

The Dawning of Enhanced Medicine

I will never forget the first time I saw a middle-aged woman who had been in a wheelchair for five years stand up and walk out of the hospital under her own power.

That's not supposed to happen, I thought.

It was 2005, and she was in the hospital regularly for treatments in a hyperbaric oxygen chamber to heal diabetic ulcers on her legs, but that regimen was unrelated to the stroke years before that had left her unable to use them.

Those improved oxygen supplies were effective. *That* was expected. But a disabled stroke patient suddenly walking? No.

Shai, there are things you don't understand, I reminded myself. *Just continue with your life.*

At the time, I was a resident in nephrology at Assaf Harofeh (now Shamir) Medical Center, one of the top hospitals in Israel. My plan was to dedicate my career to research and treatment of patients with kidney

problems. I knew about hyperbaric oxygen therapy because I was a recreational diver but didn't regard it as a specialty worth pursuing.

But then the same scene unfolded a second time, and then a third time: a patient who had received repeated hyperbaric oxygen treatments for diabetic wounds had recovered some physical movement or speaking capacity that had been previously lost due to a stroke.

I took a few deep breaths and shook my head. *Oh shit*, I thought. *This doesn't make sense to me, but . . . it doesn't necessarily need to make sense to me. The knowledge and data I have so far may be limited, not permitting me to see something as it really is.*

Was it possible that the biochemical repair mechanism healing wounds in the legs has a similar impact in the brain? Can this mechanism repair what medical science considered *chronic* brain damage from stroke? It seemed so to me. But nothing meaningful in the medical literature I found had seriously explored this.

I had to solve this puzzle.

It was never my intention to investigate or treat disorders such as stroke, concussion, fibromyalgia, post-traumatic stress disorder (PTSD), Long COVID, or possibly even Alzheimer's disease. (We examine each of these in separate chapters in Part II). But I have been doing it now for nearly twenty years as director of the Sagol Center for Hyperbaric Medicine and Research.

What we've discovered in our research—which is centered on hyperbaric treatment but goes far beyond—has the potential to be revolutionary.

The Problem with “Normal”

In modern medicine, physicians usually default to “normal” as a desired outcome when treating patients. In other words, in traditional

medicine, “normal” is considered an average condition for a patient based on their age and sex.

I will never forget the overwhelming joy of two parents on the day their daughter was able to move a finger for the first time in years and to blink her eyes in response to simple yes-or-no questions.

In her early thirties, she had suffered a severe brain injury, unable to communicate in any way following a tragic accident years before. Her parents had struggled with devastating grief ever since.

I was thrilled that night while driving to my home outside Tel Aviv. If a medical intervention can produce a change so basic as pointing a finger and blinking an eye—and unleash this powerful emotional response I had just witnessed—why should physicians be the ones to determine what a good result from treatment should be? This woman’s primitive communication mode was far below “normal for her age,” yet her parents celebrated.

I will also never forget watching on television one of the many athletes we support at our clinics, the outstanding Israeli judoka Peter Paltchik, joyfully raising Olympic bronze medals and Israel’s white-and-blue Star of David flag with his teammates in the mixed-team competition.

That achievement touched off a wave of national pride that lasted for days. Judo became the national sport of Israel. And that made me think, *Isn’t it time for physicians and medical scientists who study biology to dedicate more of their energy and resources toward enhancing human performance? To apply our rapidly developing insights in molecular biology, the workings of our bodies’ tiniest building blocks, the cells? We can help people act on their ambition to enjoy better health and better lives . . . far beyond the “normal” for their age.*

And I will never forget my first clinical patient with PTSD. Like millions of people diagnosed with PTSD, he had thought that the

blame was on him for his feelings of confusion and despair, that he had not been doing all he should be doing to cure himself, and that his “mental disability” had nothing to do with his biology. Until we showed him otherwise.

Sitting before me, he said, as if he were dreaming, “I used to have PTSD, but . . . now I don’t have it anymore.”

By then our research had led us to understand that mental illness may be rooted in tissue damaged in the brain regions responsible for what we call “mental/psychological behavior.” And that psychological trauma alone, with no corresponding tangible injury, might trigger damage to brain cells just like any physical injury suffered from a car accident, gunshot, or explosion. I wondered, *What is the biology underlying what we too often interpret as mental disorder?*

Each of these four intense personal experiences begged two important questions: Why should physicians default to “normal” as a desired outcome when treating patients? Why not aim for the best any patient’s current physiological and biological condition can allow?

