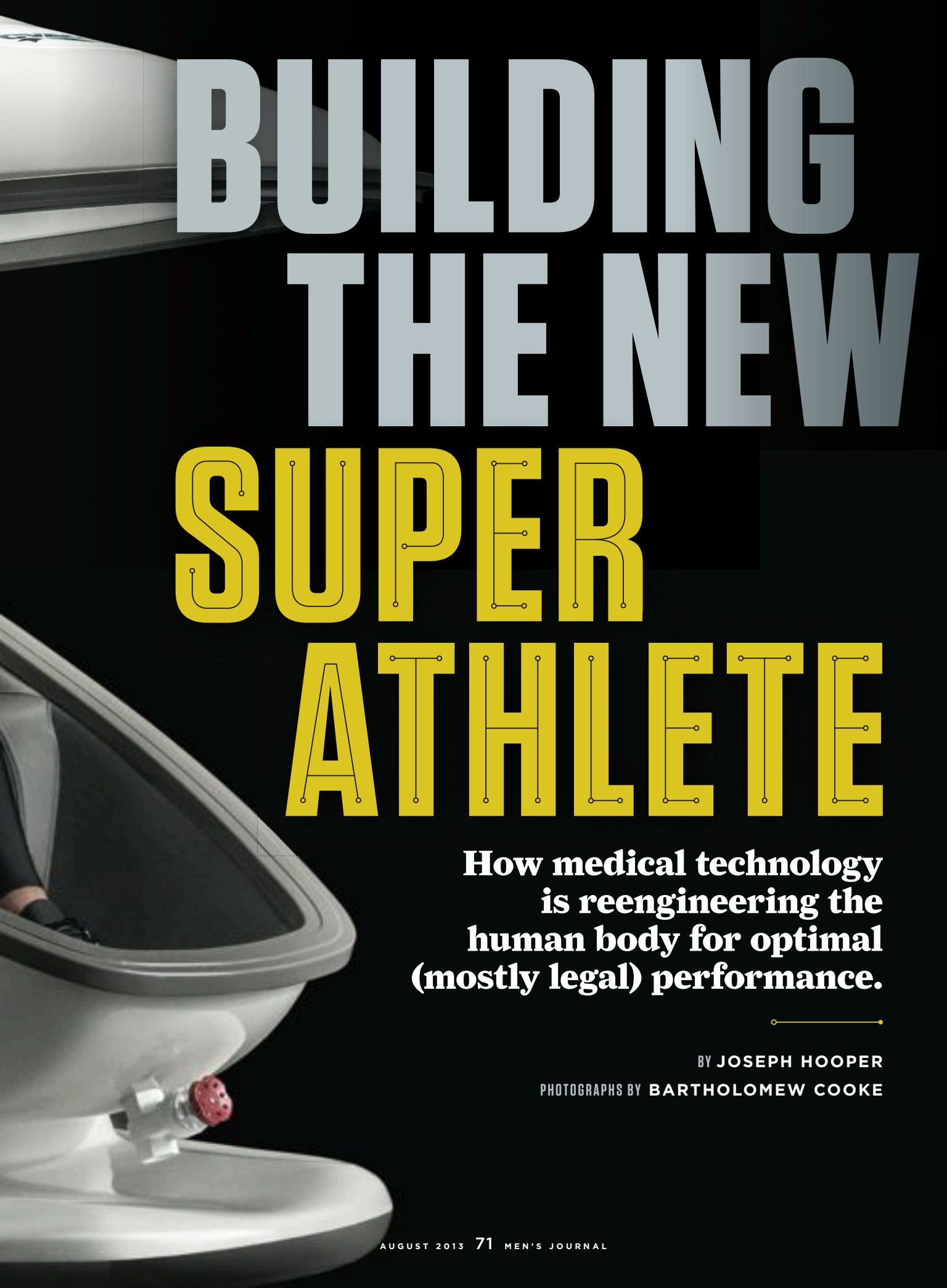
Some experts are convinced that being subjected to rapid air-pressure shifts in the CVAC pod can stimulate the lymphatic system and enhance recovery.



BUILDING THE NEW SUPER ATHLETE

How medical technology is reengineering the human body for optimal (mostly legal) performance.

