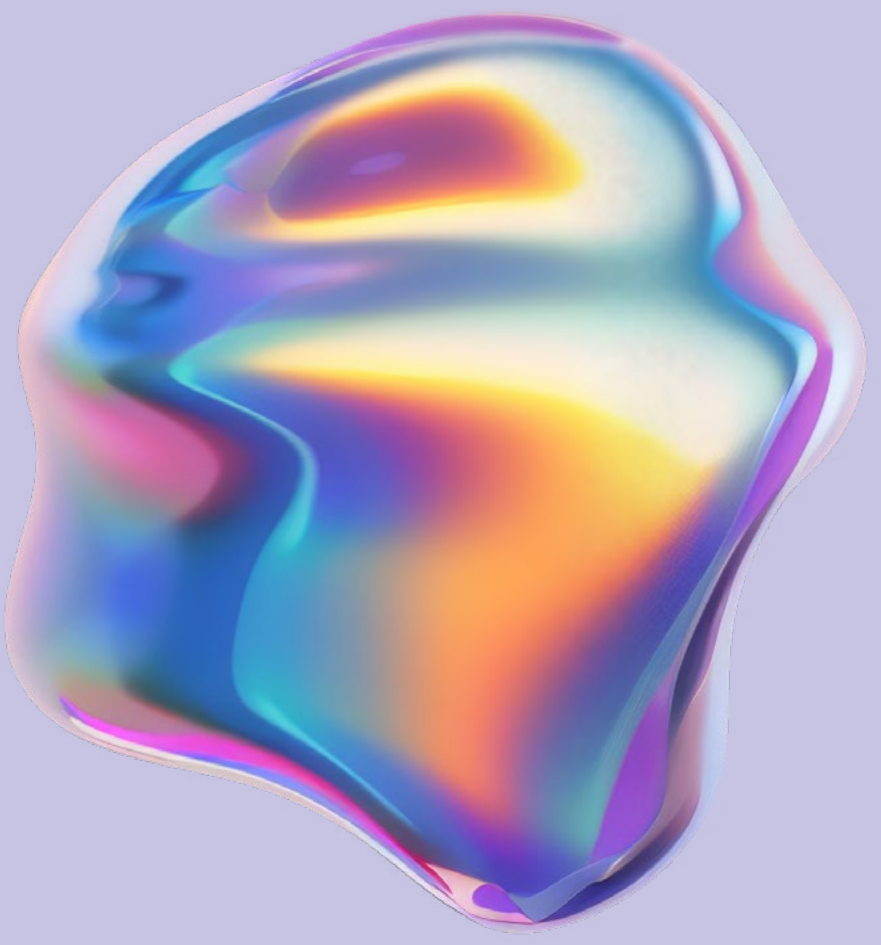
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OCTOBER 2026

THE ESSENCE

of HEALTH *and* HUMANITY



JOURNAL OF THE AVOLA DECLARATION ASSOCIATION

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Beyond Guilt, Beyond Hype

Hardly any other topic has such a contradictory focus as that of health. On the one hand, classic health promotion and disease prevention: terms that actually mean care, but in practice often come across as a moral index finger. Who doesn't know it, that quiet voice in your head: "I should do more sports." "I would have to drink less alcohol." "Why don't I finally do this or that?" Prevention thus suddenly becomes a duty to deliver, health a compulsory exercise, in which failure seems almost pre-programmed.

On the other hand, there is the longevity movement. A market that has literally exploded in recent years, with biomarkers, supplements, wearables and coaching programs that promise a long, vital life. Unlike classic prevention, longevity rarely comes with a guilty conscience, but with optimism, self-empowerment, sometimes also with a certain promise of status. Those who optimize themselves are part of it. The problem is that much of it is strongly consumption-driven, some is scientifically questionable, and the line between a legitimate interest in one's own health and expensive self-optimization is becoming increasingly blurred.

It gets interesting when you compare both movements. On closer inspection, health promotion, disease prevention and healthy longevity basically pursue the same goal: to live as well as possible for as long as possible, i.e. without disease / NCD. They differ above all in the tone with which they address us. One admonishes, the other beckons. Both can lose sight of something essential: that health is not a state that you achieve once and then possess, but a daily practice that cannot be shortened – neither by a guilty conscience nor by the next supplement.

Two movements, two completely different emotional worlds – guilt on the one hand, promise on the other. And yet, soberly considered, both are based on the same, surprisingly unspectacular cornerstones: little alcohol, no smoking, a balanced (Mediterranean) diet, sufficient sleep, ample social contacts and regular exercise. None of these six measures require a subscription, a wearable or a guilty conscience. They are old, unspectacular, and yet – or precisely because of this – they still seem the most reliable. Oral health, to which AVOLA has been committed since then, also fits seamlessly into this picture: If you brush your teeth and between your teeth properly and daily, do not smoke and eat a balanced diet, you are automatically doing something good for the rest of your body. One body, one health – on a small and large scale.

This is exactly where this issue of THE ESSENCE comes in. We do not want to moralize or market, but invite: to rediscover the always same, solid basis of health and longevity, beyond feelings of guilt and beyond the hype. Not as a duty, but as an invitation. Not as a consumer good, but as something that we can give ourselves – day after day, in small steps.

Marcel J. Scacchi
Executive Director of AVOLA

#3

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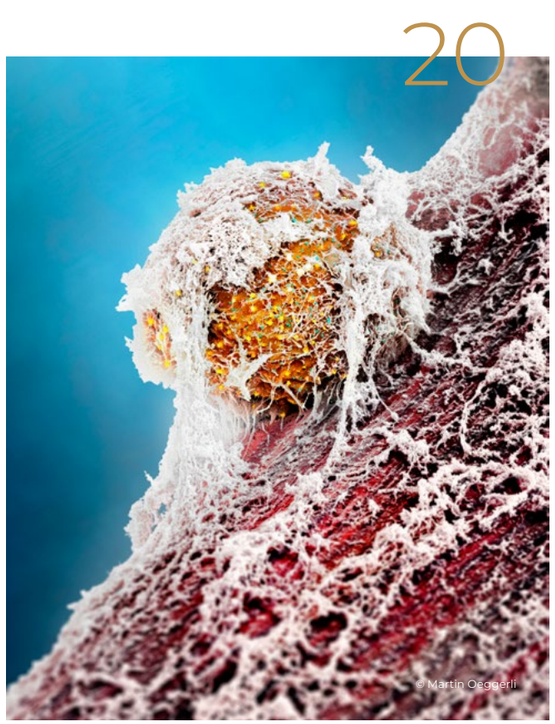
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AVOLA Symposium 2026

97% Repair vs 3% Prevention: It's Time to Turn the System Around!

Welcome to the AVOLA Symposium 2026, where the theme "One Body, One Health" invites us to rethink health as a connected and integrated whole.
The symposium is founded on the belief that health cannot be understood through isolated systems, disciplines, or professions. Instead, human wellbeing emerges from the dynamic interaction between the body, mind, behavior, environment, and society.
Advances in microbiome research, nutrition, oral health, psychology, and artificial intelligence increasingly demonstrate these powerful interconnections. The next few years are a pivotal window: AI will shift prevention from reactive and generalized to proactive and hyper-personalized – analyzing multimodal data from wearables, microbiome tests and behavior to give people real-time risk prediction and tailored oral hygiene, nutrition and lifestyle advice. For organizations like AVOLA, embracing this means our education, communication and behavior-change efforts can reach far more people, more effectively.

We bring together leading specialists to share with us how these connections – and these emerging tools – can be translated into better prevention and healthier lives. The concept of One Body, One Health recognizes that oral health, systemic health, and overall wellbeing are inseparable – a link now reinforced by the newest cardiovascular research directly connecting periodontitis to coronary plaque burden and heart disease risk[1]. This symposium offers a unique platform for learning, exchanging ideas and networking across disciplines. Together, we shall explore how integrated prevention can add not only years to life but life to years.

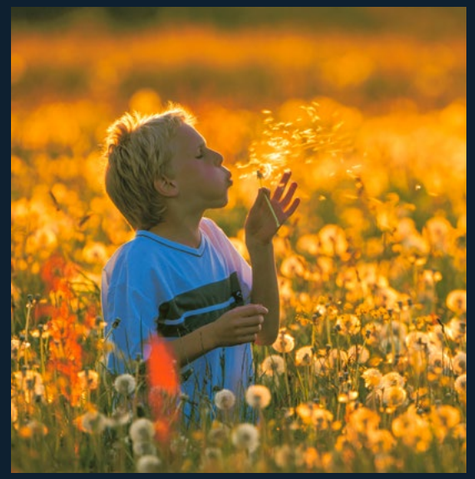
Let us be inspired by a shared vision: one body, one health, one future built on connection, prevention, and lifelong wellbeing.

One Body, One Health

Every healthcare system on the planet is, in essence, built backwards. OECD countries allocate less than 3% of their health spending on average to public health and prevention activities – even though an estimated 80% of health outcomes stem from factors that have nothing to do with the treatment system: lifestyle, nutrition, oral health, sleep, movement, social connection. This is the structural core of how modern medicine finances itself, and it has quietly become unsustainable.
The reason is not a lack of knowledge. We know, with overwhelming evidence, that periodontitis raises the risk of diabetes and cardiovascular disease; that poor nutrition drives metabolic dysfunction; and that sleep and social isolation shape brain health as much as any pharmaceutical intervention. The problem is that this knowledge lives in disconnected silos – dentistry, endocrinology, cardiology, nutrition science, neurology, and public health – each with its own conferences, journals, and funding streams. The body does not recognize these boundaries. Only our institutions do.

AVOLA

This is the basic idea behind the 2nd AVOLA Symposium, "One Body, One Health": to dismantle these silos for one day and put everyone who works on health promotion, disease prevention, and healthy longevity at the same table – clinicians, dentists, general practitioners, nutritionists, researchers, insurers, hospital leadership, educators, and policymakers. Not as adjacent tracks running in parallel, but as a genuinely shared conversation about one system: the human body and the one health it has.



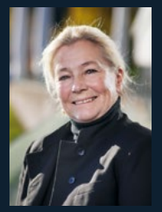
Why does this matter now? Because the current model has run out of road!
Healthcare costs rise every year, faster than wages and GDP, and the citizens and governments who bear them are approaching a breaking point. The "repair economy" of healthcare is more profitable than the "foresight economy" of prevention – treating a heart attack generates more revenue than preventing one. That incentive structure is precisely why we have ended up spending 97% on repair. But a model that depends on rising disease burden cannot be scaled indefinitely against an aging population and a tax base that is not. We do not need incremental adjustment. We need a radical shift in where the money, attention, and professional prestige in healthcare go.
A shift of that scale cannot be delivered by a single ministry or specialty. It requires stakeholders who currently operate in isolation to start designing prevention as a coordinated system rather than a collection of well-meaning individual initiatives. Nutrition, oral health, systemic health, brain health, and healthy longevity must be presented as different entry points into the same conversation.

There is one more dimension the committee should keep central: children. Adults with poor health literacy are not the root cause – they are the outcome of a childhood in which health-maintaining competence was never systematically taught. We teach children to read, calculate, and perhaps code; we rarely teach them with the same rigor how to maintain their health – how to care for their teeth, what to eat, how to move, relax, sleep, and build resilience. This competence gap in early education is the single highest-leverage place to intervene.

Prevention does not begin in the hospital, it starts in the classroom!
In short: the 2nd AVOLA Symposium is a deliberate, one-day experiment in what healthcare could look like if disease prevention, health promotion, and healthy longevity became one coordinated system – starting with a generation of children equipped to maintain their own health, not just repair it once it fails.

[1] Teleka S, Persson P, Vähäsarja N, et al. Periodontitis, epicardial adipose tissue and coronary events: the Swedish Cardiopulmonary Bioimage Study. European Heart Journal 2026;47:ehag569. https://doi.org/10.1093/eurheartj/ehag569

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Hearts and Habits: Making Prevention Stick



Author — Dr Mário Rui Araújo

Preventive dentistry does not fail because patients disagree with it. It fails because agreement is not behaviour. Every day, clinicians provide evidence-based recommendations that patients genuinely intend to follow – only to see those intentions disappear in the reality of busy lives. Closing this gap requires more than better communication or stronger motivation. It requires understanding how habits are formed, sustained, and supported over time.



Dr Mário Rui Araújo

Adjunct Professor of Portalegre Polytechnic University

"Prevention is better than cure" is rarely disputed. Most patients already believe it. The real clinical challenge is something else: can they turn that belief into repeatable behaviour, day after day, amid fatigue, distraction, and a missed routine? Disease rarely comes back because patients lack information. It returns because sustainable behaviour takes more than knowledge; it takes design, and designing for behaviour is something most clinical training never teaches.

This matters enormously for oral health. Long-term outcomes depend on clinical skill, yes, but they depend just as much on whether the patient can maintain a stable oral ecosystem at home: effective biofilm control, structured interdental cleaning, and regular professional care. Most dental treatments don't fail on the day of surgery. They fail later, at home, in the evening, when the patient is tired, and motivation has thinned. The behavioural side of oral health isn't a nice extra: it's one of the main factors determining whether treatment lasts.

The gap between knowing and doing

So why does this keep being underestimated? Start with a pattern every clinician recognises. Patients understand that bleeding gums signal inflammation, yet they still normalise it. Calling this non-compliance misdiagnoses the problem and backfires clinically. Patients aren't passive; they actively protect existing habits that feel familiar, coherent, and theirs. Change disrupts that, creating real psychological discomfort, especially when they notice the gap between what they value and what they do. In the dental chair, that discomfort turns into excuses: "my gums have always bled," "it's genetic," "I don't have time." These aren't signs of laziness but a form of self-protection that needs a clinical response tailored to it, not a louder version of the same advice.

Here's the uncomfortable part, and it applies well beyond the dental chair. Declarations, symposia, magazines and journals: all of them can fall into the same trap as the patient who nods along and changes nothing. Agreement is not behaviour. A movement built only on shared conviction risks producing beautiful statements and very little else. Prevention doesn't fail because people lack belief. It fails because nobody designed for what happens after belief. That's what the rest of this piece is actually about.

Where behaviour breaks down

Start the design with one question: when a behaviour doesn't happen, where exactly did it break down? A patient who has never been shown how to use an interdental brush has a different problem from one who intends to clean every evening but has no cue to remind them. The first is missing a skill. The second is missing an anchor. Three things can make a behaviour possible: the ability to do it, the chance to do it, and the drive to do it. Remove any one of them and the behaviour doesn't happen (Michie et al., 2011). Naming the missing piece tells the clinician what to do next. Naming "non-compliance" tells them nothing.

Agreement is not behaviour. A movement built only on shared conviction risks producing beautiful statements and very little else.

There's a second, equally common breakdown: after a patient decides to change, the intention quietly dissolves within days, not because it was weak, but because deciding to change and sustaining it draw on different mental resources (Schwarzer, 2008). One bridge works remarkably well: instead of "I'll floss more," the plan gets specific: "I'll use the interdental brush after toothbrushing, before bed." That level of detail, specifying when, where, and right after what, has a strong track record across health behaviours (Gollwitzer & Sheeran, 2006).

From telling to collaborating

None of this works if the conversation feels like pressure: clinical communication has to move from telling to building together. The clinician's job is to help the patient find their own reasons to change, working with their ambivalence instead of arguing against it. That's the core of motivational interviewing (Rollnick et al., 2008). Motivation imposed from outside behaves nothing like motivation built on meaning the patient finds for themselves (Deci & Ryan, 2008); the first predicts relapse the moment pressure lifts, the second predicts that the behaviour sticks. This is also why the relationship itself isn't a mere detail: shared goals and a bond built on trust determine whether the patient returns, remains engaged, and keeps going (Bordin, 1979).

Even the words matter: "hygiene" sounds clinical and neutral, but it often comes across as judgemental, and judgement makes people defensive (Brehm & Brehm, 2013). Framing a recommendation as the ideal can lead the patient who can't meet it to drop the whole routine rather than keep a smaller version. A better question isn't "what does perfect look like?" It's "what's the smallest version of this that the patient can actually start, stick with, and build from?" This works because believing you can do something in a specific moment is one of the strongest predictors of whether you start and keep going (Bandura, 1997). That belief grows through small wins, not by repeatedly falling short of a high bar.

The clinician's job is to help the patient find their own reasons to change, working with their ambivalence instead of arguing against it.

The appointment is only the beginning

Something more fundamental lies underneath: a recommendation with no emotional weight is filed as information and rarely turns into action; emotion and decision-making run together, not in separate systems (Adolphs & Anderson, 2018). Connect a recommendation to what the patient actually cares about, such as confidence or ease in social situations, and it sticks in a way pure facts never will. A behaviour becomes durable not when the patient understands it, but when it no longer requires a decision (Wood & Neal, 2007). That shift, from "I'm trying to remember to do this" to "I just do this," is where most maintenance plans fall apart, and where the clinician usually disappears.

Maintenance needs its own place in the treatment plan, not as an afterthought tacked onto the real work. Motivation isn't fixed; it rises and falls with pain, with visible results and with time. Once the original complaint is gone, the motivation that drove the first round of change often goes with it. Structured maintenance and regular follow-up aren't a courtesy for anxious patients: they're cost-effective in protecting outcomes over time (Gaunt et al., 2008). And relapse, when it happens, isn't failure. It's information. It points straight to which part of the routine wasn't yet realistic, didn't yet mean enough, or hadn't become automatic enough to survive a bad week (Marlatt & Gordon, 1985; Taleb, 2007).