My obsession with these questions spurred me to develop a new way for doctors and society to think about how we administer health-care. I call it *enhanced medicine*. Enhanced medicine is about not only treating injuries but making our bodies and minds reach the best of their biological potential.

Our starting point with clients or patients as physicians practicing enhanced medicine is this: “Tell us your biological wish, and we will see if we can make it happen.”

We want to help you reach higher levels of performance regardless of what you are able to do now. From wheelchair-bound paraplegics to the world’s greatest athletes, the goals of enhanced medicine are to help you improve from wherever you are now.

Some patients who approach us are in the prime of their lives, with no significant measurable or detectable health issues. They simply want

to discover their peak performance; they want to push their boundaries. In these cases, we aren't working to solve issues so much as we're looking to mine untapped potential in their bodies and minds.

Other patients come to us for healing—physical, mental, and emotional. They struggle with issues such as stroke, concussion syndrome, fibromyalgia, PTSD, Long COVID, and even early stages of Alzheimer's disease, which are all issues we'll look at more deeply in Part II. Many are looking to improve worsening and debilitating symptoms from these diseases. They want more autonomy in their lives to complete basic tasks, like dressing themselves or staying active.

It doesn't matter if you are twenty, forty, sixty, eighty years old, or beyond. We want to apply advancing disciplines of medical science and the arts of medicine to enhance your physiological and biological capacity to the maximal potential.

The Four Principles of Enhanced Medicine

FIRST PRINCIPLE: *We want to enhance your physiology and biology to the highest levels you can achieve from whatever those levels are at the outset.*

If you already perform at a high level, such as company chief executives or world-class athletes, the goal of enhanced medicine is to elevate further your physical and mental capacities, to help you think even more clearly or compete with even more power, stamina, and energy.

At the other extreme, if your physical or mental capabilities are way below average—maybe you suffered a stroke or massive brain injury—enhanced medicine should be favorable even if the impact leaves you still below average.

SECOND PRINCIPLE: *Our interventions focus intensely on finding and removing bottlenecks that prevent your biology, at the cellular level, from performing.*

What do I mean by bottlenecks? Bottlenecks are biological obstacles to better performance. For example, when blood vessels become blocked or substantially narrowed from accumulated cholesterol, the restricted supply of blood and oxygen weakens the performance of all cells downstream from that blockage. Then, too, cell performance falls if the power generators of cells, the mitochondria, malfunction in some way. Removing these and myriad other bottlenecks triggers a cascade of restorative physiological and biological responses.

In classical medicine, which is what most medical schools teach, physicians are trained to target a single troublesome enzyme or receptor using a specific drug. For example, an antibiotic is used to treat a specific bacterium. In enhanced medicine, we do use drugs embraced by classical medicine, but we have a broader intent—to trigger our whole body to function in a better way. Vaccination is a wonderful example of this.

Vaccination is a type of enhanced medicine. In effect, we inject a weakened bacteria into the body so the immune system can recognize this new invader and attack the more dangerous version after an infection. The approach in classical medicine is to use an antibiotic to treat a disease caused by an infection from those same bacteria, but *after* the infection. The vaccine keeps you safe from contracting that disease in the first place.

THIRD PRINCIPLE: *Everything we do should be measured: quantified before and after the intervention.*

Why is this important? We need to make sure that whatever improvement we are targeting in someone's health, in their biology, is achieved. We know that different interventions can induce different

biological effects on different individuals. What may be true for the general population may not hold for the specific client we are treating. In the vaccination example, for instance, we expect the immune system to be better prepared after a vaccination to ward off disease from that bacterial infection.

Blood tests enable us to measure and monitor the presence of antibodies and certain immune cells designed by the immune system to seek and destroy those bacteria. Or, if our goal is to achieve better brain functionality through hyperbaric oxygen therapy (an important part of the enhanced medicine tool kit we'll explore shortly), we can monitor that before and after the intervention by high-resolution functional imaging of the brain and by computerized cognitive tests.

FOURTH PRINCIPLE: *Enhanced medicine starts with effective communication with clients.*

We need to invest the time necessary to understand the whole picture, including the client's personal life. Our first priority is listening to understand clearly what the client needs. The second priority flows from that understanding: sketching, in detail, a realistic, achievable biological outcome for the client.

One of the most important skills for any physician is conducting a medical interview. This requires booking enough time for that discussion, often a half hour or more. In the United States and many other countries, committing a half hour or more for patient interviews is a real challenge. Most physicians have so many patients that they cannot spend more than ten or fifteen minutes with each one. They do not have time to explore any condition in detail. Prescribing a pill requires the least amount of time with a patient. So, what happens? Most often, physicians prescribe a pill.