BY JOSEPH HOOPER

PHOTOGRAPHS BY BARTHOLOMEW COOKE

IN THE ETERNAL cat-and-mouse game of athletes using banned performance-enhancing drugs and sport-regulatory bodies trying to catch them, the cat, for once, is winning. This past January, the U.S. Anti-Doping Agency brought down the most brazen and successful doper of all time, when Lance Armstrong confessed his performance-enhancing sins — testosterone, human-growth hormone, microdoses of EPO, which stimulates the production of red blood cells. Over the past year, Major League Baseball, an organization better known for looking the other way, has been collecting the doping records from a Florida "anti-aging clinic" of as many as 20 major leaguers. As of this writing, baseball is on the verge of suspending A-Rod and Ryan Braun, superstars who have managed to flout the ban on steroids and elude official sanction.

That doesn't mean ambitious, elite athletes have stopped looking for a performance edge, but increasingly they're being pushed to explore creative new technologies that haven't been banned — or not yet. The evolution of these under-the-radar therapies has pretty much followed the same pattern as the banned drugs: They're conceived as solutions to medical problems, tested in labs on animals, then brought to the clinic to hopefully bring sick people closer to health. There, sports trainers discover them as ways to bring their athletes closer to gods.

But rather than giving themselves an injection of a banned pharmaceutical to build muscle or improve stamina, today's athletes are tapping into more exotic medical technologies to fine-tune their physiology for a competitive but not overtly unfair advantage. "It's about using human ingenuity to extract that last ounce of performance without crossing the line," says Gordon Uehling, an ex-tennis pro who has turned his suburban New Jersey training center into a kind of sports hi-tech lab.

Athletes today are being injected with their own stem cells to repair worn-down joints, training their brain waves to find the optimal frequencies for competition, flushing their lymphatic systems in pressurized air "pods," even tinkering with their DNA with a controversial but readily available supplement, in hopes of becoming the ageless, indestructible jocks of the future. As Jack Groppel, co-founder of the Human Performance Institute in Orlando, sees it: "When it comes to applying science to sports performance, the technology is improving so rapidly, the future is limited only by our imaginations."

JOSEPH HOOPER *is a contributing editor. He wrote about statins in the June issue.*

California's Neurotopia hooks up an athlete to a computer so he can train his brain waves to resemble the top pros'. The theory: If your various brain waves look like PGA standout Rickie Fowler's, you'll be more likely to putt like him.

STEM CELLS JUICE OLD JOINTS

LAST YEAR, Oakland A's pitcher Bartolo Colón was suspended by Major League Baseball for using synthetic testosterone. But his other medical adventure, revealed by the *New York Times*, may be more newsworthy. In 2010, he seemingly brought his career and his badly damaged pitching arm back to life by receiving injections of his own stem cells in his elbow and shoulder. This one-day medical procedure exists in a regulatory limbo, not expressly forbidden or approved by the FDA, and as a result most academic hospitals and high-profile sports orthopedists steer clear. But over the past five or so years, pro athletes in need have learned which doctors to visit on the down low.

The current treatments won't make your joints better than new, but if they can keep them anywhere close over the course of a decade-long career, that's worth a fortune. Key to the treatment are mesenchymal adult stem cells, found in the bone marrow and extracted with a long needle from the patient's pelvic bone. The mesenchymal cells can mature into either bone, cartilage, connective tissue, or muscle, and about two decades of academic research, mostly in animals, has established that if you inject them into joints, good things can happen. There is evidence, if not proof, that they may help keep inflammation in check and drive the production of new cells needed to repair damaged tissues, especially connective tissue, like the tendons and ligaments in Colón's throwing arm.

STYLING BY VANESSA SHOKRIAN

In 2005, Dr. Christopher Centeno, a rehabilitative-medicine doctor and the Medical Director of the Centeno-Schultz Clinic outside Denver, was among the first to take stem-cell joint "re-implants" from the academic lab to the clinic. He devised a multiday procedure in which he cultured the stem cells in his laboratory, increasing their number and hence their potency inside the joint. In 2008, he says, the FDA declared that this process was, in effect, the production of a drug, and ordered him to cease and desist. "So let me get this straight," he says with practiced disgust. "I can take a scalpel or a needle, put it in the wrong place and kill the patient because I'm an idiot, yet I'm not allowed to inject the patient's own cultured stem cells? When paper after paper on the animal side shows safety and our own clinical research does, as well."

