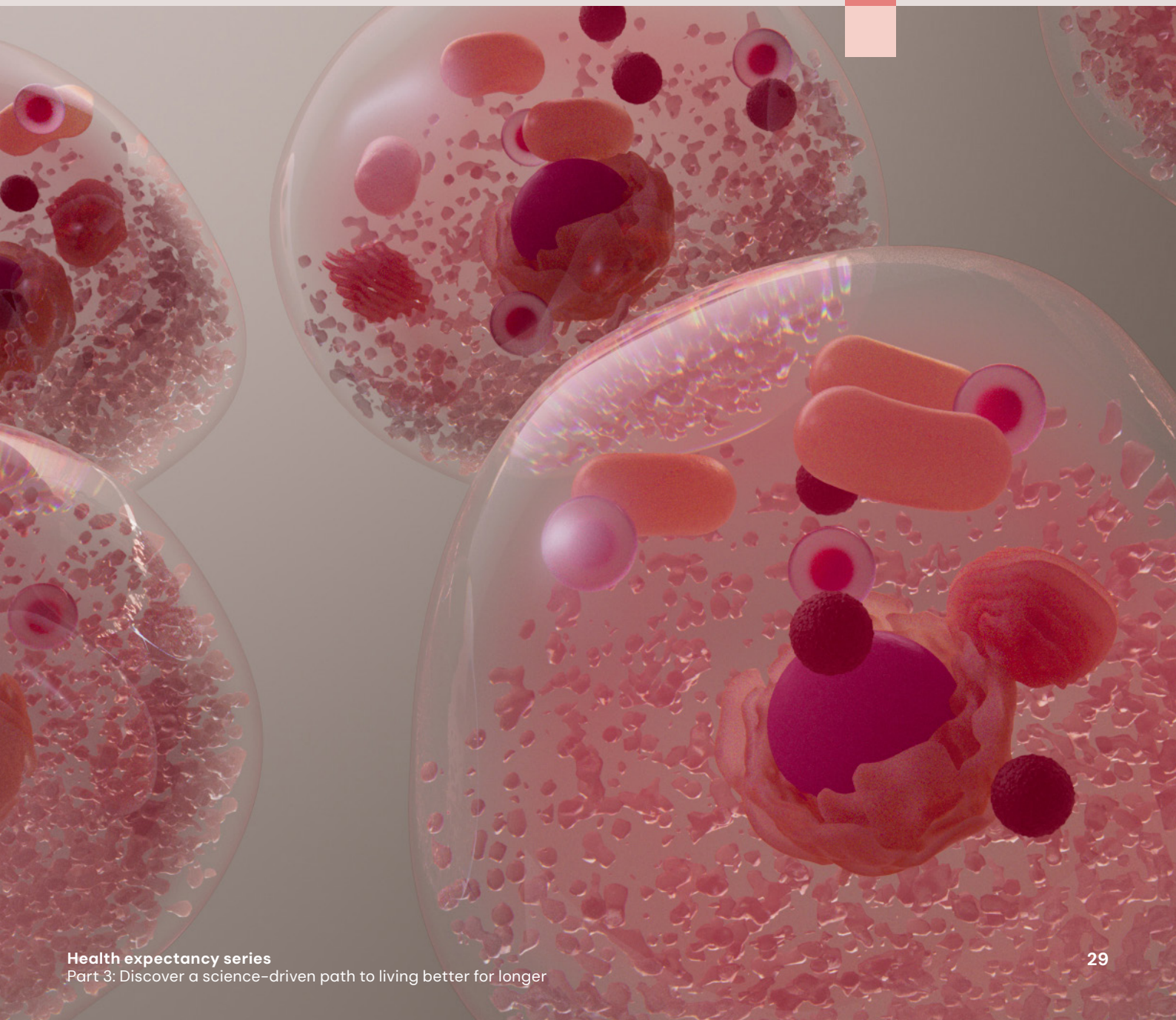
Imagine a world where supplements do more than support daily well-being—they unlock healthier lives even in aging.