This changes what the clinician's job actually is. The clinician still diagnoses and treats, but also designs the conditions for behaviour change and stays involved in maintaining it. The real question isn't only "what did we treat?" It's what the appointment leaves behind: one small, practised, specific action the patient genuinely believes they'll repeat tomorrow. That work doesn't stop when treatment ends; it runs before, during, and after, so health has something solid to stand on, not just the belief that it should.

Author's note: *The original manuscript was written by the author in Portuguese. AI tools were consulted selectively for language and structural review, and Grammarly was used to support the English translation and editorial refinement. The author reviewed and approved the final text and remains fully responsible for its content.*

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PREVENTION



Dr Barbara Studer

Neuroscientist, co-founder & CEO of Hirncoach AG

BRAINPOWER

How Our Brain Controls Our Habits

Author — Dr Barbara Studer

A few weeks ago, I caught myself reaching for my mobile phone in the morning before I'd even had my first conscious thought. Not because I wanted to. My brain had already made the decision long before 'I' could even have a say. This is precisely the essence of what neuroscientists refer to as a habit, and this is where it becomes fascinating for our mental health.

Every new action begins in the prefrontal cortex, our centre for planning and decision-making. We weigh things up, consider our options and make conscious decisions. However, if we repeat an action often enough in the same context, control gradually shifts to the basal ganglia – deeper-seated structures specialising in automation. In doing so, the brain literally saves energy. Once an action has been automated, it no longer needs to weigh things up anew each time, but instead falls back on a kind of stored 'default routine'.

Reward and repetition

A particularly fascinating study from 2025 even shows that our brain uses two separate learning systems for this: one learns from reward ("Was that good for me?"), the other simply from repetition ("I've done it that way many times before"). It is precisely this second system, independent of any reward, that forges stable habits through repeated action. This explains why we sometimes cling to a behaviour even though it has long since ceased to benefit us. Part of our brain no longer even asks whether it's still worth it.

My neuro-hack No. 1: **When I want to build a new habit, I consciously link it to an existing, already automated routine in my daily life – for example, on my way to work, after brushing my teeth or whilst the coffee is brewing. The brain loves fixed contexts, so this linking makes the most of that.**

Why '21 days' is a myth

Hardly any other figure haunts self-help guides as persistently as the '21 days to a new habit'. It does not originally stem from habit research, but from observations made by a cosmetic surgeon in the 1960s. The most important system-

atic study on this to date, conducted by University College London, paints a very different picture: on average, it took 66 days for a new behaviour to become truly automatic, with a huge range from 18 to over 250 days, depending on the complexity of the behaviour and the individual. A major new meta-analysis involving over 2,600 participants confirms this picture. The comforting thing is that a single day's break does not undo the automation, as long as you get back on track afterwards.

Neuro-hack No. 2: **I consciously do not expect perfection from myself, but rather consistency. Because I know that, thanks to its great neuroplasticity (ability to change), my brain changes as a result of my consistent behaviour and neural connections are formed. A day off or a missed opportunity is not a setback, but part of the process. This takes an astonishing amount of pressure off.**

Willpower alone is not enough

For a long time, the idea persisted that willpower was like a muscle that tires over the course of the day or can even be 'recharged' with glucose – a phenomenon also known as 'ego depletion'. However, several large, carefully controlled studies in recent years have failed to confirm this effect. The belief in limited willpower even seems, to some extent, to contribute to one's own exhaustion. In practical terms, this means: it's less worthwhile to hope for more discipline than to organise one's environment in such a way that the desired action becomes the easiest option – and the undesired one the most inconvenient.

Neuro-hack No. 3: **I deliberately put obstacles in the way of bad habits – for example, my smartphone never goes into the bedroom or onto the dining table – and make good habits as convenient as possible, such as having my sports kit ready the night before. A little friction or simplified decision-making often achieves more than grand resolutions. A specific 'if-then' plan is also more effective than the mere intention 'I want to change this': 'If I'm sitting on the sofa in the evening, then I won't even pick up my smartphone, but will put on my running shoes first.' Such pre-planned responses to familiar situations bypass the automatic routine before it can even kick in.**

> Change doesn't require more discipline. It requires better habits.

Integrating brain-friendly habits in a targeted way

Not every habit we train ourselves to adopt has to be complicated. Some of the most effective ones are surprisingly simple – we've simply forgotten how to incorporate them regularly. For me, music and exercise are right at the top of the list. Even just a few minutes of dancing, or even spontaneous singing and humming, have a direct effect on our nervous system: The vibrations produced by humming have been shown to activate the vagus nerve – our most important 'calming nerve' – thereby immediately reducing stress levels and heart rate. Particularly in tense moments – before a difficult phone call, between two meetings – this is one of the quickest, most discreet interventions I know. Contact with nature also falls into the same category. A now widely cited study by the University of Michigan shows that spending just 20 to 30 minutes in an environment perceived as 'natural' – a park, a garden, even in the middle of the city – measurably lowers cortisol levels. The benchmark here isn't hiking amidst Alpine scenery, but simply: regular, brief contact with greenery.
And finally, the body itself: rather than a single long workout, recent reviews show that short 'exercise snacks' spread throughout the day – a brisk climb up the stairs, twenty squats between two appointments – have been proven to improve mood, blood sugar regulation and even executive brain functions such as working memory and attention. Combined with carefully chosen, blood-sugar-stabilising snacks instead of sugar spikes, this keeps the prefrontal cortex functioning significantly more effectively throughout the day.

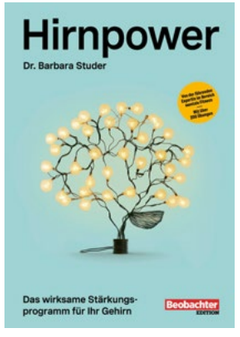
Neuro-hack No. 4: **I've got into the habit of consciously humming briefly or singing a few bars between appointments – even when I'm alone in the car or in the corridor. It feels a bit strange at first, but it has a surprisingly quick calming effect. To this end, I schedule a fixed 'green moment' every day, and if I realise I've been sitting for too long, I deliberately fit in a short exercise session before carrying on with my work – not as an extra item on my to-do list, but as part of the working day itself.**

Mindful media use to keep the brain fit

The more I understand about habits and automation in the brain, the more critically I view my own media consumption. Passive scrolling is perhaps the most highly automated habit of our time – short, unpredictable reward cues that tap into precisely the repetitive learning system we described at the start, regardless of whether the content actually helps us progress.

A second, more recent development particularly concerns me in this regard: our interaction with artificial intelligence. A study from 2025 involving 666 participants found a clear link between frequent AI use and weaker critical thinking skills – mediated by an effect known as 'cognitive offloading': we delegate the thinking to the tool instead of doing it ourselves. This doesn't mean avoiding AI – but it does mean using it consciously.

Neuro-hack No. 5: **My own rule is: think for yourself first, then bring in AI. I formulate my own assessment or solution before I even ask an AI – and then use it as a sparring partner to challenge my thinking, not as a substitute for it. That way, the thinking stays with me, and the tool becomes a complement rather than a shortcut.**



Hirnpower, the book

Dr Barbara Studer is a neuroscientist and co-founder and CEO of Hirncoach AG, an award-winning start-up offering hybrid programmes for mental fitness and health. She conducts research and lectures at the University of Bern and is a bestselling author, speaker, musician and recognised science communicator. Dr Barbara Studer's workbook *Hirnpower* is the number one non-fiction bestseller and offers a year-long programme to strengthen the brain.

Consciously strengthening connections

Perhaps the most underestimated lever for a healthy, high-performing brain is not individual at all, but social. Amy Edmondson's research and Google's well-known 'Project Aristotle' study, which examined over 180 teams over a two-year period, independently reach the same conclusion: psychological safety – the shared feeling of being allowed to admit mistakes and ask questions without being exposed – is the strongest single factor for team performance, more important than individual skills or experience.
Even though working from home is now possible almost everywhere, face-to-face interaction offers something that is difficult to replicate via video. Research into interpersonal synchronisation shows that speaking rate, facial expressions and even heart rate synchronise during direct contact – an effect that is noticeably limited via screens due to delays and the absence of secondary communication channels. This does not mean that remote working is bad for relationships, but it does mean that face-to-face meetings are not just a nice bonus, but a distinct contribution to genuine connection that cannot be fully compensated for digitally.

Neuro-hack No. 6, as CEO of Hirncoach: **I deliberately schedule regular in-person days for our team, precisely because working from home is an option – not on principle, but because I know how much trust and openness is built up in the informal moments in between, which are almost impossible to create online. And in every team meeting, I try to actively ask at least once where someone is feeling uncertain or needs support, rather than just asking for results. Psychological safety isn't created by a single announcement, but through many small, repeated signals – and in this respect, it's remarkably similar to every other habit we've discussed here.**

A personal closing thought

What reassures me most about this research is that habits aren't a reflection of character. They're a clever, very human mechanism our brain uses to conserve energy. Once you understand this, you no longer need to condemn yourself for a 'lack of discipline', but can start working with your own brain rather than against it. For me, this is where true brain power lies: not in a constant battle with yourself and your own discipline, but in the clever design of your own environment and routines.

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AI in Prevention and Oral Care: Promise, Caution, and Responsibility



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Artificial intelligence is moving from research laboratories into everyday healthcare, and oral care is no exception. From earlier detection of disease to more personalised prevention and improved access to care, AI has the potential to transform how risks are identified and managed. But better algorithms do not automatically mean better healthcare. The real challenge is ensuring that AI tools are accurate, fair, transparent, and integrated in ways that strengthen – not replace – clinical judgement.

Artificial intelligence, or AI, is becoming more visible in healthcare. In oral care, this is attracting attention because many important problems depend on noticing risks early, choosing the right preventive action, and supporting professionals who work under growing time and resource pressure.

How AI could support prevention

One of the clearest potential benefits of AI is earlier detection. AI tools have shown promising results in detecting dental caries, with reported pooled sensitivity of 85% and specificity of 90% across imaging methods [1]. This means that such tools may help identify many cases of tooth decay while also avoiding false alarms.

AI may also support prevention by helping to estimate a person's risk. Some tools can analyse protective and risk factors and use this information to suggest more personalised preventive measures. Others, such as AI-powered toothbrushes, may track brushing patterns and support better oral hygiene habits [2]. This matters because prevention is not only about treating disease once it appears. It is also about understanding who may be at risk and what support they need before problems become serious.

What AI may offer in oral care

In gum health, AI models using intraoral photographs have detected gingival inflammation with sensitivity of 92% and specificity of 94%, described as comparable to manual examination by dentists [3]. For periodontitis, AI tools using radiographs have reached accuracies of 81–99% for simpler classifications, although performance is lower when assessing disease stage or severity [4]. This distinction is important; it means that an AI tool may be good at answering a basic yes-or-no question, but less reliable when asked to judge how advanced or complex a condition is.

AI is also being studied for oral cancer and potentially malignant disorders. AI-assisted screening has been reported to distinguish abnormal from normal oral tissue with sensitivity of 89.9% and specificity of 89.2% [5]. Deep learning models have also shown high performance for detecting oral squamous cell carcinoma, with reported AUC values of 0.97–1.00, a performance comparable to or exceeding general practitioners [6,7].

Another possible benefit is access. AI could support remote screening through teledentistry, especially in places where dental professionals are scarce. For example, intraoral photographs could be uploaded by patients or community health workers, with AI flagging areas that may need professional review [7,8]. AI may also support mid-level providers by analysing images and clinical data, or help with store-and-forward consultations, where information is reviewed later rather than during a live appointment [9,10].

Why caution is needed

Despite its promise, AI in oral care should be treated with caution. A major challenge is data. Many AI models are trained on limited datasets, often from a single centre, and may not be tested enough in other real-world settings. In periodontal AI studies, external validation was absent in 90.5% of studies, raising concerns about whether tools will work equally well across different clinics and populations [4].

Bias is another serious concern. Only 2 of 10 dental imaging AI studies reported demographic characteristics, and none performed subgroup analysis across age, sex, ethnicity, or socioeconomic groups [11]. This means that even when an AI tool appears accurate in a study, we may not know whether it works equally well for everyone in a real-world context.

Transparency is also essential. Some AI systems are described as "black boxes," meaning that clinicians cannot easily understand how the system reached its conclusion. This can reduce trust and make it harder to detect or correct errors [12,13]. Clinicians need to understand enough about an AI recom-

AI should be seen as a support tool, not a replacement for healthcare professionals.

ARTIFICIAL INTELLIGENCE

mendation to decide whether it makes sense for the person in front of them.
There are also practical barriers. AI tools may be difficult to connect with older electronic health record systems or existing clinical software. They may require high initial investment, create uncertainty about return on investment, or face resistance from IT and administrative teams [14,15]. In dentistry, adoption also appears to be uneven; one 2023 survey found that only 35% of experienced dentists reported using AI tools [16].

Who may benefit, and who may be left behind

While AI could help underserved populations, especially in areas with shortages of dental professionals; the same technologies could also deepen inequalities. Algorithmic bias may worsen existing disparities. For example, machine learning models predicting foregone preventive dental care showed bias against Asian, Black, Hispanic, and other racial or ethnic minority groups, as well as low-income individuals and younger adults [17]. Smartphone-based screening may also depend on reliable internet access, smartphone ownership, and digital literacy, which are not equally available to everyone [8].
This is why AI should not be judged only by whether it works in ideal study conditions. It should also be judged by whether it works fairly, safely, and meaningfully for the people and real-world settings where it will actually be used.

Keeping humans in charge

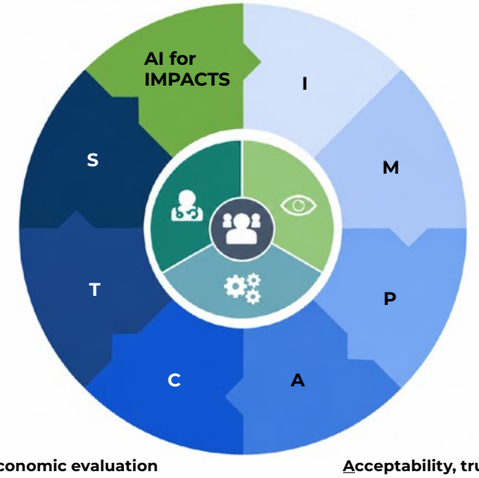
For these reasons, human judgement remains essential. AI systems do not inherently consider the consequences of misdiagnosis or act with the caution expected of a clinician [13]. Clinicians and patients also have concerns about over-reliance on AI and about who is responsible when AI-supported recommendations lead to harm [12,13].
Hence, AI should be seen as a support tool, not a replacement for healthcare professionals. Users should not rely only on AI recommendations, but should combine them with clinical expertise and patient-specific context [18]. This "human-in-the-loop" approach helps maintain accountability while still allowing AI to contribute useful information.

Asking the right questions before adoption

The concerns outlined above point to one central message: adopting AI in prevention and oral care should never be a matter of enthusiasm alone. Before an AI tool is introduced, we need to ask whether it is safe, fair, understandable, useful in everyday practice, and likely to create real value for patients and professionals. This is where assessment guides such as the AI for IMPACTS framework can provide practical guidance [19]. Developed through a collaboration between several Swiss universities and research institutions, including clinicians, AI engineers, UX experts, and implementation science experts, the framework was created to address a key gap: many AI tools are assessed mainly on technical performance, but far less often on whether they can succeed safely and meaningfully in real healthcare settings.
It asks whether an AI tool fits into clinical workflows, can be trusted by professionals and patients, protects privacy, performs fairly across different groups, is economically sustainable, and can be monitored over time. Its seven areas, highlighted in the figure below, cover integration, monitoring and governance, performance and quality, acceptability and training, cost and economic value, technological safety and transparency, and scalability and impact.
For prevention and oral care, this broader view is essential. An AI tool for detecting tooth decay, gum disease, or oral cancer should not only perform well in a study. It should also protect patient data, be understandable to professionals, be tested across diverse populations, remain safe over time, and offer real value for patients and health systems.
While AI may help make prevention and oral care more timely, personalised, and accessible; this promise will only be realised if it is implemented carefully. It is crucial that healthcare teams ask the right questions before adopting a tool, during its use, and after it has entered real-world practice. In doing so, they adopt a more responsible, ethical, evidence-based, and patient-centred approach to AI.

FIGURE 1

AI for IMPACTS



Integration, interoperability, and workflow
How seamlessly does the AI tool integrate into clinical workflows and healthcare systems?

Monitoring, governance, and accountability
How is the tool monitored, addressing model drift, data governance, and compliance with ethical standard?

Performance quality metrics
Is the model accurate, fair, explainable, reliable, and robust?

Acceptability, trust, and training
Is the AI tool accepted, trusted, and supported by adequate user training?

Cost, and economic evaluation
What are the economic implications? Is the tool cost-effective and sustainable long-term?