In 2011, Centeno crossed the Rubicon, or in this case, the Caribbean, to open a clinic in the Cayman Islands that defines the outer limit of credible orthopedic stem-cell therapies. Patients with severely damaged joints, including, at last count, 10 current professional athletes, go to the Caymans, enjoy the beaches, and have their mesenchymal stem cells extracted. (Retired Denver Bronco defensive end Jarvis Green credits the cultured stem-cell treatment for extending his NFL career by a season and for giving him a physically active life after his retirement.) Over the course of the next two to three weeks, the staff will culture the cells, increasing their number 1,000-fold. Then the athlete returns to the islands to receive his transplant injection, and the rest of the cells are banked for future use. "A couple of years later," Centeno says, "he might call up and say, 'Hey, my knee isn't doing so well.' The staff takes the cells out of the freezer, and the athlete heads back down to the Caymans for a touch-up."

Dr. Laith Jazrawi, the head of sports medicine at NYU Langone Medical Center, and one of the few academic orthopedists using the one-day stem-cell procedure — the one permitted in the U.S. — can't disguise an admiration for clinicians willing to go out on a limb for medical progress. "As a scientist, it excites me that they're doing these things," he says. He thinks the multiday processed stem cells "are probably going to be safe" — cancers have yet to pop up in the animal-research literature. But he sounds the academic's familiar refrain: "If the Colorado group's results are so good, why haven't they published anything on it?" The usual rejoinder from independent clinicians is that they can't afford to. However, a year ago, media mogul John Malone began subsidizing Centeno's research and now three clinical trials have been funded and are about to move forward. "When 10 guys use these procedures," Centeno says, "it's fringe. When 10,000 are doing it, it's a tidal wave that's going to wash all over the critics."

TRAINING THE BRAIN TO PLAY LIKE A MACHINE

MAYBE IT WAS INEVITABLE that some sports scientists would turn their attention from fine-tuning the body to tinkering with the brain. Nick Podesta was the nation's top-ranked 16-and-under tennis player when injuries forced him to take time off from the tournament circuit. Like just about any tennis phenom capable of overwhelming with big ground strokes, he was occasionally tripped up by lapses in concentration and focus. Gordon Uehling, his coach and mentor, decided to plug Podesta into a neurofeedback machine to see if he could train Nick's brain to be better at tennis.

Podesta now makes an extra weekly trip to CourtSense, Uehling's Tenafly, New Jersey headquarters, to plug into the Neurotopia machine, the first such system on the East Coast. This morning, he checks into a quiet, windowless room, settles into a cushy Barcalounger-type recliner, gets a number of electrical leads attached to his scalp, and plays a video game with his brain.

As Nick stares at the monitor screen on the wall directly in front of him, the computer registers the brain waves emanating from certain key neural regions. If there is a subtle increase in the higher-frequency beta waves, indicating a lively mental focus, the computer rewards him. The pink rocket ship on the screen billows smoke from its exhaust pipe, the music volume increases, and the screen brightens, creating a pleasing illusion of forward motion and good times in outer space. If he's in the lower theta frequencies, suggesting Nick has tuned out, the screen grows dim and quiet, no rocket smoke. "It's like a stethoscope to the brain," Uehling says from an adjoining room. Uehling's own brain is in full multitasking mode. He's observing Podesta's session on two monitors, one with the unfolding video game on it, one with real-time brain-wave analysis, and at the same time he's watching, via a laptop connection, the progress of another protégé, Christina McHale, No. 63 in the world, who is playing a tournament match in Rome, tuning up for the French Open.

The goal behind all the fancy Neurotopia electronics is something the neuroscientists like to call "self-regulation." This is the idea that using basic behavioral conditioning techniques — a positive stimulus for the "right" response, a negative stimulus for the "wrong one" — you can train your brain to influence physiological processes that we normally think are beyond, or below, conscious control: body temperature, heart rate, or, in this case, brain waves, the patterns neurons make when they fire as a group.

The Neurotopia system draws on what the San Luis Obispo, California, start-up company's chief science officer Leslie Sherlin calls a "brain bank." Sherlin is a neuroscientist, who has studied the brain waves of pro-sports teams — the Seattle Seahawks and Mariners, as well as elite, Red Bull–sponsored athletes in individual sports. He's got in his bank about 1,200 brains, that is, their EEG readouts when performing sports-related tasks. This information is fed into the computer to become the gold-standard algorithms that Neurotopia trains clients to approximate when they play the video games. Sherlin and his tech staff hooked up top golfer Rickie Fowler on the putting green as one of their reference brains. As Fowler sank putts, the electric leads attached to his head sent his brain-wave data to the Neurotopia team's three laptops arrayed around the green.