The ability to slow aging and increase health expectancy is within grasp. But achieving it cannot rely on a one-size-fits-all approach. Aging involves a symphony of interconnected processes, and to truly make an impact, we must see the bigger picture. This demands curiosity and a science-driven organization. It demands dsm-firmenich.

We see the untapped potential of health expectancy supplements, and together, we can turn this potential into progress. When you partner with dsm-firmenich you get a global, end-to-end specialist committed to increasing the health expectancy of the human race. We harness a deep understanding of the hallmarks of aging at a cellular and systemic level, and how they interact—but most importantly, we have the scientific expertise to target these pathways in a holistic way.

Together, we can enhance life's possibilities to ensure we don't just live longer, but better. Are you ready to be part of it?

Let’s shift the focus from life expectancy to health expectancy, and transform the future for billions of people globally.



We're creating an ecosystem built for success in the health expectancy space

We're ready to help you target the hallmarks of aging and tap into the transformative health expectancy market.

With our high-quality products, customized solutions, and expert services, we not only help individuals age better, but slower. Our approach is deeply rooted in scientific excellence, nutritional expertise, and a commitment to increasing health expectancy. But we want to push the boundaries of what's possible, and the journey ahead is where the real magic happens.

The path forward—our focus in the health expectancy market

Advance research: We will invest in nutritional research and generate clinical evidence to open new doors and inspire formulations that target hallmarks of aging effectively—specifically cellular senescence, mitochondrial dysfunction, chronic inflammation, and gut microbial dysbiosis.

Expand ingredient portfolio: We aim to explore emerging ingredients and solutions with high potential in this market—like biotics, senolytics, and hormetins—to unlock novel opportunities.

Transform delivery: Health expectancy solutions are only effective if they're used consistently. We will introduce formats that support convenience and improve compliance, making better aging more accessible.

Our high-quality products

The foundation of our innovation approach is a strong portfolio of evidence-based ingredients proven to deliver age-related health benefits.

	General Healthy Aging	Heart Health	Brain Health	Immune Health	Muscle Health	Vision Health	Skin Health	Oxidative Stress	Gut Health
Quali®–A	✓			✓		✓	✓		✓
Quali®–B	✓	✓	✓	✓		✓	✓		✓
Quali®–C	✓	✓	✓	✓			✓		
Quali®–D	✓	✓	✓	✓	✓		✓		✓
Quali®–E	✓	✓	✓	✓	✓		✓	✓	✓
Meg–3®, *life'sDHA®*, *life's®OMEGA* (DHA and EPA)	✓	✓	✓	✓	✓	✓	✓		✓
Quali®–Carotene (β-carotene)	✓		✓	✓		✓	✓	✓	
FloraGLO® (Lutein)	✓		✓			✓	✓		
Optisharp® (Zeaxanthin)	✓					✓			
ResVida® (Resveratrol)	✓	✓					✓	✓	✓
All Q® (CoQ10)	✓	✓				✓	✓		
Redivivo® (Lycopene)	✓	✓		✓			✓		

Table 1. Our current longevity portfolio for 'aging better'.

Customized solutions

Multi-ingredient solutions that address health expectancy concerns in novel formats are key to capturing the attention of today's consumers.

Premixes bring together select ingredients and flavors into a single uniform custom blend with exceptional functionality. Our Premix solutions are designed to fast-track health expectancy innovation, helping you get to market faster, more efficiently, and with enduring success.

Our Premix solutions

- dsm-firmenich **proprietary ingredients**
- **Carefully selected third-party ingredients**
  chosen based on scientific research and evidence supporting their potential in health expectancy formulations
- Global consumer **trend insights**
- Formulated at one of our **13 state-of-the-art premix facilities**
- **Advanced powder technologies**
  (material conditioning) designed to supercharge functional performance

The way to well is through the cell

Science has increased our life expectancy.
But not yet our health expectancy.
We want to change that.

We're in the business of finding out how to add life to our years by slowing aging. Our health expectancy strategy is powered by a team of scientists that know it takes more than just delivering an ingredient to create successful solutions—it takes passionate experts, a deep understanding of cellular aging hallmarks, and a relentless commitment to research.