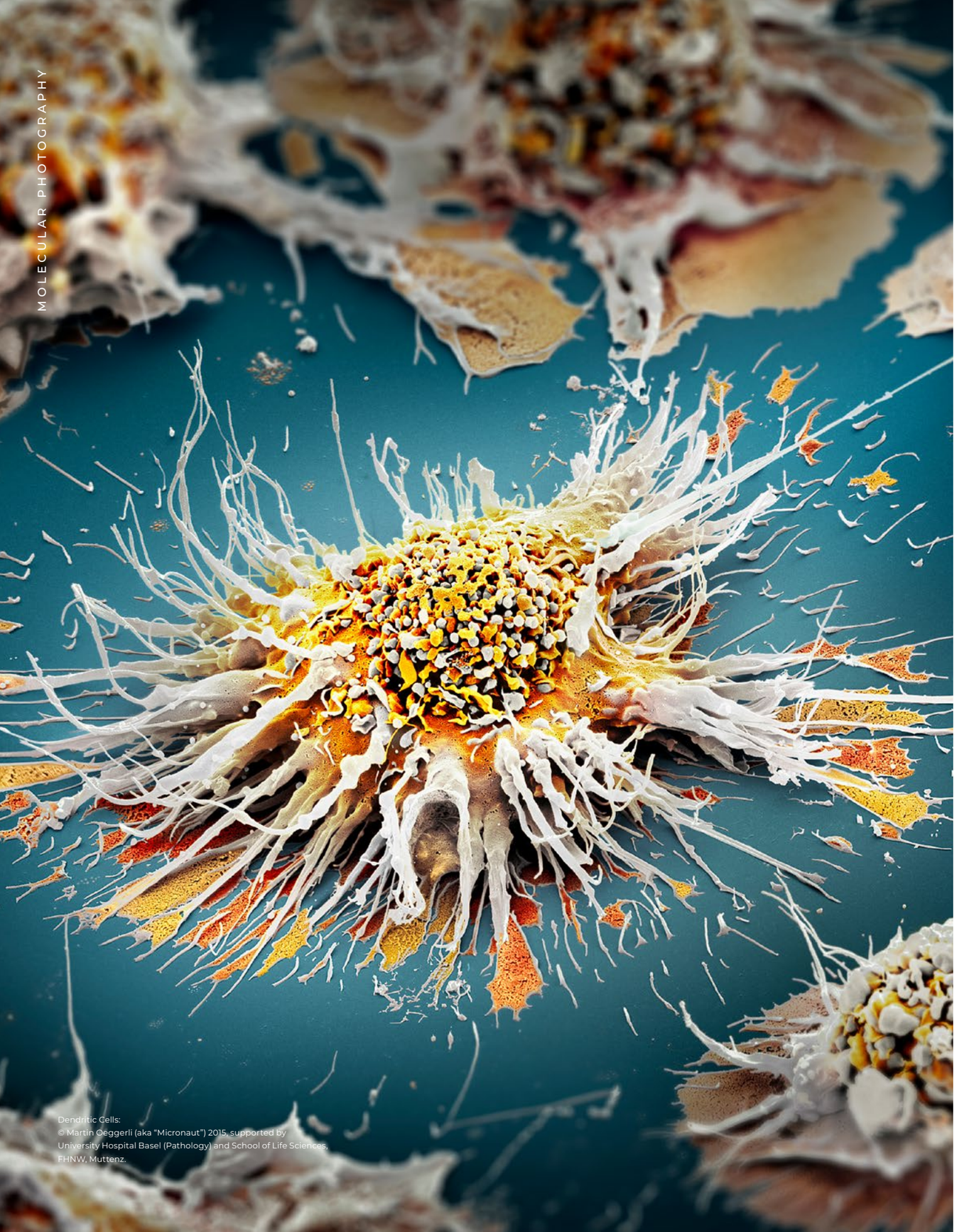
Technological safety, and transparency
What safeguards exist to ensure safety and ethical operation?

Scalability, and impact
Can the AI tool scale effectively and equitably across different settings, and what is its broader impact?

Source: Jacob et al., AI for IMPACTS Framework for Evaluating the Long-Term Real-World Impacts of AI-Powered Clinician Tools: Systematic Review and Narrative Synthesis. J Med Internet Res 2025;27:e67485. doi: 10.2196/67485

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Dendritic Cells:
© Martin Oeggerli (aka "Micronaut") 2015, supported by University Hospital Basel (Pathology) and School of Life Sciences, FHNW, Muttenz.

The Micronaut – Explorer of Invisible Worlds

MOLECULAR PHOTOGRAPHY

Author — Marcel J. Scacchi

What if the smallest structures of life could be seen as landscapes, sculptures, even works of art? Swiss molecular biologist and science photographer Martin Oeggerli makes the invisible visible. Working under the name "Micronaut", he ventures deep into the microscopic world, transforming bacteria, pollen, cells and other structures beyond the reach of the human eye into spectacular images that bridge science and art.

From cancer researcher to science photographer

Oeggerli studied biology at the University of Basel from 1994 to 2000 and earned his diploma in 2002 under David G. Senn. He went on to complete a PhD in molecular pathology and cancer research under Guido Sauter in Basel in 2005. His move into photography came almost by chance. While still working in cancer research, a colleague asked him to create colorized scanning electron microscope (SEM) images for a company's annual report. What began as a favor – and then a hobby – gradually developed into his life's work.

From 2006 onward, Oeggerli worked as a postdoctoral researcher at University Hospital Basel on a project funded by the Swiss National Science Foundation. At the same time, he began establishing himself as a science photographer and worked as a consultant for a laboratory specializing in scanning electron microscopy. For years, science and photography developed side by side, until he ultimately devoted himself fully to his visual work in 2015.

The Micronaut method

As Micronaut, Oeggerli explores some of the smallest organisms and structures on Earth: bacteria, pollen grains, insect eggs, mites and cellular structures. His primary tool is scanning electron microscopy (SEM), a technique that uses electron beams rather than light and can magnify specimens up to 500,000 times their actual size. Yet the microscope provides only part of the image. SEM records surface topography in grayscale; it does not capture color. Oeggerli therefore meticulously colors his images in post-production, in a process he calls "coloration." Combining scientific accuracy with painterly intuition, this painstaking work can take hours or even days for a single image. The results are at once scientifically revealing and visually surreal: monumental portraits of organisms and structures far too small for the naked eye to perceive in such detail. In Oeggerli's hands, the microscopic world becomes an unfamiliar landscape – strange, intricate and unexpectedly beautiful.



Martin Oeggerli

Artist, life sciences, award-winning photographer

Martin Oeggerli, born on March 7, 1974, in Riedholz, Switzerland, occupies a rare space between science and art. Trained as a molecular biologist, he has spent the past two decades transforming the invisible microscopic world into images of extraordinary beauty. He publishes his work under the name "Micronaut" – an explorer of invisible worlds.

Recognition and reach

Oeggerli's breakthrough came in 2009, when *National Geographic* published his first feature, "Love Is in the Air," exploring the extraordinary forms of pollen. He has described it as the moment he truly became a scientific photographer. Since then, his work has appeared in publications including the *BBC, GEO, Nature, Science, Cell, Vogue* and, repeatedly, *National Geographic*. His honors include two EMBO Journal Best Scientific Cover Image awards (2008 and 2010), two Bild der Wissenschaft German Prizes for Scientific Photography (2009 and 2011), and International Photography Awards in the "Special: Micro" category.

In 2022, he received the Lennart Nilsson Award, one of the most prestigious distinctions in scientific photography. His imagery has also reached audiences far beyond scientific publications: in 2020, he designed two special-edition postage stamps for Swiss Post, and his TED Talk, "Beautiful Monsters," brought his microscopic universe to an international audience. Artist Ai Weiwei has described his images as "innovative works of art."

I try to make things visible that would otherwise remain unseen.

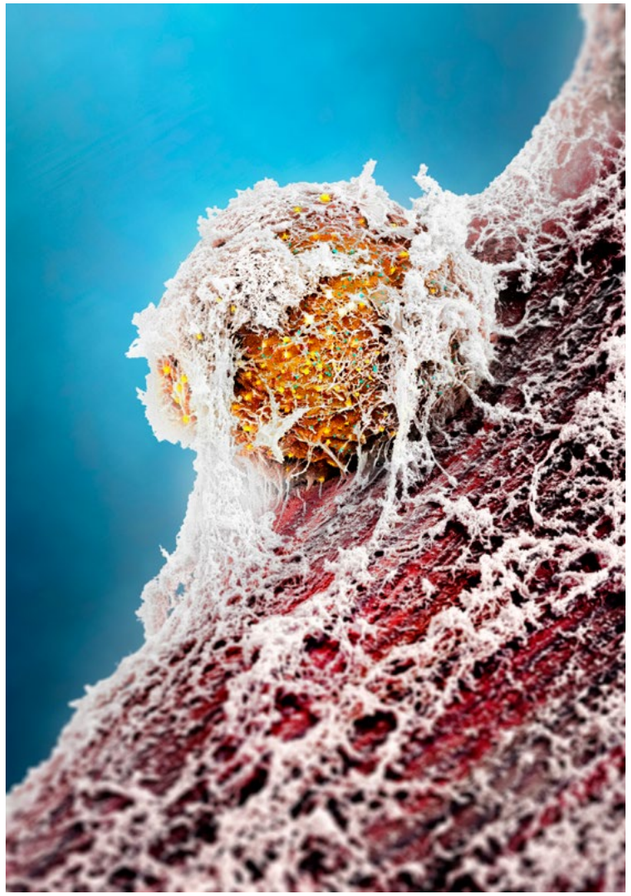
Making the invisible matter

At the heart of Oeggerli's work is a simple ambition: to replace fear of the unknown with curiosity and wonder by revealing the hidden beauty of nature's smallest designs.

Today, based in Basel and working through Micronaut GmbH, he continues to collaborate with art curators and researchers around the world. By combining scientific rigor with a distinctive artistic vision, he gives visual form to biology, immunology and the microbiome – making complex science tangible and emotionally resonant for a broad audience.

This ability is particularly relevant to the questions at the heart of AVOLA. Oeggerli's exploration of the microscopic architecture of the human body – from the oral cavity and gut to immune structures and microbial communities – creates a powerful visual connection to microbiome science and oral-systemic health. His work does more than document what science discovers: it allows people to see it. In doing so, the Micronaut turns an invisible world into something we can understand, appreciate – and perhaps even care about.

Muscle Stem Cell:
© Martin Oeggerli (aka "Micronaut") 2021, with S Dilbaz, G Santos and C Handschin, Biozentrum and Bio-EM Lab, University Basel, and University Hospital Basel (Pathology).



What Your Bowel Habits May Reveal About Your Health



Jean-Pierre Richterich, MD

Specialist in Gastro-enterology in Küsnacht ZH, FMH

Author — Jean-Pierre Richterich

Bowel movements may seem mundane, but they can offer a surprising window into our health. Emerging research links bowel habits to the gut microbiome, metabolism, kidney function and even cognitive health – suggesting that what happens in the bathroom may reflect far more than digestion alone.

The stool is not the diagnosis, but it can be a surprisingly useful window into what is happening inside us. As a gastroenterologist, I ask patients about their bowel movements almost every day. It may not be the most elegant topic of conversation, but it is often remarkably informative.

How frequently we go to the bathroom, the consistency of the stool, whether emptying feels effortless or difficult, and whether our usual pattern suddenly changes can tell us something about intestinal motility, diet, hydration and the environment in which our gut microbiota live.

But numbers alone do not capture what bowel disease can mean in everyday life. In his recent memoir My Year on the Toilet, Franck Tabouring describes with remarkable openness and dark humour how ulcerative colitis trans-



The Adult Human Microbiome:
© Martin Oeggerli (aka "Micronaut") 2012, supported by HP Martin, Swiss TPH, Basel, University Hospital Basel (Pathology), and School of Life Sciences, FHNW, Muttenz.

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The stool is not the diagnosis, but it can be a surprisingly useful window into what is happening inside us.

formed ordinary routines into a daily negotiation with pain, urgency, uncertainty and loss of control. His account is not a medical guide; it is a patient perspective, and a useful reminder that bowel function is not merely a physiological measurement. When it changes significantly, it can affect almost every dimension of a person's life. (1)

Increasingly, research suggests that bowel habits may also tell us something about the wider biological system. Two recent studies have attracted particular attention because they connect bowel-movement frequency not only with gastrointestinal health, but also with the gut microbiome, systemic metabolism, kidney function and cognitive health. (2,3)

There is no perfect number

One of the questions patients frequently ask me is: How often should I have a bowel movement?

There is no single correct answer. For one person, twice a day may be entirely normal; for another, every second day can represent a stable and healthy pattern. Frequency alone therefore does not define a healthy bowel.

What interests me clinically is the whole picture: Is this your normal rhythm? Is the stool comfortably formed? Do you have to strain? Do you feel completely emptied? Are there associated symptoms such as pain, bloating, blood or unexpected weight loss?

Nevertheless, at population level, bowel-movement frequency appears to contain interesting information.

A 2024 multi-omics study of generally healthy adults found that people at the extremes of bowel-movement frequency displayed differences in their gut microbiota and in circulating metabolites. In people with constipation, microbial metabolism shifted away from fibre fermentation and short-chain-fatty-acid production and towards greater protein fermentation, with increased production of potentially harmful metabolites. One of these, 3-indoxyl sulfate, partially mediated the association between lower bowel-movement frequency and reduced kidney function. (2)

This does not mean that constipation inevitably damages the kidneys. It tells us something subtler and, in my view, more interesting: intestinal transit influences the ecological and metabolic environment of the gut.

The intestine is an ecosystem

We often talk about the microbiome as though it were a fixed collection of "good" and "bad" bacteria. It is much more dynamic than that.

What our microbes produce depends partly on what we feed them and on how long intestinal contents remain in the colon.

When plant fibres reach the colon, certain bacteria ferment them and produce short-chain fatty acids such as butyrate. These compounds play important roles in maintaining the intestinal barrier and regulating local and systemic metabolism.

If transit becomes very slow and readily fermentable carbohydrates are depleted, microbial metabolism can shift increasingly towards proteins. This produces a different spectrum of metabolites, some of which may become undesirable when produced or absorbed in excess. (2)

This is why I prefer not to view constipation simply as a mechanical problem of stool that "does not come out". It can also reflect a change in the intestinal environment.

And then there is the brain

The intestine and brain communicate constantly through neural, immune, endocrine and metabolic pathways, the so called gut-brain axis.

A large prospective study involving more than 112,000 adults examined bowel habits, the microbiome and cognitive function. Compared with participants having approximately daily bowel movements, people reporting bowel movements only every three days or less had poorer cognitive performance. In one analysis, the difference corresponded statistically to approximately three years of cognitive ageing. (3)

Importantly, this was an association, not proof that constipation causes cognitive decline.

Yet the microbiome findings were intriguing. Less frequent bowel movements and poorer cognition were associated with depletion of some butyrate-producing microorganisms, while very frequent bowel movements were also associated with an altered microbial profile and poorer cognitive outcomes. (3)

What we eat matters, but "more fibre" is not the whole story

If bowel function and microbial metabolism are interconnected, food is one of the most obvious levers we have.

Dietary fibre remains central. An updated systematic review and meta-analysis of 16 randomised trials in adults with chronic constipation found that fibre supplementation improved treatment response and increased stool frequency. Psyllium was among the fibre types with a significant effect, although the authors also noted substantial heterogeneity between studies and more flatulence with fibre. (4)

Large observational data also support a relationship between what we eat and bowel rhythm. In more than 20,000 participants in the EPIC-Oxford cohort, higher intakes of dietary fibre and non-alcoholic fluids were associated with more frequent bowel movements. Vegetarians, and particularly vegans, also had higher bowel-movement frequencies than meat eaters. This is an association, however, and not evidence that a particular diet is automatically healthier for every person. (5)

But I would not reduce gastrointestinal health to counting grams of fibre. The source, variety and individual tolerance of food matter.

A systematic review and meta-analysis looking specifically at foods, drinks and diets in adults with chronic constipation found evidence that certain whole foods can improve selected bowel outcomes. Kiwifruit and other fruits increased stool frequency in some trials, rye bread performed better than white bread, and certain high-mineral waters also showed benefit. At the same time, the authors emphasised that evidence for individual foods remains limited and that more high-quality trials are needed. (6)

Rather than searching for one "superfood for the gut", I generally encourage patients to create an intestinal environment that works well over time. That usually means a diverse, predominantly plant-rich diet containing vegetables, fruits, legumes, whole grains, nuts and seeds; adequate fluids; regular physical activity; and as little dependence as possible on heavily processed foods.

Sometimes the simplest intervention is the right one

When somebody comes to me with uncomplicated constipation, treatment does not necessarily start with medication. We first look at daily life.

- Is there enough fibre, and was it introduced gradually?
- Is the person drinking adequately?
- Are they moving regularly?
- Do they repeatedly ignore the urge to defecate?
- Have medications changed?
- Has the bowel pattern itself changed?

Soluble bulking agents such as psyllium can be very useful and are among the interventions with reasonable evidence. But even fibre has to be individualised. In a person with pronounced bloating, pelvic-floor dysfunction or certain motility disorders, simply adding ever more fibre may make symptoms worse rather than better.

That is why treating a patient is different from treating a number.

Do not normalise a new symptom

Most variations in bowel habits are benign. But a persistent change deserves attention, particularly when it is new.