Sherlin found distinct patterns in the way the top pros were able to toggle back and forth between focusing on the task and then, at the moment of truth — in this case Fowler swinging the putter — relaxing into an open mental state. That's a skill that doesn't show up in the brain scans of even a scratch club player. "I don't want to stand on a pedestal and say we've figured it all out," Sherlin says, "because this data is still anecdotal. But definitely, the elite perform differently, even if the nonelite is really good."

If Neurotopia has not yet arrived at the final portrait of the perfect brain orchestrating the perfect putt or home-run swing, the system is good enough to have been embraced by the likes of Nascar racer and all-around motor-sports stud Travis Pastrana, Olympic beach volleyball heroines Kerri Walsh and Misty Mae Trainer, and Mike Bryan, of the Bryan brothers men's doubles tennis juggernaut. And, for his part, Nick Podesta is keen.

During a match, he says, he now finds it easier to maintain his concentration — in Neurotopia-speak, his "focus endurance."

Patients with damaged joints — including 10 pro athletes — go to the Caymans, enjoy the beaches, and have their stem cells extracted so they can be transplanted back in.

If the match isn't going well, if the weather conditions are bad or the line calls are going against him, he taps into another Neurotopia training, "stress recovery," a kind of Zen letting-go empowered by a decrease in "mind chatter." "I'm physically pumped up, running down balls," he says. "But my mind is able to stay relaxed, in the moment. I'm not overthinking."

The future of brain training in sport may take us to stranger places than Sherlin might care to imagine. Over the past few years, Johns Hopkins' Dr. Pablo Celnik has done a handful of landmark studies demonstrating that techniques like transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS), emerging depression therapies, can also improve the way healthy people learn and retain "motor behaviors." He's currently working with the Air Force to see if brain stimulation can enhance pilots' ability to perform physically in challenging, fast-moving environments. "Someone may be able to practice with a stimulator on their head, and they will perform better," Celnik says. "Then, when the Olympics comes around, he doesn't need to have it on his head anymore. You cannot trace it. So yes, in a way, this would be 21st-century doping."

WHO'S SEEKING AN EDGE

Athletes are always looking to science for a boost. Here are five who've recently sought advantages on the far edge of medical technology.

NOVAK DJOKOVIC
The *Wall Street Journal* reported his use of the CVAC pod.

BARTOLO COLÓN
In 2010, he was injected with his own stem cells to revitalize his arm.

KOBE BRYANT
In 2011, he used cryotherapy at a German soccer club's rehab center.

TRAVIS PASTRANA
This year, he used a Neurotopia video game for mental training.

DUSTIN KELLER
In 2011, he used TA-65 to speed his recovery process.

LONGER CHROMOSOMES = LONGER CAREERS

IN 2002, Manhattan entrepreneur and anti-aging gadfly Noel Patton purchased the rights to a biological compound some longevity scientists believe is our best shot at extending the span of human life. In 2007, Patton signed up about 100 affluent human guinea pigs who were willing to pay $25,000 for the privilege of taking his untested supplement, TA-65, for a year while having their health closely monitored.

The molecule at the heart of the supplement, isolated and intensively refined from the traditional Chinese herb astragalus, was the only substance that had ever been discovered to enhance, albeit modestly, the body's ability to produce the enzyme telomerase. Telomerase's job is to replenish the tips of our chromosomes, the telomeres, which allow our cells to keep on dividing, which they need to do for the body to keep growing and repairing itself. "Telomerase is what keeps stem cells happy," Dr. Joseph Raffaele, a prominent Manhattan anti-aging doc says. "It allows them to keep dividing and replacing damaged cells in the body."

The paying volunteers weren't sure whether they might live forever (shortening telomeres is one of the drivers of aging and bodily decline), get cancer (telomerase fuels runaway cell growth in cancer), or derive results somewhere in between. In between won out. The scientific consultants to Patton's TA Sciences company, Raffaele and Calvin Harley, one of the world's leading telomere biologists, published a paper that showed a modest improvement in the immune systems of some of the subjects. They are set to publish another one this fall that details some cardiovascular and insulin-system upgrade as well. But many of the subjects reported big lifts — cognitive, sexual, all-around vitality. The athletes who subsequently signed up seemed particularly happy. NFL tight end Dustin Keller was an early adopter who said he went on it to "strengthen my immune system and speed my recovery process throughout the season." The first paying customer, Bill Andrews, a molecular biologist who helped discover the human telomerase gene back in the 1990s, says that three weeks after he began taking the supplement, his ultramarathoning career went through the roof. "I've always been a back-of-the-pack runner," he says, "but I was in a race in Salt Lake City and blowing by runners who've always beaten me."