In contrast, evaluations and interventions in enhanced medicine are time-consuming. This time commitment is crucial for physicians

and clients to achieve their specific goals. Physicians practicing enhanced medicine need to invest time with people in their care to gather insights and updates about their experience. Physicians should be prepared to put everything on the table when they meet a patient and to encourage an open discussion.

Let's say, for example, that you have had a stroke and now are considering a program in enhanced medicine. Our first steps before treatment would be analyzing state-of-the-art functional and structural images of your brain, then compiling a comprehensive physical and cognitive evaluation of your brain. At that point, we would explain in simple, nontechnical terms to you what we believe we can achieve.

As you might expect, it takes time to walk through and translate, in simple terms, all the analyses and evaluations we assembled and the questions and prospects for treatment that they raise. We might see, for example, a high probability to improve your ability to think but not your motor skills. Would you be willing to accept that outcome? Would you want to proceed with an enhanced medicine program, or not?

Our purpose—our imperative, really—in taking these initial steps is to establish high levels of trust that are necessary to customize the deep knowledge and medical technologies available now for treating patients or clients in enhanced medicine.

The Six Core Disciplines of Enhanced Medicine

1. Hormesis

- Hormesis plays a crucial role in enhanced medicine, generating a signal to help prepare the body for the next stressor events. It is a grand idea and a grand bargain: to induce stress in the

body for a positive biological change. We are fine-tuning the body, preparing for physical challenges you expect.

- The basic concept is to expose your body to a specific stress in low “doses”—in a safe, controlled way that is below some higher level that could cause real damage. This requires a controlled exposure to a stress. You need to stress your body for it to work better, to enhance your performance. That is what I mean by a “grand bargain.” The goal is to trigger your biology to function better to reach your biological goal.
- We condition our whole body at the cellular level to be ready for an array of biological challenges that may arise. You cannot just go out some day with no prior training and run a 10k as fast as you can and expect to avoid injury. You prepare for the run over time by, in effect, triggering your biology to adjust with a controlled lower “dose” of rising stressors in distance, tempo, and speed. Otherwise, you will risk stress fractures, torn muscles, and other injuries, and you will not reach your biological goals to help you run a faster, injury-free race.
- The grand bargain is to push yourself, to induce stress in limited amounts similar to what you anticipate during the race. You don’t run at maximum speed longer than these limited bursts because you don’t want to accelerate the stress to a point where you risk injury.
- Fast runs up to a distance of 100 yards that approach your maximum speed—sprints known as striders—are an

example of controlled exposure. The physical exertion during these sprints prepares all the cells in your body—heart, lungs, liver, kidneys, stomach, and more—to achieve the pace goal you set for upcoming races. It is more than a matter of conditioning the bone, muscle, and ligaments in your lower body.

- Consider again our vaccination example. Being vaccinated with a small dose of weakened bacteria or virus is another way of using hormesis to achieve a certain biological goal. The weak quantities of a virus or bacteria injected into your bloodstream train your immune system in advance to defend against the more potent virus or bacteria, should you encounter it. As we noted before, in classical medicine you are given an antibiotic or other medicine after you are already sick.

Misconceptions, Fallacies, Rejections

Hormesis has a bad reputation among some medical professionals for at least three reasons. First, the basics of hormesis are not taught in medical school. Most practicing physicians are not familiar with the concepts or the science and, as a result, they are often skeptical about its principles and approach.

Then, too, practitioners of homeopathic medicine made unsubstantiated claims that extremely small doses of undetectable toxic biochemicals will train your body to ward off illness. The homeopathic practitioners lauded these undetectable and unmeasured levels of toxic biochemicals

as examples of hormesis at work, of how the body can heal itself. They were not.

The final point, which relates closely to the first, is that even among physicians who are aware of hormesis, most do not incorporate the concepts and science of hormesis into their own lives. Many lack the knowledge and motivation required to do this. Thus, they are not able to be genuine advocates for hormesis. If asked, they cannot reply positively to the simple question, “Are you doing it yourself?”

2. Physical Exercise

The physiological, biological, and mental benefits of intermittent physical exercise, of course, have been extensively investigated by scientists, physiologists, and other professionals. Millions of people have embraced these findings to improve their health and well-being. The benefits are legion.