Blood in the stool, unexplained weight loss, anaemia, persistent nocturnal symptoms, significant abdominal pain or a major unexplained change in bowel habits should be medically evaluated. Likewise, chronic diarrhoea should not simply be managed indefinitely by removing foods from the diet. Food intolerances, medications, infection, inflammatory bowel disease, bile-acid disorders, coeliac disease and other conditions may need to be considered.

A small daily signal from a much larger system

The most interesting development in modern gastroenterology is perhaps that we are gradually moving away from looking at organs in isolation.

The intestine interacts with the immune system, liver, kidneys, metabolism and nervous system. The microorganisms living inside it add another layer of complexity.

We are still far from being able to look at somebody's bowel frequency or microbiome profile and predict their future health. The studies described here are largely observational, and they cannot establish that changing bowel frequency itself will prevent kidney disease or cognitive decline. (2,3)

But they reinforce something I see every day in clinical practice: digestion should not be considered an isolated function that only matters when it becomes uncomfortable.

Patient stories reinforce the same point from a different angle. A bowel disorder can affect eating, sleep, work, travel, relationships and the simple confidence of leaving home. Science helps us understand the mechanisms; patient experience reminds us why those mechanisms matter. (1)

How we eat affects our intestinal environment. That environment influences the microbiome. The microbiome produces molecules that interact with us. And sometimes something as ordinary as our bowel habits provides the first visible clue to how that system is functioning.

Perhaps that is reason enough to start paying a little more attention to what happens after we eat.

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GASTROENTEROLOGY



Promoting Periodontal Health Through Healthy Eating Patterns

NUTRITION



Dr Sanna Syrjäläinen

Dentist, clinical teacher, and post-doctoral researcher in Periodontology at the University of Turku Institute of Dentistry and HUS Helsinki University Hospital

Author — Dr Sanna Syrjäläinen

Can what we eat influence the health of our gums? A growing body of research suggests that the answer is yes. Beyond brushing and flossing, dietary choices appear to play an important role in shaping the body's inflammatory response, the oral microbiome, and ultimately the risk of developing periodontitis. While no single food can prevent or cause gum disease, evidence increasingly points to the benefits of a balanced, anti-inflammatory diet rich in fruits, vegetables, whole grains, fish, and healthy fats. As periodontitis becomes more common in ageing populations, nutrition is emerging as an important – and modifiable – piece of the periodontal health puzzle.

Periodontitis is a microbe-induced inflammatory disease of tooth-supporting tissues (1). The pathogenesis of periodontitis is multifactorial, involving a complex interplay between the subgingival microbiota and the host immune response (2). An increasing body of evidence suggests that periodontitis is linked to systemic diseases, illustrating how oral health reflects overall systemic health. In addition, the prevalence of periodontitis is expected to increase as the population ages (3), which underscores the importance of identifying modifiable risk factors to prevent the onset of the disease.

Diet is one potential lifestyle factor that may modulate host susceptibility to periodontitis, and research around this topic has been active. Diet may affect periodontal health through direct physiological actions, as exemplified by vitamin C and its role in stabilising collagen (4). On the other hand, diet can indirectly influence periodontitis by modulating the host response, such as immune function or oxidative stress. Additionally, dietary habits shape the composition of the oral microbiome (5).

Key nutrients and their impact on gum health

A variety of nutrients have been examined in relation to periodontitis. For example, through their antioxidant properties, vitamins A, C, and E are thought to protect against tissue damage caused by oxidative stress, which is one of the key pathological cascades in periodontitis (6). Vitamin D, however, is believed to protect against periodontitis via its role in bone metabolism and immunity (7).

Fairly convincing evidence also suggests a link between certain macronutrients and the development of periodontitis. A reduction of free sugars in diet (i.e. added monosaccharides and disaccharides in foods) has been associated with reduced gingival inflammation (8). Also, a higher dietary saturated fatty acid intake as well as high ratio of n-6 to n-3 polyunsaturated fatty acids (PUFAs) has been associated with an increased risk of periodontitis and tooth loss (9,10). Conversely, higher intake of n-3 PUFAs has been associated with lower prevalence of periodontitis (11,12), and omega-3 supplementation seems to enhance periodontal healing when used as an adjunct to periodontal treatment (13).

While there are plausible biological pathways for the above-mentioned nutrients to affect periodontal health, the findings from population-based studies and randomised controlled trials remain inconclusive (14).

> Diet alone does not dictate whether an individual develops periodontitis, but it serves as one important risk among many.

The whole diet approach: Beyond single nutrients

Focusing exclusively on single nutrients, on the other hand, fails to account for the inherent complexity of the diet and the synergistic interactions and intercorrelations between nutrients (15). Moreover, the effect of single nutrients may be too small to detect, whereas combining the intake of multiple nutrients into dietary patterns may provide sufficient power to detect associations. To address these issues, a whole diet approach has been adopted in many studies to analyse the overall role of the diet in the risk of periodontitis.

One common method is to use a pre-defined scoring system, where researchers evaluate a person's diet by comparing it to established nutritional guidelines or well-known healthy diets, such as the Mediterranean diet or the Healthy Eating Index (HEI) (15). A study analysing 1,197 post-menopausal women found four dietary patterns – the HEI, alternative HEI, alternate Mediterranean diet, and Dietary Approaches to Stop Hypertension (DASH) – to be associated with better clinical periodontal measures (16). Another study examining hospital patients in the UK found that lower adherence to the Mediterranean diet was associated with more severe gum disease (17). There are similar results from multiple observational studies showing a reduced risk of periodontitis in people who adhered to a healthier diet (18).

The inflammatory potential of diet

As periodontitis is an inflammatory condition, researchers are increasingly focusing on the "inflammatory potential" of the diet in relation to periodontal health. A randomised controlled trial conducted by Woelber et al. showed that shifting to an anti-inflammatory diet – rich in n-3 PUFAs, vitamins, and fibre while low in processed sugars – can significantly reduce gingival inflammation in just four weeks, even without changes in plaque levels (19). This link is further supported by large-scale, population-based studies showing that higher dietary inflammatory potential is linked with an increased risk of periodontitis (20–22).

Clinical implications and future directions

Periodontitis is a complex disease, and diet alone is unlikely to either prevent or cause it. However, given how common the condition is and the significant burden it places on both individuals and healthcare systems, identifying modifiable lifestyle factors is essential. Research into the link between nutrition and gum health has become highly active, exploring the issue from many different angles.

While diet alone does not dictate whether an individual develops periodontitis, it serves as one important risk factor among many. The core evidence supports the consumption of fruits, vegetables, unsaturated fats, whole grains, and fish, while consistently recommending the limitation of components like refined sugars, saturated fats, and processed meat products that contribute to systemic inflammation. Furthermore, maintaining a healthy weight remains a cornerstone of preventing gum inflammation (23,24). Ultimately, these principles align perfectly with national dietary guidelines worldwide. For both clinicians and policymakers, integrating nutritional awareness into periodontal care is an evidence-based strategy. Supporting and enabling these dietary changes not only improves periodontal health but also drives systemic well-being.

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Put Function First – Orofacial Fitness as the Key to Nutrition, Satisfaction and Quality of Life





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How well older adults can still chew is one of the aspects of function that most directly shapes their meals, their nutrition, and their quality of life. In geriatric assessment, simple functional markers such as gait speed and grip strength have established themselves because they measure something the patient feels in daily life. Masticatory performance belongs in the same category. It rarely sits there in practice, largely because the tools to measure it were, for many years, confined to the research laboratory. That has changed.

In a Japanese cohort of 21,881 adults aged 75 and over, objective masticatory performance carried the highest population-attributable fraction of any oral-health factor for both functional disability and all-cause mortality (1). Twenty-three per cent of the disability burden and 16% of the mortality burden in this population is statistically associated to impaired chewing. No other oral exposure outranked it, not periodontal disease, not tooth count, not denture status. This is not a peripheral outcome of dentistry. It is, in measurable terms, one of the largest modifiable oral determinants of staying alive and staying independent in late life. And yet, when we examine how dentistry actually treats older patients in Switzerland and across Europe today, function is almost never measured. We count teeth, we probe pockets, we cement crowns, we deliver dentures. We assume that if the dentition has been technically restored, the patient will once again chew, eat, and thrive. The evidence says otherwise.

Restoring the teeth is necessary. It is not sufficient.

The gap between what we build and what patients do

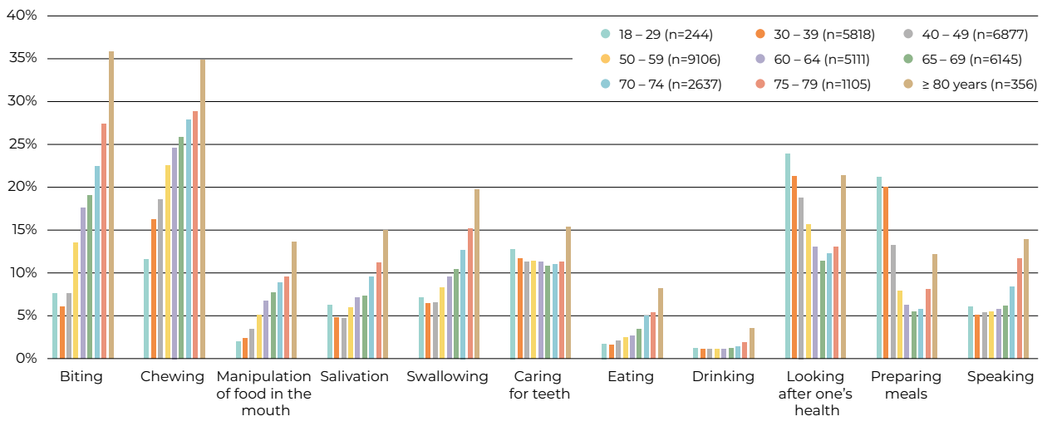
Three randomised controlled trials, one from Belfast, one from Montreal, one from Geneva, converge on a finding that should make any clinician pause. In partially dentate older adults, we showed that both the shortened dental arch concept and conventional removable partial dentures improved objective masticatory performance significantly over twelve months. Neither strategy, however, predicted the nutritional state of the patient at follow-up (2). The mouth chewed better. The diet did not improve. The Montreal group reached the same conclusion at the more dramatic end of the spectrum. Edentulous older adults rehabilitated with two-implant mandibular overdentures, for decades considered the gold standard of geriatric prosthodontics, did not, on their own, eat better than patients with conventional dentures (3). The Geneva trial in very old adults confirmed the pattern (4). Across these three studies, in three countries, in three different prosthetic configurations, the conclusion is the same. Restoring the teeth is necessary. It is not sufficient. The reason is biological rather than technical, and it is the reason the title of this article matters. The aging brain has a finite neuroplastic reserve. Re-learning to chew with a new occlusal scheme, a new bite force pattern, and a foreign body resting on the palate is a complex sensorimotor task. Patients who have spent years quietly adapting their diet to soft, processed, low-fibre foods do not spontaneously return to apples, raw vegetables, and crusty bread once their dentition has been rebuilt. The habits of avoidance, once established, persist past the cause. Kito and colleagues showed in a cluster-randomised trial that combining textured-food gatherings with structured oral and physical exercise was needed to actually shift both function and behaviour in community-dwelling older people (5). The dental chair is the beginning of the rehabilitation, not the end of it.

A framework that takes function seriously

To move beyond a tooth-counting view of oral health, we proposed in 2021 a conceptual model of oro-facial health that adapts the Swiss Meikirch Model of health (6) to oro-facial function (7). The model distinguishes two potentials that together determine whether the mouth can meet the requirements of daily life. The first is the biologically given potential, comprising the dentition you were born with and developed, the salivary glands, the masticatory muscles, and the cortical motor map. This potential inevitably declines with age, with disease, and with tooth loss. The second is the personally acquired potential, comprising the motor skills you have trained, the prosthesis-handling competence you have built, the dietary adaptations you have learned, and the coping strategies you deploy when function falters. This second potential can be trained, reinforced, and rebuilt throughout life.

FIGURE 1

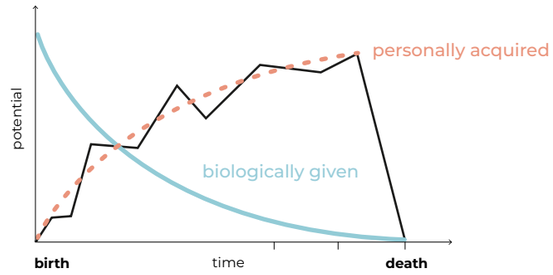
Percentage of individuals with oral impairments according to their age



Redraw from Hennequin et al Appetite 2024: Prevalence of participants with at least one impairment in each ICF item across various age groups (N = 39 597).

FIGURE 2

Biologically given potential



Reference: Schimmel et al. 2021

Orofacial fitness, in this framework, is the state in which the two potentials together suffice to meet the requirements of life: sensing, tasting, biting, chewing, swallowing, speaking, smiling, expressing emotion, sharing meals. Oral hypofunction is the state in which they do not. The framework is patient-centred and deliberately positive. It asks not only what is broken in the mouth, but whether the person sitting in front of you can meet the demands of their daily life. It puts function, and the trainability of function, at the centre of clinical reasoning.

This European framing converges with, but is broader than, the Japanese concepts of oral hypofunction (8) and oral frailty (9). The Japanese diagnosis of oral hypofunction requires three or more of seven impaired items: oral hygiene, oral dryness, occlusal force, tongue-lip motor function, tongue pressure, masticatory function, and swallowing. The signal of these concepts is consistent across continents. What has been missing in routine European practice is a feasible way to measure orofacial fitness at the chairside.

A test that fits in a drawer

For decades, chewing function in research was assessed with laboratory comminution tests. Patients chewed a fixed number of cycles on standardised material, the bolus was sieved, and particle size distributions were calculated. These methods are valid but unfeasible outside a research setting. In clinic, we relied on what patients told us, which correlates only weakly with what they can actually do (10).

The two-colour chewing-gum mixing ability test changed this (11,12). The patient chews a bi-coloured chewing gum, the Hue-Check Gum©, for twenty chewing cycles. The bolus is flattened to a one-millimetre wafer between two transparent sheets. The wafer is then either graded visually on a five-point scale, from SA1 (essentially unmixed, with cusp impressions still visible) to SA5 (a single uniform colour), or scanned and analysed opto-electronically with the ViewGum software, which calculates a standard deviation of hue across the wafer. A low standard deviation of hue means a homogeneous bolus and a well-functioning chewer. A high value means impaired mixing and a patient who has likely been adapting their diet for some time.

The test takes ninety seconds. The materials cost less than one Swiss franc per patient. It requires no electricity. It is feasible in a private practice, in a hospital ward, in a nursing home, and at the bedside of a frail patient who cannot be transported.

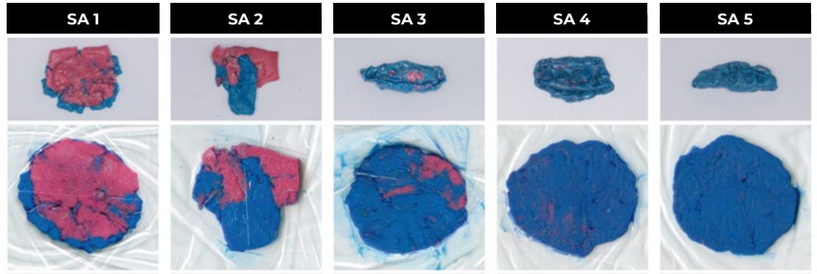
How does this look at population scale? In a study of more than 40,000 adults in the French NutriNet-Santé cohort, in which we applied the Hue-Check Gum together with the International Classification of Functioning, Disability and Health framework, the prevalence of impaired chewing rose steeply with age (13). In adults aged 18 to 29, around 11% showed chewing impairment. In adults aged 80 and over, that figure rose to roughly 35%. Parallel age gradients were seen for biting, manipulation of food in the mouth, and swallowing. This is the population in which the orofacial-fitness framework predicts that the gap between biologically given and personally acquired potential begins to bite, and the instrument detects exactly what the model predicts, at a scale and in a Western European population that no previous study had documented.

Two recent developments have moved this instrument from a research tool to a clinical and regulatory standard. The first is international endorsement. The 2023 ID-COSM consensus, the official core outcome set for implant dentistry clinical trials developed under the COMET methodology, explicitly names masticatory function in the Function core domain, and explicitly names this instrument (14). Any implant trial published after 2023 that ignores masticatory function is now, by international consensus, methodologically incomplete.

The second is the emergence of defensible thresholds. Until recently, clinicians using the test lacked a population-based cut-off for the boundary between normal and impaired. A study published by Hennequin et al. this year established normative reference values in healthy young adults with intact dentition and physiologically normal chewing: at twenty chewing cycles with Hue-Check Gum, the lower bound of normal corresponds to a mixing percentage of approximately 85% and a standard deviation of hue of approximately 0.13 (15). A complementary cut-off for care-dependent older adults, the population where the clinical stakes are highest, was proposed by Imamura and colleagues at approximately 0.43 (16). In daily practice, the visual SA scale is often enough. A bolus graded SA1 or SA2 should trigger a conversation about diet, about nutrition, and about training, not only an adjustment of the denture (17).