Our experts are here to make it happen

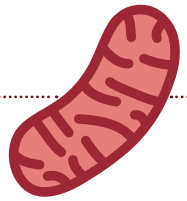
Better health expectancy starts at a cellular level. With our ingredient solutions and cutting-edge expertise, we can help you target and manage key hallmarks of aging to slow the aging process.

1

Cellular senescence

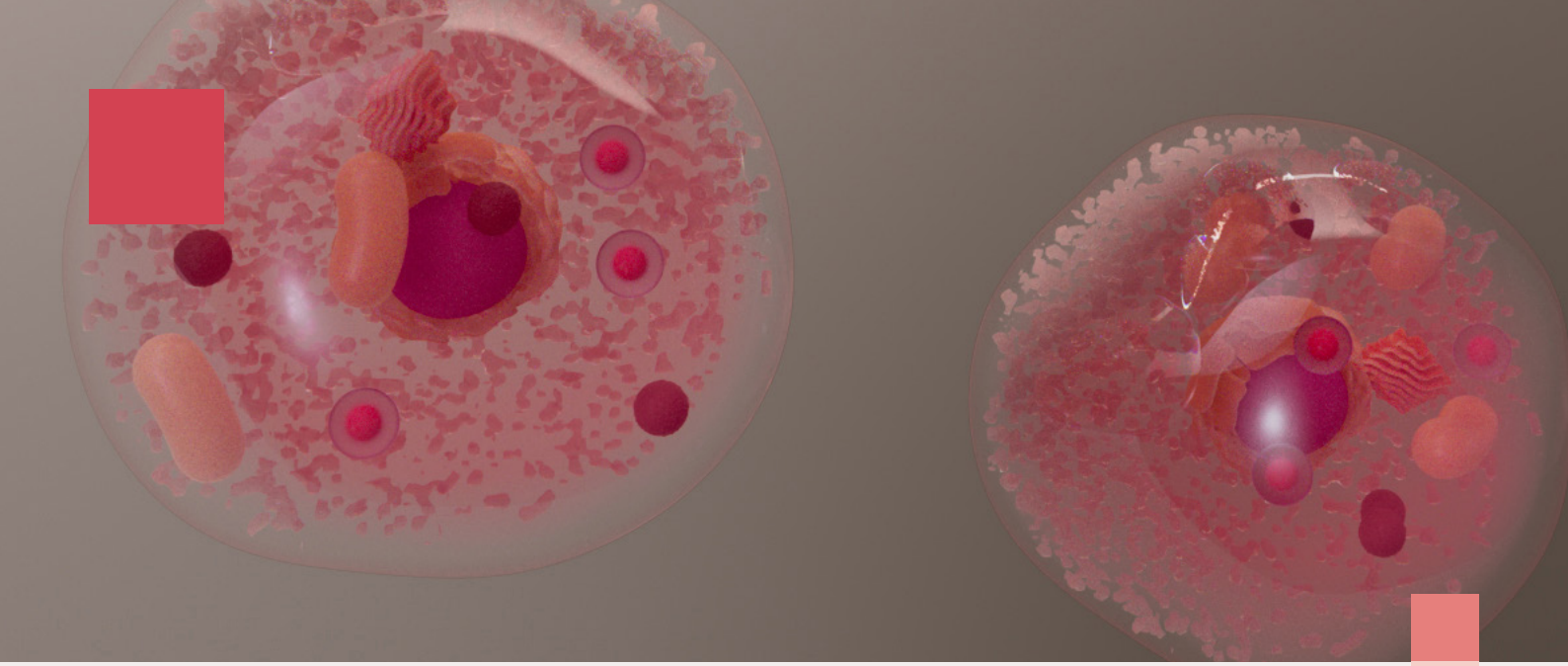
Cellular senescence sees cells lose their key functions—like division—but not die. When these cells accumulate over time, they create a pro-inflammatory environment, which can damage the surrounding tissues and systems. Approaches to remove senescent cells are emerging, including the use of 'senolytic' compounds.

2



Mitochondrial dysfunction

Mitochondria—the 'powerhouse' of the cell—produce energy for cellular processes. Supporting mitochondrial function and energy production as we age may enhance health expectancy.