To date, some 20,000 people have spent upward of $8,000 for a year's supply, purchased through the TA Science's network of health-care providers. (Much of the product is sold online.) High-visibility clients (who don't go on record) include Hollywood producers and one A-list actor esteemed for his ripped physique. And yet, still the best scientific evidence we have about the effects of taking TA-65 comes from mice. A study from a top telomere biologist showed that the supplemented mice better resist the depredations of aging — they process glucose better; their skin and bones are healthier.

What TA-65 might be doing for the Bill Andrewses of the world is open to conjecture. One plausible theory: By goosing the body's ability to generate new immune-system cells, the supplement enhances athletic recovery. Endurance athletes subject themselves to huge amounts of systemic inflammation, and the immune-system reinforcements may allow athletes to resist exhaustion at the cellular level, to continue to perform at a high intensity. It could be driving cell growth in the muscle or the lung tissues. People who exercise tend to have longer telomeres, so maybe taking TA-65 and, it is hoped, slowing down the normal rate of telomere decline, is like getting exercise in a bottle. At this point, nobody knows.

THE POWER OF THE POD

HEATHER HINIKER OWNS and runs what could be considered a gym of the future in Newport Beach, California. The machine does all the work. At her Ascent facility, the training consists of showing up and settling into one of her three stationary CVAC pods for a 20-minute session. The air pressure inside will yo-yo between sea level and about 22,500 feet, with 200–400 pressure changes in between. When you hit maximum altitude (or rather the air-pressure equivalent), you take a rapid nosedive back to Earth, akin to racing up to the top of Aconcagua and jumping off.

The 36-year-old Hiniker says the pod is the only thing that has kept her rheumatoid arthritis at bay. She left her job in finance, sank her life savings into Ascent, and saw her business nearly go under, until

FROM LEFT: DOMINIQUE CHARRIAU/GETTY IMAGES; KEVIN JAIRAJ/USA TODAY SPORTS; ANDREW D. BERNSTEIN/NBAE/GETTY IMAGES; JERRY MARKLAND/GETTY IMAGES; NICK LAHAM/GETTY IMAGES

In a cryotherapy chamber, air cools to about –250 degrees, stimulating a big release of anti-inflammatory chemicals, and allowing athletes to push harder the next day.

word started spreading on the California jock grapevine that the pod could enhance performance. Now she says the majority of her clients are professional athletes — UFC fighters, a major-league ballplayer, two members of the U.S. Olympic men's volleyball team, and a famous pro cyclist who demands secrecy. "He doesn't even tell his teammates about it," she says.

Dr. Karen Herbst, an endocrinologist at the University of California San Diego, sees the pod as a means to "replicate exercise" in a machine. "I don't see it as an altitude chamber anymore," she says. The standard high-altitude tents that some athletes sleep in as a training aid simulate only one aspect of living at higher altitude: the reduced amount of oxygen the body absorbs. The CVAC, on the other hand, subjects the body to actual air-pressure changes, rhythmically squeezing and relaxing the whole human package — blood, organs, the works — the way an empty plastic water bottle with its cap screwed on collapses in on itself when the simulated altitude goes up and the pressure drops, and plumps back out on the descent when the pressure rises back to normal.

The effect, Herbst believes, is a stimulation of the lymphatic system, which then drains metabolic waste more vigorously, thereby reducing inflammation. This is how she explains the positive results she got in a 2010 pilot study, in which the CVAC reduced pain in subjects who suffered from a genetic pain disorder. Athletes, she says, may get another benefit. The intermittent exposure to the low-oxygen, high-altitude pressure can create oxygen free radicals. In excess, they damage the body; in moderation, they signal the cells' power plants, the mitochondria, to grow more robust. We get the same training effect on a good run, subjecting the body to the mild stress of operating at oxygen deficit, depending on how hard we push. "As with exercise," Herbst says, "you're stimulating all these stress pathways and, hopefully, improving the body's entire metabolism to better handle the stresses of life."