FIGURE 3

Subjective Assessment Scale (SA) Evo 5 to assess the Hue-check Gum®



SA1 to SA5 visual scale of the chewed gum wafers.
The brief: a five-image strip showing graded mixing from poor to perfect, captioned with the clinical interpretation at each level.
SA1 and SA2 are the red flags. SA3 is borderline. SA4 and SA5 are unimpaired.

Reference: Eggimann et al.

A question worth asking

Switzerland reached a demographic threshold this spring. For the first time in the country's history, residents aged 65 and over outnumber those under 20. Life expectancy stands at 86.3 years for women and 82.7 years for men (17). The population requiring complex oral rehabilitation, and the population in which oral function determines real-world health, is no longer a minority of dental practice. It is becoming the majority of what we will do for the next thirty years.

Switzerland has chosen, deliberately and consistently, to keep dental care (besides well- defined exceptions such as genetic disorders, or tumour treatment) outside basic health insurance. That is not the discussion this article seeks to open. The discussion this article seeks to open is narrower and, we believe, defensible across the political spectrum. In Swiss long-term care, third-party payers already fund a range of preventive and rehabilitative interventions for care-dependent older adults: physiotherapy after a fall, occupational therapy after a stroke, nutritional counselling in cases of documented malnutrition, swallowing assessment after aspiration. The question worth asking is whether structured assessment of orofacial fitness, and the preventive interventions that follow from a positive screen, such as nutritional counselling, oro-motor training, preventive measures and denture optimisation in the institutional setting, belong in that same category for the frail and care-dependent population.

The instrument to identify the at-risk population now exists, material costs less than two francs per assessment, has been endorsed by international consensus, and produces interpretable distributions in real European populations (17). What the present generation of clinicians and researchers can offer is the measurement. What follows from that measurement, in clinical pathways, in nursing-home quality indicators, in the architecture of long-term care, is a conversation for the broader AVOLA community, for clinical specialists, for payers, and for policymakers to have together.

The WHO Global Oral Health Action Plan 2023–2030 (19) and the Bangkok Declaration adopted in November 2024 (20) commit signatories to integrating oral health into universal health coverage by 2030. The declaration's central commitment, that there is no health without oral health, is operationally empty unless we can measure what we promise. Function is measurable. The instrument exists. How we use it is the question now in front of us.

Where this leaves the clinician on monday morning

For the dentist seeing patients next week, the practical message is short. Consider screening every patient aged 65 and over with a chewing-gum test at first contact and at each recall. An SA1 or SA2 result is a red flag. A standard deviation of hue above 0.13 in a community-dwelling older adult, or above 0.43 in a care-dependent patient, is a red flag. A red flag is not necessarily a reason to make a new denture. It is a reason to talk about what the patient is eating, to consider referral for nutritional counselling, to think about oro-motor training, and, where prosthodontic work is also indicated, to plan that work as part of a functional rehabilitation rather than as the whole of it. We have, for the first time, an inexpensive, validated, internationally endorsed way to measure one of the largest modifiable oral determinants of healthy ageing. Whether and how this measurement enters care pathways, guidelines, and quality assurance in long-term care is a question that the AVOLA community is well placed to take up.

A diagnosis in search of an instrument

The 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, jointly developed by the European Federation of Periodontology and the American Academy of Periodontology, introduced the staging and grading framework that periodontists across Europe now use every day (21,22). Its central innovation — separating the severity of past destruction from the complexity of future management — was overdue and is a real advance.

The complexity criteria for Stage IV, the most severe and most demanding category, begin with a single phrase: need for complex rehabilitation due to masticatory dysfunction, secondary occlusal trauma (tooth mobility degree ≥2), severe ridge defects, bite collapse, drifting, flaring, less than 20 remaining teeth (10 opposing pairs) (21). Masticatory dysfunction is listed first. It is one of the defining features that distinguishes a Stage IV case from a Stage III case — that is, a patient with severe periodontitis from a patient with severe periodontitis whose rehabilitation will be complex.

The classification does not, however, specify how masticatory dysfunction is to be measured. There is no recommended instrument, no threshold, no protocol. Clinicians assign the stage on the basis of overall clinical impression. Two experienced colleagues looking at the same patient may reasonably disagree about whether dysfunction is present, and the system gives them no objective tiebreaker.

This is the same gap, in a different specialty, that this article describes in older adults receiving prosthodontic care. A name has been given to the phenomenon, but the phenomenon has not been operationalised. The validated chairside instruments now exist to close the gap. A ninety-second Hue-Check Gum test and an SA scale reading would give a periodontist staging a complex case the same kind of objective anchor that probing depths give for severity. The 2018 framework would lose nothing of its conceptual clarity and would gain a measurable definition of one of its central terms. We see this not as a critique of the framework, but as a constructive completion of it.

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ORAL HEALTH PROGRAMM

Oral Health Care in Greenland: Delivering Moder n Dentistry Across the Arctic



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Authors — Dr Bo Danielsen and Dr Arinnguaq Filskov

Greenland's vast distances, harsh Arctic climate, and scattered population present unique challenges for healthcare delivery. Despite these obstacles, the country has developed a comprehensive public dental service that reaches even the most remote settlements. A strong focus on prevention, locally adapted education, and close collaboration within communities has led to remarkable improvements in the oral health of Greenlandic children and adolescents.

Greenland's ice sheet is more than 3 km thick at its deepest point. The inhabitable 20% of Greenland lies along the periphery, primarily in the south and west. There are a total of 56,700 inhabitants living in 71 geographical locations. Transportation between settlements originally took place by dog sled and boat, but today it is carried out by ship and aircraft. There are no roads between towns. Thus, people live quite scattered about.

The healthcare system operates health stations in all locations. In the larger settlements, healthcare personnel are assigned and handle a wide range of tasks. In many instances challenges and problems are resolved locally within the community. Care for the community and for others is very widespread and permeates society. This is clearly felt when meeting Greenlanders. The desire for collective success is often far greater than the pursuit of individual success—an approach that helped ensure survival and success in earlier times.

From traditional diet to modern oral health challenges

The geography and the Arctic environment form the framework of Greenlandic society. Nature is rich in food sources. From the sea come fish, shellfish, seals, and whales. From the land, hunting yields reindeer, musk oxen, hares, and many different birds. These were the original sources of food for the Greenlandic population. They also provided materials for clothing, kayaks, boats, and lighting.

Today, sheep farming and the cultivation of hardy vegetables take place in the inner fjords of southern Greenland. Challenges related to transportation and climate make the import of fresh food very expensive compared to frozen and preserved products. As a result, many sugar-rich products are easily accessible and relatively inexpensive.

The original Inuit diet was not particularly cariogenic, but with the increasing import of carbohydrate-rich foods escalating in the 1950ties, both the frequency and severity of dental caries

have increased dramatically. A similar development is seen in other Arctic populations.

Building a nationwide dental service

Therefore, need for dental care has emerged and became an important part of the public healthcare system. In larger towns dental clinics are staffed by dental teams consisting of dental assistants, dental hygienists, clinical dental technicians, and dentists. In smaller towns, the permanent staff varies. In some places there are dental assistants and hygienists, with dentists present only during certain periods of the year. Small settlements with few inhabitants receive visits from mobile dental teams, with the frequency depending on the population size.

With spectacular views of icebergs from the clinic windows, dental practice in Greenland encompasses a wide range of settings. Professionals may work in modern, well-equipped dental clinics in larger towns as well as less equipped facilities in remote settlements with as few as 50–100 inhabitants. Outreach visits to these settlements generally last up to one week and involve travel by boat or helicopter, while dog sleds have occasionally been used for transportation in more remote areas.

Prevention as a national strategy

Due to the high prevalence of dental caries in the population, a national preventive program targeting children and adolescents was introduced. The strategy focused on improving oral health through systematic, population-based and individual approaches to health promotion and prevention initiatives implemented across the entire country. As part of the program, annual oral health registrations were established for selected age groups allowing for continuous monitoring of dental status and evaluation of the health promotion and preventive program. Comprehensive data on caries prevalence among children and adolescents are available.



The logo of the Dental services in Greenland

Significant improvements in children's oral health

Data on the caries prevalence among children and adolescents illustrate marked improvements over time following the implementation of the national strategy. To provide two concrete examples, we illustrate data for 6 year olds and 15 year olds.

Among 6-year-olds, the proportion of children and adolescents without need for operative treatment has increased substantially from 25% in 2008 to 50% in 2018, reflecting a notable positive development in early childhood oral health. Although a slight decline has been observed in more recent years the overall level remains considerably higher than at baseline.

A similar, though more gradual, improvement has been observed among 15-year-olds. In 2008, only 14% of this age group were without need for operative treatment. This proportion increased to 31% in 2018 and further to 39% in 2025, demonstrating a steady and sustained improvement over time, albeit from a lower starting point.

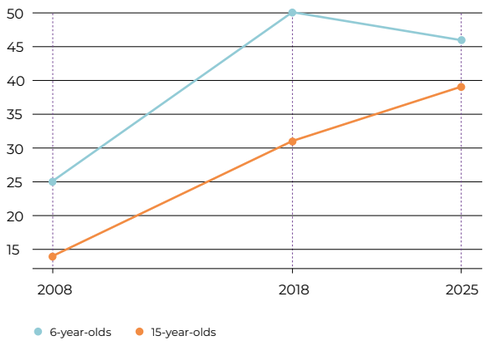
Delivering care across a vast country

Most of the population are receiving modern dentistry provided by the professionals of the dental team in modern clinics. The subpopulation living in the smallest settlements has access to a more sporadic dental care service in connection with visits from dental staff to the settlement. This means that more radical treatment choices may be necessary.

To this day, children and young people are prioritized if staffing resources become scarce. Then adults are then offered a limited range of treatments until full restorative care becomes available again. Clinical dental technicians travel around providing dentures and partial prostheses for those with major tooth loss.

FIGURE 1

Caries and gingivitis in 9-year-old children



Proportion of caries without cavities among 6- and 15-year-olds in Greenland in 2008, 2018, and 2025. A marked improvement is observed over time, particularly among 6-year-olds, with a doubling in the proportion of caries-free children from 2008 to 2018, followed by a slight decline by 2025. Among 15-year-olds, a steady increase is observed across the entire period.





Outreach visits involve travel by boat or helicopter – and occasionally even by dog sled.



Education and the greenlandic dental workforce

Dentists and clinical dental technicians are trained in Denmark. Most of the dentists are recruited from Denmark. The dentist provides dental services. When people need dentures, they are serviced by clinical dental technicians that go around the country. They provide their service from the clinics in the cities, and the health stations in the smaller communities.

Dental assistants and dental hygienists are trained locally through programs tailored to the specific tasks they face in Greenland. A strong emphasis has been placed on enabling these professionals to provide health promotion and preventive care. The education programs have been conducted locally, with special consideration of the challenges of the work and the unique conditions in Greenland. Dental assistants and hygienists are bilingual, allowing them to work with citizens in both Greenlandic and Danish.

Society, community and the artic way of life

In Greenland, you cannot own land in the same way as in most other countries. All land belongs to Greenlandic society. Instead of buying and owning a plot of land, you can apply for and obtain a right of use to a specific area for a particular purpose, such as housing. The right of use is typically granted without a fixed end date and remains valid as long as the conditions are met. The right of use can be revoked if the land is not utilized, if the terms are violated, or if society needs the land. You own the building you build, but not the land on which it stands. It is possible to sell a building and at the same time transfer the right of use to the land, provided that the authorities approve it.

Traditionally, hunting was a communal activity that provided food while strengthening social cohesion and cooperation within Greenlandic communities. Today, many locals still make use of nature for hunting, fishing, and berry picking. Trophy hunting attracts many foreigners to Greenland, just like those who wish to experience its many unique natural attractions.

The Business of Living Longer

Author — Angel Gonzalo

Living longer, ageing more healthily, delaying the onset of disease – the vision of the longevity movement fascinates researchers, investors and health-conscious individuals alike. Yet whilst tech entrepreneurs with billions at stake are banking on biotechnological breakthroughs, experts are calling for a more level-headed approach. Swiss author and financial expert Harry Büsser has spent seven years investigating the longevity hype and has reached a nuanced conclusion. A story between science, billion-dollar investments and the search for the fountain of youth.

The quest for a long life has been with humankind for millennia. Alchemists once sought the philosopher's stone; later, wealthy individuals had themselves cryopreserved after death – in the hope of one day being brought back to life. Worldwide, there are several hundred individuals currently being stored in tanks of liquid nitrogen. However, based on existing scientific knowledge, resuscitation is deemed impossible.

This requires the modern longevity movement to take a much more pragmatic approach. Its goal is not immortality, but the extension of healthy life expectancy. The aim is for people to remain physically fit, mentally alert and free from chronic diseases for as long as possible. The focus is not merely on the number of years lived, but on the quality of those years.

Billion-dollar market with great promise

Hardly any other field of future medicine is currently attracting as much attention as longevity. Prominent technology entrepreneurs such as Larry Page, Sergey Brin, Jeff Bezos and Sam Altman are investing billions in research projects designed to slow down or even reverse the ageing process.

The economic stakes are sky-high. The global longevity market is currently estimated at around 22 billion dollars – and set to almost triple by 2035. The number of companies offering dietary supplements, diagnostic programmes, anti-ageing therapies or biological rejuvenation treatments is growing accordingly.

Harry Büsser, author of the book Longevity – 50 Antworten rund ums längere Leben (Edition Beobachter, 2025), believes this is precisely why caution is called for. The former business and finance journalist views the industry with the same scepticism he uses when analysing financial markets: "So far, the longevity scene has promised a great deal and delivered comparatively little", is his blunt conclusion. Whilst the research is fascinating, he notes, there is often a considerable gap between scientific hope and verifiable results.



LONGEVITY

When mice became Methuselahs

Büsser first became aware of the longevity movement through the substance nicotinamide mononucleotide (NMN). It occurs naturally in various fruits and vegetables and is regarded as an important building block of cellular metabolism.

NMN gained international attention partly through the work of Harvard researcher David Sinclair, who, based on animal experiments, pointed to possible life-extending effects. Studies in mice yielded remarkable results.

In humans, however, the findings are considerably less encouraging. In a randomised, placebo-controlled trial involving 66 adults, there was no robust evidence of a clear benefit over the placebo. A pattern that, according to Büsser, is frequently repeated in longevity research: promising results in the laboratory, but so far little substantial evidence in humans.

It's a similar story with rapamycin. The drug has been used successfully for decades in organ transplants because it suppresses the immune system, thus preventing rejection reactions. In animal trials, rapamycin extended the lifespan of older mice by up to 60 percent – a spectacular result.

In humans, however, the use of rapamycin is a sensitive issue due to potential side effects and its immunosuppressive action. There is as yet insufficient evidence to show whether lower or intermittent doses offer any benefit to healthy people. Intensive research is currently underway into rapamycin derivatives designed to retain the potential anti-ageing effect whilst minimising the immunosuppressive side effects. However, these approaches are still at an experimental stage.

The allure of rejuvenation

Methods reminiscent of science fiction are particularly appealing to the media. These include the idea that young blood can rejuvenate older organisms. This concept became widely known through the American entrepreneur Bryan Johnson. By his own accounts, the tech millionaire invests around two million dollars a year in optimising his personal health. A team of doctors monitors his body round the clock, his diet is meticulously planned, and he takes dozens of dietary supplements every day. In 2023, Johnson made headlines worldwide when he arranged for blood transfusions to take place between himself, his son and his father. The idea was based on older studies in mice which had provided evidence of possible rejuvenating effects from youthful blood. However, Johnson's scientific case proved to be weak. Despite this, commercial models based on the concept briefly emerged. The Californian company Ambrosia started offering young blood plasma for several thousand dollars before the US Food and Drug Administration explicitly warned against such services, pointing to a lack of clinical benefit and the potential risks.

What actually works

The deeper Harry Büsser delved into the subject, the clearer it became to him: the most effective ways to achieve a long and healthy life are surprisingly unspectacular.

Regular exercise, a balanced Mediterranean diet, sufficient sleep, social interaction, and avoiding tobacco and excessive alcohol consumption are still among the best-evidenced measures. "Essentially, these are the same recommendations that our grandparents were already familiar with," says Büsser. As an example, he cites the Japanese island of Okinawa, which is known for its exceptionally high number of centenarians. The traditional diet is based on vegetables, sweet potatoes, seaweed and herbs. People eat according to the principle of Hara Hachi Bu – stopping when they are around 80 percent full.

The role played by genes is also noteworthy. Contrary to widely held belief, they account for only a small part of our life expectancy. Our lifestyle, habits and social environment have a greater impact.

Between vision and science

Anyone wishing to understand the full scope of the ideas behind the longevity movement cannot ignore Aubrey de Grey. For decades, the British biogerontologist has been regarded as one of its most charismatic proponents. Harry Büsser has held several in-depth conversations with him.

De Grey puts forward the theory that ageing is not an inescapable fate, but a biological defect that can one day be medically remedied. His boldest predictions suggest that the first person to live to over 1,000 years of age may already have been born. For him, old age is a disease – and any disease can, in principle, be cured.

As visionary as these ideas may seem, the scientific advances of recent years cannot be entirely dismissed. Particularly high hopes are riding on stem cell research and so-called cell reprogramming. Among the most high-profile players is Altos Labs, a billionaire-funded biotechnology company backed by, amongst others, Amazon founder Jeff Bezos.