- Let’s look at two key points about intermittent physical exercise that explain its crucial role in enhanced medicine programs: One is hormesis, preparing the body at the cellular level to meet the next physical challenge. Physical exercise builds more mitochondria, more muscles, more blood vessels. It improves your heart’s capacity to pump more blood through the body, enabling your mitochondria to process more oxygen and generate more energy. These benefits to your physiology and biology happen not during the exercise itself but between exercise sessions. That is why physicians, nurses, physical therapists, and well-trained coaches preach that recovery time is crucial for athletes.

- If you take physical exercise or training to the extreme—without taking recovery days in between—you risk breaking bones, major tissue injuries, endless inflammation, and more. Your physical condition will decline. However, if you exercise for a certain period of time—not continuously, not every day of the week—and then follow with recovery periods, these various exercises build strength and endurance. In hormesis terms, they induce resilience to the next stressor. As we build resilience to stressors through an ongoing, regular exercise schedule, the body prepares itself for this repetitive event.
- The second point is that when you exercise, there are immediate, direct benefits that flow from your body's natural biochemistry. For example, exercise may directly affect areas of the brain, such as the amygdala and prefrontal cortex, that are rich in receptors for endocannabinoids and that regulate the stress response.
- Endocannabinoids have the same chemical compounds found in cannabis, the marijuana plant: the “don't worry, be happy” chemicals. Endocannabinoid molecules reduce anxiety and induce a state of contentment when they lock into these receptors in the amygdala and prefrontal cortex. Endocannabinoids also increase dopamine in the brain's reward system, further fueling sensations of optimism.
- Osteocalcin, a hormone, is another example of how exercise produces biochemical benefits in the brain. During workouts, your bones manufacture and release osteocalcin into your bloodstream. In the brain,

osteocalcin helps sharpen your thinking by improving brain function and memory. Osteocalcin has many other known benefits beyond the brain, such as making energy more available in muscles, improving male fertility, and promoting absorption of glucose into liver, fat, and skeletal muscle cells.

3. Nutrition, Diet, and Fasting

The design of different diet regimens should be matched carefully with whatever biological goal we aim to achieve.

- Just as the quality of the fuel we pump into our car affects engine performance and the efficiency of fuel lines, the food that we take into our bodies has a huge effect on the performance of our mitochondria (those cellular engines that convert oxygen to energy), blood vessels (“fuel lines” that carry oxygen to the mitochondria), and hormones (connecting signals that orchestrate the performance of different organs). The amount of food we eat—and the frequency—are factors just as important in shaping the impact of our diets as food quality.
- When not to eat is as important as when to eat. *What?! you might be thinking. Even if I’m hungry late at night or early in the morning?* I’ve learned to anticipate this puzzled response from clients and patients. Many of us learn from an early age that if we’re hungry, we should eat something if we can to ease the hunger. We learn that hunger is bad, a signal

from the body to our brain. Well, hunger is not bad for limited periods. It is another illustration of hormesis: inducing stress in the body for a positive biological change. Let me explain.

- Intermittent fasting is a discipline that encourages us to eat main meals within a limited time span each day, and then go cold turkey—no snacks, no light meals—at other times. I use an eight-hour time window for eating and fast the other sixteen hours. Intermittent fasting induces a controlled stress as hunger emerges; that is, as the body gradually craves more nutrients, more food. This limited “hunger stress” helps mitochondria to better convert oxygen to energy, and cells to better synthesize new molecules and process other aspects of cell metabolism and resilience. Intermittent fasting also helps the body clean out the garbage accumulated within our cells—a process known as *autophagy*. When we fast roughly twelve hours or more, our cells start consuming unnecessary or dysfunctional components as food. “Auto” means self and “phagy” means eat, so the literal meaning of autophagy is “self-eating.”
- Think of it this way: If you eat more of that cream cake in the refrigerator and not the vegetables nearby, over time the vegetables will rot, smell bad, and make all food in the refrigerator unappetizing. However, if all you see in the refrigerator is vegetables, you have no other choice if you are hungry. You will eat them. This is what happens in your cells after twelve hours of fasting.

- We will get into details of my personal regimen for hyperbaric oxygen therapy sessions, fitness, nutrition, and diet in chapter 13.

4. Immune System

- Our immune system plays a crucial role in many chronic illnesses in addition to diseases caused by a specific invading pathogen (bacteria, virus, or fungal). Diseases such as lupus, multiple sclerosis, or rheumatoid arthritis, for example, are triggered by an overzealous immune system that attacks healthy cells, tissues, and other normal parts of the body. On the other hand, when the immune system is generally weak, our body is more vulnerable to invasion and damage from external pathogens. Moreover, our body's capacity to regenerate or repair tissues harmed by any illness or injury is also severely damaged.
- We have also learned in recent years more about the immune system's significant role in fighting cancer cells and the rise of immunotherapy treatments to attack tumor cells. The immune system's resilience or weakness also is a factor in many age-related declines of our physiological and biological functions.
- Immune system resilience—and how we should preserve and enhance it for specific biological goals—will be examined closely as we move through different chapters of the book.