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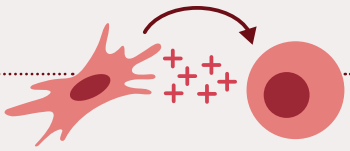

Chronic inflammation

As we get older, our ability to manage inflammation and stress weakens. Several micronutrients and compounds can be harnessed to help control inflammation for better tissue repair and overall balance.

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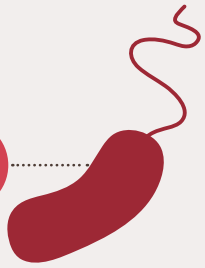


Gut microbial dysbiosis

A balanced gut microbiome is strongly linked to immune function, homeostasis in the body, and nutrient absorption. Targeting the gut microbiome is therefore a promising avenue for health expectancy innovation.

We don't just get the science; we're actively advancing it

In our quest to develop research-tested formulations tailored to win in the health expectancy arena, we are fueling new insights via:

- **Preclinical models:** We study how well our interventions target key aging hallmarks, assess their effectiveness, and explore ingredient synergies.
- **Observational studies:** We examine links between dietary habits and healthy aging in targeted groups to inform formulation development.
- **Human trials:** We test interventions in people, focusing on biological clock markers and health benefits.

We're not just scientists

We're experts across the entire product development cycle. Our expert services provide support from concept to launch, and beyond.

Application and technical

Our **50+ formulation and application experts** can help you overcome product development challenges and meet your target audience's evolving needs.

Insights and marketing

Elevate your product claims and appeal based on our consumer insights to resonate deeper with your target audience.

Quality and regulatory knowledge

Enjoy peace of mind launching new products that are safe, compliant, and high-quality.

Delivery format expertise

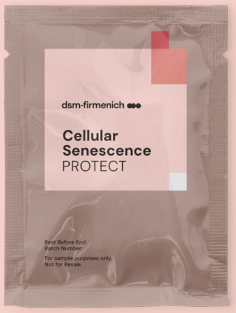
We can help overcome barriers linked to aging and decreased nutrient intake—such as bioavailability, slower metabolism, and convenience.

Best-in-class flavor and masking expertise

We have 1**00+ flavorists, 11 sensory facilities, and 130,000 flavors** to help you create products that deliver exceptional taste and experience.

Prevent and combat the effects of cellular aging with our 3-step cellular senescence concept

We can help you unlock a complete senotherapeutic mode of action with our ready-to-do premix concepts—reducing the burden of senescent cells to restore health and function.



01 Month 1: Protect

Prevent further damage by senescent cells with ResVida®, a powerful senomorphic and antioxidant. Senomorphics modify the functions and characteristics of senescent cells to make them resemble youthful cells or prevent young cells from becoming senescent.

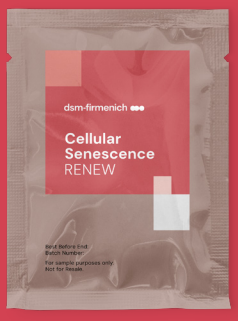
	Ingredient
Hero	**ResVida®** (Resveratrol)
Supporting	**Indena Opextan®** (Olea Europea)
Backbone	**Vitamin B12**
	Vitamin B9
	Vitamin B6
	Vitamin B3

02 Month 2: Boost

Strengthen the immune system to recognize and eliminate aged (senescent) cells with ALL Q® (CoQ10 Ubiquinone) and super antioxidant Redivivo® (Lycopene).

- ALL Q® is an essential coenzyme for maintaining cell energy levels.
- Redivivo® is a bioactive form of lycopene, which helps regulate the body's processes responsible for producing inflammatory substances.

	Ingredient
Hero	**ALL-Q®** (CoQ10 Ubiquinone)
Supporting	**Redivivo®** (Lycopene)
Backbone	**Vitamin C**
	Vitamin D3
	Zinc



03 Month 3: Renew

Eliminate left-over senescent cells to complete the renewal process with Quercefit®, a natural flavonoid that has the power to neutralize free radicals and remove senescent cells.

	Ingredient
Hero	**Quercefit® Indena** (Quercetin)
Backbone	**Vitamin E**

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