Altos is researching methods by which ageing cells could be restored to a younger biological state. These methods are based on the so-called Yamanaka factors, named after the Japanese Nobel laureate Shin'ya Yamanaka. They make it possible to revert specialised body cells to a stem cell-like state and then reprogramme them in a targeted manner.

These techniques are still largely experimental, and research is still a long way from large-scale clinical application. Nevertheless, many scientists consider cell reprogramming to be one of the most promising approaches in modern ageing research. Harry Büsser also thinks it entirely conceivable that significant progress will be made over the next ten years. Whether this will actually lead to a path towards biological rejuvenation, however, remains one of the most exciting unanswered questions in medicine.

Who benefits from a long life?

Beyond medical considerations, longevity also raises social and ethical issues. Critics view the multi-billion-dollar investments not so much as a humanistic project as an attempt by a wealthy elite to buy themselves additional healthy years of life. The question is therefore not only whether we can live longer, but also who will have access to these opportunities. What would happen if, in future, people remained healthy for ten, twenty or thirty years longer? What consequences would there be for pension systems, healthcare costs or the labour market? Could new forms of social inequality emerge? For Büsser, these are questions that go far beyond medicine. They have implications for society as a whole.

The real challenge

Scepticism aside, Harry Büsser by no means regards longevity research as a dead end. Significant advances are entirely conceivable in upcoming years in the fields of stem cell research, regenerative medicine and cell programming. The key question, however, is not whether people might one day live to be 150 or even 200 years old. What is far more important is to reduce the number of years between good health and illness. If we succeed in significantly reducing the period of chronic ailments at the end of life and extending the years of good health, much will already have been accomplished – for the individual as well as for society. Perhaps, then, the future of longevity lies not in the dream of attaining immortality, but in a more modest yet realistic vision: living a longer, healthy life, rather than simply living longer.

Artificial intelligence for more healthy years of life

Artificial intelligence is emerging as one of the most important technologies in modern medicine. It is already helping doctors to interpret X-ray, CT and MRI images, identify abnormalities in large volumes of data and take on time-consuming documentation tasks. This speeds up the diagnostic process and reduces the workload on healthcare professionals.

AI opens up new possibilities, particularly in the field of longevity. By analysing health data, laboratory results, genetic information and data from smart watches or other wearables, individual health risks can be identified at an earlier stage. In future, conditions such as cardiovascular disease, diabetes or cancer could, in some cases, be detected before the first symptoms appear. At the same time, AI enables more personalised medicine, in which treatments and preventive measures are better tailored to a person's individual needs.

Despite these advances, people remain first and foremost: AI supports medical decision-making but replaces neither medical expertise nor personalised care. For the technology to realise its full potential, high data protection standards, secure systems and well-trained professionals are crucial. Thanks to a strong research landscape, innovative healthcare institutions and targeted digitalisation initiatives, Switzerland is one of the countries particularly well-placed to help shape the future of AI-supported medicine.



Harry Büsser

Author, financial expert and longevity specialist

Harry Büsser studied business administration, specialising in risk management, at the University of St Gallen (HSG); he is a CFA charterholder and spend many years working as a journalist. He has received numerous awards for his articles on economic and financial topics. Today, he is a subject matter expert at the comparison service Comparis – specialising in property, insurance, the healthcare system and health insurance providers.

His book "Longevity – 50 Antworten rund ums längere Leben", published in 2025 by Edition Beobachter, presents a critical yet open-minded assessment of a growing area of research.

Büsser examines which interventions are scientifically sound – and where hope, hype or marketing predominate.

Büsser already had an interest in longevity whilst working as a journalist. As editor-in-chief of a luxury magazine, he wrote extensively about the quest for a longer, healthier life. His research took on a personal dimension when he became a father at the age of 50: would he still be fit enough to go skiing or play tennis with his daughter when she grew up?

As a financial coach, Büsser is accustomed to differentiating between promise and reality – an approach he also applies to longevity. While much has been promised, little has been delivered so far. Despite encouraging approaches, the 'fountain of youth' remains elusive. In his book, Büsser provides a measured assessment of these advances and questions the movement's core narratives – without fundamentally denying the fascination with the research.

LONGEVITY

A Brief History of the Toothbrush



Author — Marcel J. Scacchi

Modern societies teach their members about health and cleanliness. But people used to brush their teeth even before that. Learn how the 'toothbrush tree' got its name, and what the Prophet Muhammad has to do with oral hygiene.

He was fifty years old and had never seen a toothbrush before. He lived in a mountain village in Montenegro. His name was Popović. He watched two tourists brushing their teeth. The tourists aroused his curiosity. When they left, they gave Popović one of their brushes. This was to have dreadful consequences for him.

In October 1933, a correspondent for the New York Times reported on the trial in the Popović murder case. The report revealed a slight air of arrogance towards Europeans who were 'behind the times' when it came to oral hygiene. This was unjustified, as the toothbrush only became an everyday item in the USA in the 1930s. As late as 1927, only one in seven Americans owned one. And of those, only one in five even knew how to use it properly! There were tooth-brushing competitions in New York. Schoolchildren competed against one another with the aim of demonstrating the best brushing technique. For a long time therefore, oral care was by no means a given, and the American press repeatedly reported on people who had accidentally swallowed their toothbrush whilst brushing their teeth and had to undergo surgery to have it removed.

Dramatic consequences

Popović was not as clumsy as these Americans. He used the gift every day, always at the water pump in his garden. He certainly expected positive results for his oral health, and he was right. But he misjudged the reaction of those around him. Rumour had it that strange things were happening in the area. The other villagers thought this must have something to do with the devil. And what else could have summoned Satan's presence, if not this daily ritual of sticking a wooden stick in one's mouth? Thirteen men sought out Popović in his little cottage one night and beat him to death. Ever since the world and Montenegro had existed, the Montenegrins had had good teeth and no reason to clean them. To change this was the work of the devil and had to be stopped. That is what the mayor of the municipality said in court; he too was one of the men who had ganged up to beat Popović to death.

The dental prophet

Since then, fanatical religious violence has not gone away. And given the horror it causes, it seems rather out of touch to pause whilst brushing one's teeth, mouth full of foam, to look at the toothbrush in one's hand and ponder its history. But perhaps it takes one's mind off other things.

In any case, as one ponders, one finds oneself thinking of a dental hygiene expert named Muhammad, around the year 600 AD. Yes, that very same Muhammad who one must refrain from caricaturing if one wishes to show up alive – or at least in good health – in front of the bathroom mirror again tomorrow. The Prophet recommended



On the left: Toothbrushes with horsehair bristles, London, England, 1870–1920. Credit: Science Museum, London, CC BY.

cleaning the mouth with a twig called a ‘siwak’. Derived from ancient Indian customs, the technique had become widespread in the Arab world at that time.
From an environmental perspective, the use of the siwak makes total sense. The ends of the twigs were chewed or split open. The wood fibres, which then splayed apart, were used to clean the teeth and the spaces between them. The wood of Salvadora persica, known today as the toothbrush tree, was particularly suitable.
It does, in fact, contain a certain amount of fluoride. According to one biographer, Muhammad was so convinced of the benefits of good oral hygiene that he cleaned his teeth with a siwak even shortly before his death. Prior to this, one of his wives had moistened the stick with her saliva.

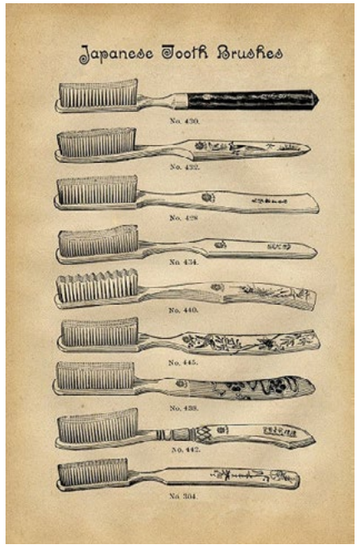
For a long time, oral care was by no means a given.



Origins in China
Anyone who currently has several spouses, or possibly none at all, or maybe just one who takes a less hand-on approach to oral hygiene than that particular spouse, would probably be better off sticking with the type of implement that Popović used. Its origins lie in China. A model with an ivory handle and horsehair is said to have been used there as far back as the year 1000. The rustic version from around 1500 – made of cattle bones and pig bristles – proved more successful. At some point, after a lengthy delay, it also became established in Europe and North America.

Biting down
It is shocking how long it took the supposedly innovative West to get used to regular toothbrushing, despite brushes being readily available. The problem is usually illustrated by horror stories from the ‘rotten-toothed’ Middle Ages. But there’s no need to go back that far. During the American Civil War of 1861–1865, there were plans to issue Union soldiers with gunpowder and other ammunition in small paper bags. These were to be torn open with their teeth at the battlefront, as they would not have both hands free whilst holding their weapons. In theory, half a dozen teeth in roughly the right arrangement would have been enough to open a small bag; in practice, however, they were quite often missing!
As late as 1916, during the First World War, a third of American volunteers failed the ‘six-teeth test’.

Discovering a foaming cream
Such findings heralded a new era, and modern societies soon set about educating their members in cleanliness and health. Medical professionals had always known what needed to be done; social reformers put the concepts into practice. However, the high cost of pig bristles stood in the way of widespread prevention measures.









The wealthy, at least, could afford toothbrushes and, in the 19th century, dipped them into pots containing increasingly sophisticated contents. An innovation at the time was a cream that foamed up in the mouth. The idea caught on. A little later, the son of an American toothpaste manufacturer travelled to Paris and spent his time hanging about in artists’ studios. The tube-like objects from which the painters squeezed their paints onto their palettes caught his eye. He passed this observation on to his father and from 1892 onwards, consumers became familiar with the toothpaste tube.

The plastics revolution
In October 1938 – and it was high time – the pig bristle era came to an end. In New York, the chemical company Du Pont announced a particularly flexible synthetic fibre. The managers envisaged a world full of nylon stockings, nylon cling film and nylon fishing lines. They also announced which radically innovative product would be the first to hit the market: toothbrushes with nylon bristles. These were much softer than those made from boar and sow bristles and, above all, affordable.
If one overlooks the plastic pollution plaguing our planet, the history of the toothbrush has since entered its golden age. Toothbrushes and toothpastes designed to combat tooth decay have been on the market since the mid-1950s. So we have everything we need.

The wealthy, at least, could afford toothbrushes and, in the 19th century, dipped them into pots containing increasingly sophisticated contents.

The path to the modern age
That said, some questions remain unanswered, and this is where solid research comes into its own. Should one brush before or after breakfast? Floss or use an interdental brush every day? But the trickiest question of all is: manual or electric?
Back in the mid-20th century, the Geneva-based microbiologist Philippe-Guy Woog – who had suffered from severe gum disease as a young man – had already championed the use of electricity. He sought a solution to his problem and ended up developing the modern electric toothbrush (‘Broxodent’), which has been available since 1954.

Tidbits of Science

Gut microbes control our heart via the brain

Previously unknown gut-brain-heart axis could pave the way for treatments for high blood pressure and heart failure.



A metabolite produced by bacteria in our gut controls heart function via cells in the brain. A team from the Max Delbrück Center has described this previously unknown gut-brain-heart axis in Circulation Research. It points the way towards potential treatments for high blood pressure and heart failure.

Millions of people worldwide suffer from high blood pressure or heart failure. In many cases, the cause is diastolic dysfunction – brought about by an increasingly stiff heart muscle that finds it difficult to relax and fill completely with blood. Why the heart stiffens is not yet fully understood.

A team led by Dr Suphansa Sawamiphak, head of the Cardiovascular-Hematopoietic Interaction research group at the Max Delbrück Center, has now discovered that gut bacteria could play a crucial role in this disease process. In experiments using zebrafish as a model, the researchers discovered that certain microbes in the gut produce a small molecule called indole-3-acetic acid (IES) from the amino acid tryptophan. IES acts on neurons in the brain, which in turn control the heart. Sawamiphak and her colleagues describe this direct link between bacteria, the brain and the heart in the journal Circulation Research.

"We were surprised that a single bacterial metabolite can simultaneously influence the central nervous system, the heart and, moreover, key hormonal systems," says the study's lead author, Bhakti Zakarauskas-Seth from Sawamiphak's team. "This shows that the brain can act as a central hub in communication between the gut and the heart."

High blood pressure caused by overactive neurons

To understand how gut bacteria might influence the heart, the researchers focused on a group of neurons in the hypothalamus of zebrafish larvae that produce certain neuropeptides known as hypocretins (HCRT). These neurotransmitters, also known as orexins, regulate many involuntary functions in the body, such as sleep and eating behaviour, as well as heart activity. When IES levels fell in the zebrafish larvae, the HCRT neurons became overactive. This amplified their sympathetic nerve signals to the heart, causing the heart muscle to stiffen and reducing its ability to relax fully.

When the scientists administered IES to the larvae, neuronal activity returned to normal. Heart function and blood pressure improved, and even related hormones such as renin and angiotensinogen returned to healthier levels.

In the next step, Zakarauskas-Seth and her colleagues analysed data from a group of patients.

After all, we humans also possess HCRT neurons. The researchers found that IES levels were reduced in patients with high blood pressure. Notably, they observed a gender-specific effect: women with high blood pressure had significantly lower IES levels in their serum samples than men suffering from hypertension.

Prevention and treatment

Diastolic dysfunction is very common – almost half of all people over the age of 70 show at least mild symptoms. It is the cause of heart failure with preserved ejection fraction (HFpEF), which affects more than 50 percent of patients with heart failure.

For these people, the research findings open up several possibilities, says Zakarauskas-Seth: "IES levels could serve as a biomarker to identify patients at high risk of high blood pressure or heart failure. And from a therapeutic perspective, increased IES concentrations – achieved, for example, through diet, probiotics or dietary supplements – could represent a new strategy for preventing or treating cardiovascular diseases."

The fact that a single bacterial metabolite can influence the central nervous system, the heart and the endocrine system is an important message, adds Zakarauskas-Seth. "The body does not function in isolated compartments: gut health, microbial balance and diet have a direct impact on how well the heart functions." The researchers now intend to validate their findings in other animal models. Clinical trials will also be required to determine what actual benefits patients can derive from increased IES levels.

Live healthier, live longer

How risk factors affect life expectancy.



People aged 50 who do not smoke, have normal blood pressure, do not have high cholesterol levels or diabetes, and maintain a healthy body weight not only live longer but also remain free from cardiovascular disease for longer. This applies equally to women and men. However, even those who make changes later in life can still benefit. This is what scientists at the University Medical Center Hamburg-Eppendorf (UKE) have discovered in a large-scale study – in collaboration with around 120 researchers worldwide.

The findings were presented at the main conference of the American College of Cardiology and published simultaneously in the New England Journal of Medicine.

"The five classic risk factors – high blood pressure, smoking, diabetes, being underweight, overweight or obese, and high cholesterol levels – are responsible for around half of all cardiovascular diseases worldwide. We wanted to know how the absence or control of these factors affects life expectancy," says Prof. Dr Christina Magnussen, lead author and deputy director of the Department of Cardiology at the UKE.

The study shows that women who do not have any of these risk factors at the age of 50 develop cardiovascular disease on average 13.3 years later and die 14.5 years later than women with all five risk factors.

Men without these risk factors live 10.6 years longer without cardiovascular disease and die, on average, 11.8 years later than men with the risk factors. The risk factors themselves have varying significance; for example, women who do not smoke at the age of 50 live 5.5 years longer without cardiovascular disease, whilst for men the figure is 4.8 years.

Another important finding of the study is that behavioural changes are worthwhile even later in life. "Of all five risk factors, controlling blood pressure is linked to the greatest number of additional healthy years of life," says Prof. Dr Stefan Blankenberg, the study's senior author and Medical Director of the University Heart and Vascular Center at the UKE. People who bring their high blood pressure under control or give up smoking between the ages of 55 and 60 live longer and without cardiovascular disease than those who do not change their lifestyle.

The researchers analysed data from more than two million people across 39 countries for their study. This makes it one of the most comprehensive research projects to date on the impact of risk factors on life expectancy.

Why our immune system remembers vaccinations for decades

Metabolic quiescence is the key to long-lasting immunological memory.



Why is the human immune system often able to remember a vaccination for a lifetime? Researchers at Friedrich-Alexander University Erlangen-Nuremberg (FAU) and Erlangen University Hospital have explored this question, and their study provides a surprisingly clear answer: the immune cells responsible for immunological memory switch to a kind of standby mode at an early stage. They can survive for many decades in this state. The findings have now been published in the journal *Nature Immunology*.

The research team used the yellow fever vaccine as a model system. And with good reason, as it is considered one of the best examples of an effective vaccine in humans: for most people, it requires just a single injection. Nevertheless, its protective effect is exceptionally strong and often lasts a lifetime. This makes the vaccine an ideal blueprint for understanding how stable immunological memory develops.

The researchers studied more than 50 healthy adults who had just received a yellow fever vaccination and monitored their immune response over the course of a year. They also analysed blood samples from people who had been vaccinated against yellow fever between seven and 26 years earlier. This allowed them to directly compare the characteristics exhibited by the body's defence cells shortly after vaccination – and those they retain over the course of decades.