5. Hyperbaric Oxygen Therapy (HBOT)

Hyperbaric oxygen therapy treatments, known as HBOT, are one of the most powerful elements we have in enhanced medicine. HBOT has two primary benefits as well. One is to overcome one of the more common bottlenecks our bodies develop over time: atherosclerosis, a reduced capacity of our cardiovascular system to deliver oxygen to our cells due to the narrowing passageways in our vessels as plaque deposits accumulate and constrict blood flow.

The second is another form of hormesis. One of the most powerful biochemical triggers for the regenerative-repair cascade we prize in enhanced medicine is hypoxia, the lack of oxygen. For that reason, we mimic hypoxia in our hyperbaric oxygen chambers by generating a fast decline from a very high level of oxygen back to the normal level. In these carefully monitored conditions, hypoxia becomes a safe control stressor.

As the body interprets the fast decline from a very high oxygen level to a normal level as hypoxia, it activates a set of responses we call the “hyperoxic–hypoxic paradox” or HHP. This activates multiple biochemical mechanisms to repair whatever new damage the body senses happening from hypoxia, the oxygen deprivation.

Generating HPP through the protocols of HBOT elevates our biochemistry in four remarkable ways. It enables us to (1) dramatically increase the volume of mitochondria; (2) make mitochondria’s capacity to convert oxygen to energy more efficient; (3) accelerate the production and migration of stem cells; and (4) generate new blood vessels where blood flows have been reduced.

The HPP component is at the core of why HBOT can be a powerful tool, an important biochemical insight that we’ll examine more closely in chapter 3. It shifts the balance from the degeneration of your physical condition (injuries or diseases that take your biology down and the

normal decline we experience as we age chronologically) to regeneration (repair and growth).

6. Mental Perception and Resilience

I always teach my students that different people can share the same environment, yet they sense and experience that environment in totally different ways. This is because our perceptions of the world and the more immediate environment we live in are sorted out in our brains. We can go even further: you yourself can experience what appears to be the exact same environment in dramatically different ways at different times in your life.

Picture in your mind several people waiting in line to buy ice cream at Disney World. A child who catches your eye is appealingly curious, enjoying the faces surrounding her and the voices she hears. She delights in the waiting. Yet that same person will react in dramatically different ways to the same stimuli if years later she has developed PTSD after her military service. Now, those nearby faces and voices provoke waves of fear, even terror. Her dread from that moment will affect all her biological functions and, in fact, all her cells.

Or consider a person who is depressed, lacks a sense of purpose, and has no meaningful plans for his future—regardless of chronological age. It could be someone in their twenties, sixties, or eighties. The regenerative biological capacity for this person will be significantly decreased, and any medical insult—any injury or infectious disease—may lead to significant chronic damage. He may not be capable of making much progress in the other core dimensions of enhanced medicine.

Moreover, take the case of two soldiers who went through the same combat situation, the same horrific life-threatening sequence of events. One developed PTSD. He is debilitated, cannot sleep, cannot

concentrate, and cannot focus on a mission. He cannot work, cannot write computer code as he did in the past. He continues to relive the horrifying event again and again—likely for the rest of his life if not treated successfully.

The other soldier did not develop PTSD. Why? The baseline of mental resilience was much higher for the second soldier than the baseline for the first soldier. All of us need this baseline resilience to cope successfully with the many repeated stressful events that we encounter in life. With each stress we encounter, we can either continue to build resilience (hormesis) or slip further toward a breakdown.

The different elements of mental perception and resilience will be discussed as well in following chapters, including exciting breakthroughs in imaging technologies that enable us to see and measure markers in the brain for baseline mental resilience.

This is the toolbox of principles and disciplines we have within our grasp, new medical insights and technologies with proven potential to elevate your mental and physical abilities to *your* maximum level. We are now at the dawning of enhanced medicine.

Key Takeaways

The Four Principles

1. Enhance your physiology and biology to the highest levels you can achieve from whatever those levels are at the outset.
2. Focus interventions on finding and removing bottlenecks that prevent your biology from performing.
3. Measure everything before and after the intervention. Health metrics defining a desired outcome based on

average results for the client's age are not relevant in enhanced medicine.

4. Effective communication begins by listening to patients' or clients' perspectives to set goals.