Powerful fighters, long-lasting guardians

The team focused their attention on what are known as T lymphocytes. There are many different types of these cells in the body, each specialising in a specific category of pathogens. Following a yellow fever infection (or a corresponding vaccination), those types of T cells that target body cells infected with the yellow fever virus proliferate preferentially. This rapidly creates a whole arsenal of suitable defence cells. Once they have successfully combated the virus, most of them die off. However, some 'memory cells' persist in the long term.

Right from the start of the immune response, not all T cells are dedicated to fighting the pathogen: some branch off to stand guard in the future – often for many decades.

"In the event of a repeat infection, they can then multiply very rapidly," explains Prof. Dr Kilian Schober, Heisenberg Professor of T-Cell Immunology at the Institute of Microbiology (Director: Prof. Dr Christian Bogdan) at Erlangen University Hospital, who led the study. "The immune system then reacts much more quickly than during the first encounter with the pathogen and can nip the infection in the bud." This induced immunological memory is also the main reason why vaccination protects against diseases.

Survival in energy-saving mode

But how exactly do these long-lived memory T cells differ from their counterparts that are active in fighting off infection? To answer this question, the researchers measured, amongst other things, the metabolic rate of the yellow fever-specific T cells. "We were thus able to show that some of them – namely those that later form the immunological memory – switch to a kind of energy-saving mode at an early stage," says Sina Frischholz from Schober's research group, who carried out the majority of the experimental work as part of her PhD. "They drastically slow down their metabolism and are thus able to survive for years and decades."

The team was surprised at how clearly this principle emerged. "The longest-lived immune cells are not the most active ones, but those that learn very early on to use their energy reserves sparingly," Frischholz emphasises. For the measurements, the team used, amongst others, a substance called puromycin. The more active a cell is, the more of it it incorporates into its proteins. By analysing this correlation, the researchers were able to determine how the metabolic activity of individual T cells was influenced by the yellow fever vaccination. "These data show very clearly that long-term immune memory is based on restraint, not on consistently high activity," explains Schober's colleague Dr Ev-Marie Schuster, who contributed her expertise in the field of cellular metabolism.

This pattern was already evident in the first few weeks following vaccination and was verified in participants whose vaccination had taken place many years earlier. The large volume and diversity of the measured data required complex computer-assisted analyses. "It was only through a systematic bioinformatic analysis that we were able to identify how stable this energy-saving programme remains over periods of decades," says Dr Myriam Grotz, who was responsible for the data analysis.

Observations also apply to the Covid vaccination

To ensure that this is a fundamental principle, the team tested its results in two different mouse models of bacterial and viral infections. The researchers also studied individuals who had just received a vaccination against SARS-CoV-2. The identified correlation was also reflected in these analyses. "This demonstrates that metabolic quiescence is not a special case specific to the yellow fever vaccine, but rather a fundamental principle of the immunobiology of memory cells," says Prof. Schober.

A consistently strong immune system is therefore not based on constant peak performance. "The key seems to be the ability of individual immune cells to shift down a gear at the right time, and precisely because of this, to remain operational for decades," emphasises Schober. "This changes our understanding of how long-lasting immunity develops – and could help us develop vaccines and immunotherapies in a more targeted way."



5,000-year-old bacteria defy 10 modern antibiotics

Ice cave bacteria could exacerbate the antibiotic resistance crisis – or help solve it.

Bacteria have evolved to adapt to all extreme conditions on Earth, from scorching heat to temperatures well below zero. Ice caves are just one of the environments that harbour a wide variety of microorganisms, representing a source of genetic diversity that has not yet been fully explored.

Romanian researchers have investigated the antibiotic resistance profiles of a bacterial strain that, until recently, was hidden in a 5,000-year-old layer of ice in an underground ice cave – and found that it could offer a way to develop new strategies to prevent the rise of antibiotic resistance and to study the natural development and spread of resistance. They reported their discovery in Frontiers in Microbiology.

"The bacterial strain *Psychrobacter* SC65A.3, which was isolated from the Scarisoara ice cave, is resistant to several modern antibiotics despite its ancient origins and carries over 100 resistance genes," said the author, Dr Cristina Purcarea, a senior researcher at the Institute of Biology in Bucharest, part of the Romanian Academy. "But it can also inhibit the growth of several important antibiotic-resistant 'superbugs' and exhibits key enzymatic activities with significant biotechnological potential."

Ancient resistance to modern drugs

Psychrobacter SC65A.3 is a strain of the genus *Psychrobacter*, which comprises bacteria adapted to cold environments. Some species can cause infections in humans or animals. *Psychrobacter* bacteria have biotechnological potential, but their antibiotic resistance profiles are largely unknown. "The study of microbes such as *Psychrobacter* SC65A.3, which were isolated from millennia-old cave ice deposits, shows how antibiotic resistance developed naturally in the environment long before modern antibiotics were used," said Purcarea.

The team drilled a 25-metre-long ice core from the area of the cave known as the Great Hall, which spans a period of 13,000 years. To avoid contamination, the ice fragments extracted from the core were stored in sterile bags and frozen on the return journey to the laboratory. There, the researchers isolated various bacterial strains and sequenced

their genomes to determine which genes enable the strain to survive at low temperatures and which confer antimicrobial resistance and activity.
They tested the SC65A strain's resistance to 28 antibiotics from ten classes that are routinely used to treat bacterial infections or are reserved for this purpose, including antibiotics previously found to harbour resistance genes or mutations that give them the ability to withstand the effects of medication.
This allowed them to test whether the predicted mechanisms lead to measurable resistance. "The 10 antibiotics we found resistance to are frequently used in clinical practice in oral and injectable treatments for a range of serious bacterial infections," said Purcarea. Diseases such as tuberculosis, colitis and urinary tract infections can be treated with some of the antibiotics against which the researchers detected resistance, including rifampicin, vancomycin and ciprofloxacin.
SC65A.3 is the first *Psychrobacter strain* in which resistance to certain antibiotics – including trimethoprim, clindamycin and metronidazole – has been detected. These antibiotics are used to treat urinary tract infections, as well as infections of the lungs, skin, blood and the reproductive system. The resistance profile of SC65A.3 suggests that strains capable of surviving in cold environments could act as reservoirs for resistance genes – specific DNA sequences that help them survive exposure to drugs.

Potential risks

Bacterial strains such as the one studied here hold both a threat and a promise. "If melting ice releases these microbes, these genes could spread to modern bacteria and exacerbate the global problem of antibiotic resistance," said Purcarea. "On the other hand, they produce unique enzymes and antimicrobial compounds that could inspire new antibiotics, industrial enzymes and other biotechnological innovations.
In the genome of *Psychrobacter* SC65A.3, the researchers found nearly 600 genes with unknown functions, suggesting a previously untapped source for the discovery of new biological mechanisms. Analysis of the genome also revealed 11 genes that are potentially capable of killing other bacteria, fungi and viruses, or halting their growth.
Such potential is becoming increasingly important in a world where antibiotic resistance is a growing problem. Drawing on ancient genomes and uncovering their potential highlights the important role that the natural environment has played in the spread and development of antibiotic resistance. "These ancient bacteria are indispensable to science and medicine," Purcarea concluded, "but careful handling and safety measures in the laboratory are essential to reduce the risk of uncontrolled spread."

A healthy diet in early life influences lifelong brain health

Gut bacteria and prebiotics from onions or garlic mitigate long-term brain changes caused by early poor nutrition.

Consuming unhealthy foods at a young age leaves lasting changes in the brain and in dietary patterns, but gut bacteria can help restore a healthy diet, according to new research by University College Cork (UCC).
A diet high in fat and sugar during the early years of life can cause long-lasting changes in the way the brain regulates eating, even after the unhealthy diet has been stopped and body weight has returned to normal, researchers at APC Microbiome, a leading research institute at UCC, have found.
Children today grow up in an environment saturated with high-fat and high-sugar foods that are readily available and heavily advertised. From birthday parties and school fetes to sporting events and even as rewards for good behaviour, these foods have become an everyday part of childhood experiences.
This new research highlights the long-term effects of this early exposure and demonstrates that frequent consumption of energy-dense, nutrient-poor foods during childhood can shape preferences and establish unhealthy eating habits that persist into adulthood.
The study, published in the journal *Nature Communications*, also shows that interventions targeting the microbiota – including a specific strain of beneficial gut bacteria (*Bifidobacterium longum* APC1472) or prebiotic fibres (fructo-oligosaccharides (FOS) and galacto-oligosaccharides (GOS), which occur naturally in foods such as onions, garlic, leeks, asparagus and bananas and are widely used in fortified foods and prebiotic dietary supplements), could help prevent these effects if administered throughout life.
The researchers found that a high-fat, high-sugar diet during early life led to persistent changes in eating behaviour in adulthood in a preclinical mouse model. These behavioural changes were linked to lasting disruptions in the hypothalamus, a key region of the brain involved in appetite control and energy balance.



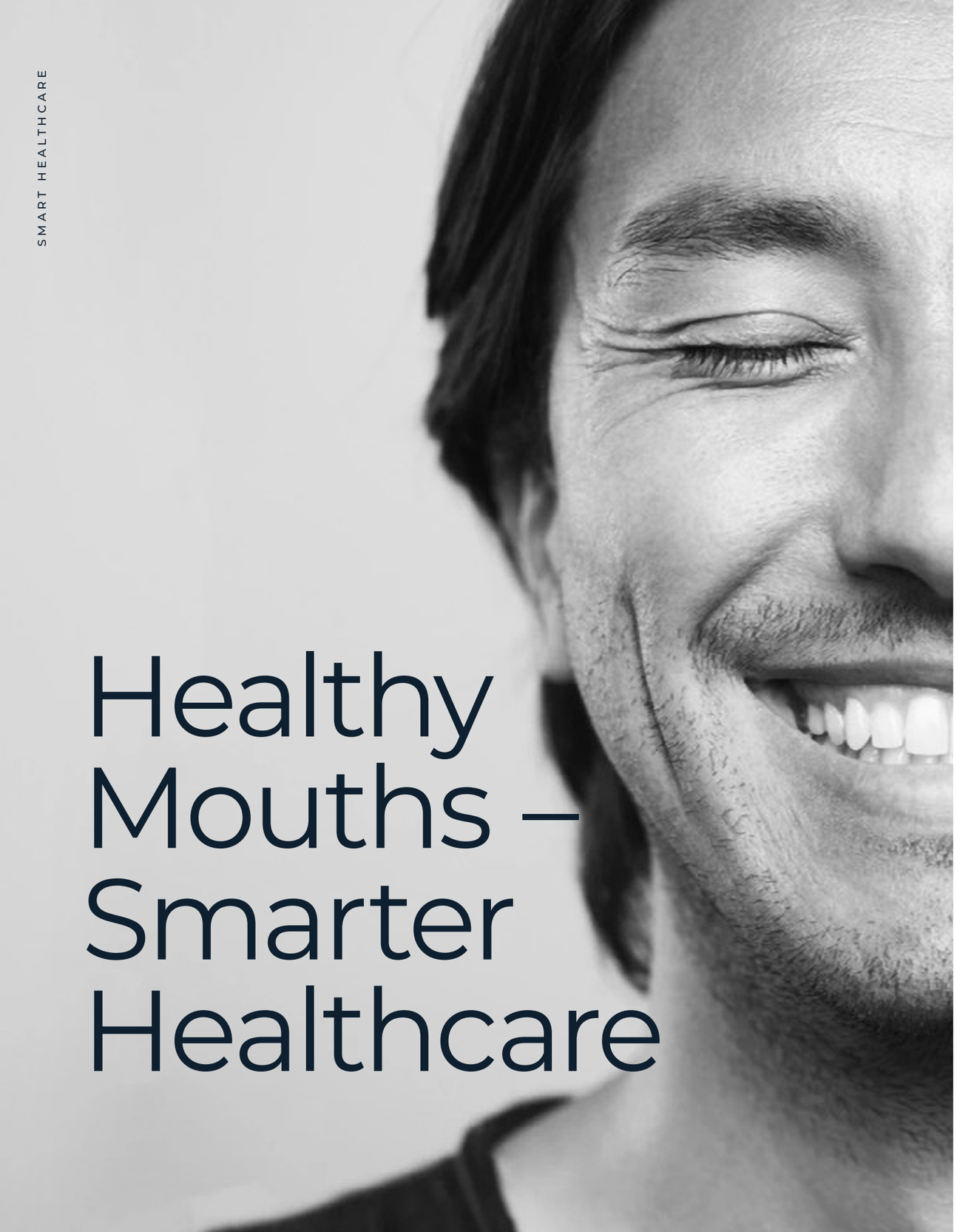
What we eat early in life matters

"Our findings show that what we eat at a young age really does matter," said Dr Cristina Cuesta-Martí, the study's lead author. "Early dietary exposure can have hidden, long-term effects on eating behaviour that are not immediately apparent from weight alone."
The study showed that an unhealthy diet in early life disrupts the brain pathways responsible for eating habits, with the effects persisting into adulthood, suggesting an increased risk of obesity later in life.
Importantly, targeted manipulation of the gut microbiota was able to counteract these long-term diet-related effects. The putative probiotic strain *Bifidobacterium longum* APC1472 led to a marked improvement in dietary habits whilst causing only minor changes to the overall microbiome composition, suggesting a targeted mode of action. By comparison, the prebiotic combination (FOS+GOS) led to more extensive shifts in the gut microbiome.

Targeted modulation of the gut microbiota can mitigate long-term effects

Study lead Dr Harriet Schellekens added: "Our findings show that targeted modulation of the gut microbiota can mitigate the long-term effects of an unhealthy diet in early life on later eating behaviour. Supporting the gut microbiota from birth helps to maintain healthier eating habits later in life."
Professor John F. Cryan, Vice-President for Research and Innovation at UCC and a contributor to the study, said: "Studies such as this are an example of how basic research can lead to potential innovative solutions to major societal challenges. By demonstrating how nutrition in early childhood shapes the brain pathways involved in regulating food intake, this work opens up new possibilities for interventions based on the microbiota".

The UCC-led study was carried out in collaboration with colleagues from the University of Seville (Spain), the University of Gothenburg (Sweden) and the Teagasc Food Research Centre (Fermoy, Ireland), and was funded by Research Ireland, a postgraduate scholarship from the Irish Government and a research grant from the Biostime Institute for Nutrition & Care.



Healthy Mouths – Smarter Healthcare

Authors — Giselle Richterich, Aleksandar Milosavljevic, Céline Lehnherr, Marta Mazur, Selma Dervisbegovic and Raman Kaur Preet

Can we afford to wait until prevention is no longer possible? Nearly 3.7 billion people live with oral diseases, close to half of the world's population. Yet healthcare systems still invest more readily in repairing damage than in preventing it. The question is no longer whether prevention has value. It is whether we can afford to continue acting too late.[1,2]

Bleeding gums when brushing rarely feel like a health emergency. There is usually no severe pain and often no major diagnosis. Gingivitis, an inflammation of the gums that may cause bleeding when brushing, is common, usually reversible and easily dismissed as a minor dental problem. But this seemingly small sign may represent one of the clearest opportunities in healthcare: What if we stopped treating gingivitis as an insignificant inconvenience and began recognising it as an early opportunity for prevention?[3,4]

Healthcare has become highly skilled at diagnosing, treating and repairing. However, it remains less organised around recognising early signals and changing the trajectory before disease becomes complex, expensive and irreversible.

Where does disease begin and how early can prevention truly start?

The oral cavity is home to a complex and dynamic microbial ecosystem that exists in close interaction with the human host. In a healthy system, this relationship remains dynamic but relatively stable: oral biofilm is present, the immune system responds, and the tissues remain clinically healthy. This balance is influenced by saliva, diet, fluoride exposure, oral hygiene, smoking, medication, systemic conditions and the individual immune response.[5,6]

Oral disease rarely begins as a dramatic event. More often, it develops through a gradual deterioration in the relationship between microbial ecology and host response.

In dental caries, frequent sugar exposure can favour acid-producing and acid-tolerant microorganisms, contributing to mineral loss from the teeth. In gingivitis, accumulated biofilm triggers an inflammatory response in the gingival tissues. If inflammation persists, some susceptible individuals may progress towards periodontitis, where destruction of the tissues supporting the teeth is no longer fully reversible.[3,4,6]

This distinction matters. Biofilm is a structured microbial community, whereas gingivitis is an inflammatory response to its accumulation. Periodontitis is a chronic inflammatory disease involving irreversible tissue destruction.[3,4]

Prevention depends on recognising where a person stands along this pathway.

Gingivitis is not insignificant because it is common and often reversible. Its reversibility is precisely what makes it valuable. It represents a window in which action can still alter the direction of disease.[3,4]

Bleeding gums may not feel alarming. Clinically, however, they may indicate that the relationship between biofilm, behaviour and host response is deteriorating. Prevention begins when that signal is recognised rather than dismissed.

Biofilm, behaviour and daily prevention

Daily behaviours influence the oral microbiome. Toothbrushing, interdental cleaning, fluoride use, dietary patterns and smoking all affect the relationship between the oral microbiome and the host. When biofilm accumulates, it can trigger gingival inflammation. In susceptible individuals, persistent inflammation may contribute to periodontitis.[3,4,5,6]

This is the thinking behind a simple but powerful message: There is no magic pill, only daily biofilm control.

These actions may appear ordinary, but repeated consistently over time, they become meaningful forms of prevention. Oral hygiene is not merely a cosmetic routine; it is one of the ways in which people can influence their oral ecology and long-term health.

However, scientific knowledge alone does not change behaviour. Daily routines are shaped by motivation, manual ability, stress, family habits, culture, cost, access, fear, shame and previous experiences of care. Preventive advice can therefore fail even when the information itself is scientifically correct.

A successful preventive approach must be both biologically sound and behaviourally realistic.

For one person, the most relevant intervention may be improving interdental cleaning. For another, it may be reducing frequent sugar exposure, improving fluoride use, stopping smoking or attending supportive care more consistently.

Personalised prevention should not mean vague advice. It should translate individual risk into actions that are clear, achievable and meaningful.[4]

A human-centred approach asks:

- What does this person understand about their risk?
- What action feels realistic this week?
- What information will motivate rather than frighten them?
- What barriers make change difficult?
- What support would make healthier behaviour more possible?

This also broadens the role of the healthcare professional. Diagnosis and treatment remain essential, but professionals must also be able to communicate risk,

support behaviour change and recognise when oral findings form part of a wider health pattern. Dentists, dental hygienists, physicians, dietitians, psychologists and other professionals need to know when collaboration matters. Prevention becomes stronger when disciplines stop treating one person as a collection of unrelated systems.

The mouth as part of systemic health

The connection between oral and systemic health is particularly evident in periodontology. Periodontitis shares several risk factors with other non-communicable diseases, including smoking, dietary patterns, socioeconomic factors and systemic conditions. It is also associated with diabetes and cardiovascular disease. While periodontitis should not be presented as a simple cause of every associated systemic condition, it contributes to inflammatory burden, interacts with metabolic and immune pathways and may influence systemic health in clinically relevant ways.[7,8]

The relationship with diabetes is one of the strongest examples. Poor glycaemic control can negatively affect periodontal tissues and treatment response, while periodontal inflammation may make metabolic control more difficult.[7] This bidirectional relationship demonstrates why oral inflammation should not be regarded only as a local dental problem. It forms part of the person's broader inflammatory and metabolic status.

Cardiovascular disease is another area in which periodontal disease is discussed in relation to systemic inflammation and shared risk factors, although causal interpretations require appropriate caution.[8]

The practical implication is important. An oral health professional may identify signs that belong to a wider metabolic or inflammatory picture. A medical professional caring for a person with diabetes may need to consider periodontal health as part of disease management. The same person may also experience gut symptoms, stress, disrupted sleep, dietary risks, smoking exposure or a relevant family history.

If oral health is treated in isolation, the larger picture may be missed. When it is incorporated into a broader assessment of health and risk, the mouth becomes a valuable clinical window rather than a separate technical territory. This is where oral health begins to move from dentistry into healthcare.

From the mouth to the gut: two ecosystems, one body

The emerging discussion around the oral-gut axis adds another dimension, but it must also be approached with scientific care. The mouth is the first part of the gastrointestinal tract, and oral microorganisms are swallowed continuously. Under healthy conditions, this is part of normal physiology. However, in circumstances involving oral dysbiosis, periodontal inflammation, gut dysbiosis or reduced host resilience, interactions between the oral and intestinal ecosystems may become clinically relevant.[9]

> The smartest healthcare does not wait for disease. It acts while prevention is still possible.

Historically, dentistry has focused on teeth, gingiva and oral biofilm, while gastroenterology has focused on digestion, the intestinal mucosa and the gut microbiome. Biologically, however, these fields are connected through microbial exposure, epithelial barriers, immune signalling, nutrition and inflammation.

Current evidence supports the biological plausibility of this oral–gut connection. Shared microbiological and immunological pathways are being explored, particularly in relation to periodontitis and inflammatory bowel disease. Nevertheless, the evidence does not justify simplistic claims that every oral problem is a gut problem or that every patient requires microbiome testing.[9] Scientific caution is essential.

The value of the oral-gut concept is not that it offers one explanation for every disease. Its value is that it reminds us that oral health exists within a wider biological system.

Oral inflammation, systemic inflammation, metabolic health, nutrition, behaviour and gut health may be connected, but not in a simple linear way.

The economic value of acting earlier

Oral diseases are among the most prevalent health conditions worldwide. Approximately 3.69 billion people were living with major oral conditions in 2021, and untreated caries in permanent teeth remains the most prevalent health condition globally.[1,2]

Untreated caries, periodontitis, tooth loss and repeated restorative or rehabilitative interventions generate costs for individuals, healthcare systems and society. These include direct costs for treatment, maintenance and prosthetic rehabilitation, but also pain, impaired chewing, reduced quality of life, absence from work and lost productivity.[1,2,10]

Recent estimates illustrate the scale of this burden. In 2025 worldwide direct treatment costs and productivity losses associated with periodontitis, including periodontitis-related tooth loss, were estimated at approximately US$186 billion and US$142 billion, respectively.[10]

Disadvantaged populations often face a combination of higher disease risk, more challenging social determinants and reduced access to preventive and professional care.[10]

Therefore, an important economic question is not only: How much does treatment cost? It is also: What does it cost when an opportunity for prevention is missed? Gingivitis offers a practical way to consider this questions. It is common, detectable and often reversible before irreversible periodontal destruction occurs. Once periodontitis is established, treatment becomes more complex, long-term maintenance becomes necessary, and the consequences may include tooth loss, reduced function and ongoing inflammatory burden.

From a health-economic perspective, the transition from gingivitis to periodontitis is therefore not only a biological progression. It is a missed opportunity.

Economic modelling suggests that preventing periodontitis through the prevention and management of gingivitis, supported by effective oral home care, may be more cost-efficient than several treatment-focused alternatives. In the Economist Impact model discussed by Pattamatta, Chapple and Listl, eliminating gingivitis through professionally supported home care increased healthy life years, reduced costs and produced a positive return on investment across the countries studied.[10]

This supports the biological argument that prevention has its greatest value when applied before irreversible periodontal destruction has occurred.

It does not mean that treatment is unnecessary. Established periodontitis must be diagnosed and managed appropriately. Teeth affected by disease require professional care, and advanced conditions will continue to demand advanced treatment.

The choice is not between prevention and treatment. The challenge is to place greater emphasis on the stage at which prevention can still change the disease trajectory.[4,10]

A healthcare system that mainly reacts after disease has become irreversible will carry a greater clinical and economic burden than one capable of recognising risk and intervening earlier.

Prevention is often described as an expense. However, it may be one of the most valuable investments a healthcare system can make.

From individual action to shared responsibility

Oral health begins with daily action, but it cannot end there. Individuals brush, clean interdentally, make food choices and attend care. Families establish early routines and influence microbial and behavioural development. Dental teams identify risk and provide professional support. Medical teams manage systemic conditions. Researchers and educators produce knowledge and translate it. Policymakers, insurers and industry influence whether preventive care is accessible, rewarded and scalable.

Hence, health is more than an individual experience; it is shaped and influenced within the communities to which we belong. This is why prevention must move from me to we. From me: my toothbrush, my biofilm, my habits and my risk. To we: our families, our clinics, our systems and our responsibility.

Prevention cannot be reduced to a private lifestyle project available only to highly informed and motivated individuals. It must become a shared health culture:

- A culture in which gingivitis is recognised as an early opportunity rather than dismissed as a minor inconvenience.
- A culture in which oral health is understood as part of whole-body health.
- A culture in which scientific evidence is translated into practical daily action.
- A culture in which healthcare professionals collaborate before disease forces them to.

These perspectives point in the same direction. Prevention must begin early enough to matter. It must remain scientifically credible. It must be translated into realistic daily behaviour that connects oral health with the whole person. And it must be supported by systems that value health creation, not only disease treatment.

The mouth may be where the discussion begins. The ambition is much broader: earlier, more integrated and more sustainable healthcare.

For clinicians, the practical takeaway is simple: Treat gingivitis as the intervention point, not attachment loss as the alarm bell. The question is no longer whether the world can afford to invest in prevention. It is whether the world can afford not to.

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Join for Science. Stay for Friendship.

How the AVOLA Associate Board is becoming more than a board.

Authors — members of The AVOLA Associate Board

In June 2025, we came together for the first time in Stockholm.

Six people. Six trained dentists with six distinct professional paths and six different stories. At that point, most of us were still strangers. We were connected by AVOLA, by a shared interest in prevention, and by the belief that oral health plays a larger role in systemic health than healthcare systems often recognise.

But we did not yet know one another. We did not know how we would think together, disagree together, laugh together or support one another. Or, whether such an Associate Board could grow into more than a formal structure.

A year later, in June 2026, we met again in Madrid. This time, something had changed.

The conversations were deeper. The laughter came faster. The questions were more honest, and our sense of purpose was stronger. We were no longer simply individuals representing different interests, practices and countries. We felt like a team.

We had joined AVOLA because we believed in the science of prevention. Along the way, we found people who shared the same impatience with fragmented healthcare, the same curiosity about the future, and the same desire to build bridges where systems still create silos.

The AVOLA Associate Board brings together professionals working across dentistry, dental public health, public health, microbiome science, nutrition, communication, health economics, and innovation. Each of us contributes a different perspective. Together, we are learning that prevention is an interconnected way of seeing health.

Six strangers, one shared question

When we first met, none of us was looking for another committee. We already had more than enough meetings, projects, deadlines, patients, students, research responsibilities and personal commitments.

What brought us together was not simply the opportunity to sit on a board. It was a question: What would healthcare look like if prevention were truly at its centre?

Prevention: Not as a slogan, or a paragraph in a policy document, or as advice offered too late, when disease is already visible. But prevention as a genuine principle for public health, healthcare, education, communication, economics and daily life. Each Associate Board member approaches this question through their own professional and personal experience.

Giselle builds bridges between dentistry, oral-systemic health, the gut microbiome and prevention strategy.



Her perspective is shaped by the belief that the mouth is not separate from the body, and that future healthcare must connect the mind and the body, awareness, science and daily life before symptoms appear.

Aleksandar brings the perspective of periodontal prevention, health economics and digital innovation. He asks what it would mean if we measured not only the cost of treating disease, but also the value of preventing it. His work reminds us that gingivitis and periodontitis are not merely clinical conditions; they are fundamental public-health and economic challenges.

Céline supports the importance of communication, dissemination, and public voice. Prevention will not change systems if it remains confined to professional circles. It needs language that people understand, stories that travel, and messages that feel human rather than institutional.

Marta navigates the world of the oral microbiome, biofilm and lifestyle medicine. She reminds us that daily oral hygiene is not simply about removing biofilm, but about shaping an ecosystem. Her message is beautifully simple and scientifically powerful: there is no magic pill, only daily biofilm control, repeated over time.

> Prevention begins with science, but it becomes a movement when knowledge connects people, disciplines, and purpose.

Selma works at the intersection of nutrition, oral health, and prevention. Her voice is crucial because prevention does not take place only in the dental chair or during a medical consultation. It also happens through what people eat, how they understand their habits, and how professionals translate scientific evidence into realistic daily choices.

Raman holds conversations together, encourages questions, makes space for reflection and creates structure. She believes that "prevention is an attitude." It requires leadership that listens carefully, observes what is present, values each perspective and empowers others to transform ideas into shared direction and action.

None of these perspectives is sufficient on its own. That is exactly the point.

The strength of the Associate Board lies in the fact that we do not think alike. We challenge one another because we approach the same problem from different entry points. We speak different professional languages, alongside each of our own native languages, cultures, and contexts. Together, we are learning to collate and synergise our ideas and perspectives into a shared language: prevention.

What prevention means to us

For us, prevention means acting before disease becomes inevitable. It means recognising early signals. It also means understanding risk before symptoms dominate, supporting people before they become patients in the traditional sense, and moving from reaction to anticipation.

We also understand prevention as something deeply personal. Each of us has seen, in different ways, what happens when prevention comes too late. We have seen oral inflammation dismissed until it becomes periodontal destruction; chronic diseases to be managed for years while earlier opportunities were missed. How difficult it is for people to change their habits when systems offer too little time, support or continuity!

However, we have also seen the power of small interventions.

A patient who finally understands why bleeding gums matter.

A child whose early habits shape lifelong health.

A conversation that connects nutrition, inflammation and oral health.

A professional who begins to see beyond their own discipline.

A network that helps an idea become visible.

Therefore, prevention is not only about avoiding disease. It is about boosting behaviour, and about preserving the possibility that oral cavity matters. The mouth provides an important accessible window into the body. It reflects behaviour, microbiology, inflammation, nutrition, stress, hormones, systemic disease and daily care. Gingivitis, biofilm, saliva and the oral microbiota are not minor details. They are part of a wider picture of health and resilience.

When we speak about prevention, we are speaking about this larger picture. We are speaking about the relationship between oral health and diabetes. Between periodontal inflammation and cardiovascular risk, oral microbiota and the gut, daily hygiene and lifelong health, and individual habits and public-health systems. And the gap between what science knows and what people are realistically able to do.

We recognise that prevention remains underfunded because many existing incentives reward treatment more readily than the avoidance of disease. Hence, prevention, for us, is not moralising. It is about building conversations, relationships, environments and systems that make healthier choices possible.

Why personal voices matter

It became particularly clear to us in Madrid: AVOLA cannot speak only through institutional language. We debated that scientific accuracy, evidence and professional credibility are essential. But prevention is also about trust, and trust is built and nurtured through people.

Communication may be correct and polished, yet still fail to move anyone if it feels distant or generic. Prevention needs messages that feel alive. It needs relatable voices that are willing to explain why this work matters to them personally.

This is why the question “What does prevention mean for you?” is so powerful.

It does not ask for a title.

It does not ask for a publication list.

It does not ask for a professional achievement.

It asks for meaning. A meaning to what begins to transform a network into a movement.

People do not join movements because of information alone. They join because they recognise something of themselves in the story. They stay because they find people who make the work feel possible. This is what we are beginning to experience within the Associate Board. We joined for the science. But we remain because the friendships make the science more courageous and more impactful.

Friendship may sound like a soft word within a scientific organisation. But perhaps it is not soft at all. Perhaps friendship is what allows honest disagreement. It gives people the courage to bring forward unfinished ideas. It is what turns a meeting into a community and allows an Associate Board, working alongside the Senior Board, to develop a genuine voice within an international network.

Together, we are here because prevention cannot be achieved alone.

From a board to a movement

We see the Associate Board as a place where professional identity and personal conviction meet. It is a place where we can ask:

What kind of healthcare do we want to help create?

What responsibility do we have to translate knowledge into action?

For each of us, the answer may be slightly different. But the direction is shared.

We are here to strengthen prevention awareness, to connect disciplines, to bring professional and individual voices into the conversation, to learn from the Senior Board and contribute our own perspectives. Within the AVOLA Associate Board, we are still learning how to work together, how to communicate and how to contribute meaningfully to the future. But something is already becoming clear: our contribution must be driven by energy.

The energy to ask better questions and bring oral health into systemic prevention, to make microbiome science understandable while discussing health economics without losing sight of the patient, to use technology without losing humanity, and to make prevention not only scientifically valid but also emotionally compelling and to foster self-awareness, recognising early signals and understanding how daily choices shape our health.

AVOLA’s strength lies in bringing together people who might not otherwise meet: senior experts and younger professionals, clinicians and researchers, oral health and medicine, science and communication, vision and implementation.

The Associate Board is one expression of that strength. We do not have all the answers, but we are curious and believe that all kinds of questions matter, and that prevention deserves a collective voice. We are creating conversations about a future of healthcare in which incentives are better aligned with prevention, and multidisciplinary and multisectoral action is not merely encouraged, but mobilised.

The important question is no longer whether the world can afford to invest in preventive health. It is whether the world can afford not to. That is what a movement needs.

The AVOLA Associate Board



Raman Kaur Preet
Chair

Raman is a public-health practitioner and researcher specialising in dental public health, global health research leadership, coordination and communication. She is committed to advancing the integration of oral health within health systems by translating evidence into action.



Aleksandar Milosavljevic
Vice Chair

Aleksandar Milosavljevic, DDS, PhD, is a specialist periodontist, Assistant Professor and Head of Periodontology at the Faculty of Odontology, Malmö University. His work bridges clinical expertise, academic teaching and innovative research, with a focus on digital transformation and prevention in periodontal care.



Céline Lehnherr

Céline brings an important voice in communication, dissemination and community-building. She reminds us that prevention must be understandable, relatable and visible beyond scientific and professional circles.



Giselle Richterich

Giselle Richterich, DDS, EMBA, focuses on driving health and education outcomes through strategy, science and market impact. She connects dentistry, oral-systemic health and the gut microbiome with health awareness and prevention strategy. Her work centres on building bridges between clinical practice, business intelligence, risk stratification and human-centred care.



Marta Mazur

Marta is a dentist, orthodontic specialist, researcher and Assistant Professor at Sapienza University of Rome. Her work focuses on the oral microbiota, biofilm, lifestyle and the daily practices that shape long-term oral and systemic health.



Selma Dervisbegovic

Selma brings the perspective of a periodontist, university educator and prevention advocate. She connects periodontal health with nutrition, oral hygiene and everyday behaviours, combining a scientific interest in prevention research with a strong focus on translating evidence into meaningful daily patient care.

THE ESSENCE

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