In the case of Adam Neff, the nation's second-ranked tennis player in the 12-and-under set, that would be the physical stress of playing high-level tennis all week. Three times a day, Neff spends time in the CVAC pod that his coach leases for him to the tune of about $100,000 for five years. "It was a little freaky at first," Neff says, the feeling of the lid closing down and then having to constantly move the jaw muscles to equalize the air pressure that builds up in the eustachian tubes during the pod's high-speed altitude changes. Neff says his year of using CVAC has given him more stamina. He's not dragged out after a week of hard training, a fact he attributes to the longer and heavier sleep he gets every night. Uehling agrees. "It relaxes my brain," he says. "I'm really present in the moment when I get out of the pod."

A Stanford pilot study found that CVAC modestly improved glucose metabolism in subjects who were type-2 diabetic, and in those at risk for the disease. Its author is intrigued by the technology's potential to boost athletic performance. "I had two Masters cyclists using the CVAC informally but consistently," says Anne Friedlander, a human-biology professor. "They swore by it and said they could 'push more watts' the next day."

A DEEPER FREEZE

THREE TIMES A WEEK during the off-season, veteran NFL safety Will Allen has his body flash-frozen. For the three-minute session, which he does at Cryohealthcare in Beverly Hills, the liquid nitrogen–cooled air, brought down to about –250 degrees, swirls around his body in the form of a fine white vapor. "After the second shot of air, I'm like, 'This sucks,'" Allen says. "And then I get used to it. I'm going into my 10th season. I need something legal to help me maintain."

The ice bath has been a fixture in team training rooms for years, but by taking cold to extremes, whole-body cryotherapy, advocates say, tamps down inflammation in a frozen flash, reducing soreness and recharging the entire system to handle intense muscle-quivering workouts. "The extreme temperatures stimulate the skin and the subcutaneous flesh into releasing anti-inflammatory chemicals, cytokines like interleukin 10," explains Dr. Jonas Kuehne, an L.A. physician whose Cryohealthcare practice is heavy on celebrities and athletes, including Allen.

If all goes well, these mice will have muscles that aren't only stronger than normal but more fatigue-resistant, a cross between a powerlifter and a marathoner.

Long a staple of European spas and sports teams, cryo use has risen in the U.S. in the past few years, propelled by celebrity success narratives. Kobe Bryant described his cryo experience in Germany as "an unbelievably intense feeling." Jason Kidd said it was a secret weapon the Dallas Mavericks used (they later bought a unit) en route to their 2011 NBA championship.

In this country, the dominant player is Dallas-based Millennium Ice, which has sold its cozy, one-person, Ukrainian-style canisters (your head sticks out) to the Mavs, the Knicks, and to Nike in Beaverton, Oregon, where distance-running guru Alberto Salazar and trainees like Olympic champion Mo Farah do their three minutes after workouts. A new company, KryoLife, is set to open a flagship deep freeze in Midtown Manhattan this fall.

At their "beta" test facility in Tenafly, I enter their gleaming new unit. Inside the chamber, it feels cold but it's not as unpleasant a shock to the system as being submerged in an ice bath. (According to Kuehne, this is because air doesn't conduct cold nearly as efficiently as water. Otherwise, I'd be dead by now.) The cold doesn't have long enough to penetrate deeply, as the body shunts blood from the extremities to the core to protect the inner organs. (On the heels of his four-year doping suspension, American sprinter Justin Gatlin made the mistake of doing cryo in damp socks before the 2011 World Championships. He got frostbite and failed to qualify for the finals in the 100-meter dash.)

Session over, I hit the exercise bike for the required 10-minute warm-down. I feel good, and I'm not alone. "They just give me so much more on the field the next day," says trainer Matthew Uohara, who works with Allen and other pro athletes during their off-seasons.

While lab research has established that cryo is able to decrease inflammatory markers, Alan Donnelly, a professor of exercise physiology at the University of Limerick, Ireland, says he didn't see any functional improvements in his cryo study, no decrease in muscle soreness or increase in strength. It is possible, of course, that the cryo lift may be less in the muscles and more in the head. "All of the subjects in our study raved about it," Donnelly allows. "They thought it was fantastic."

ENGINEERING THE DNA TO BUILD THE ULTIMATE ATHLETE

HERE ON THE SEVENTH FLOOR of the University of Pennsylvania's Clinical Research Building, biologist H. Lee Sweeney is preparing to genetically reengineer mice that could become something close to the world's greatest athletes. If all goes well, these mice will have muscles that aren't only bigger and stronger than normal, but more fatigue-resistant, a cross between a powerlifter and a marathoner. "If someone had the resources," Sweeney says, "they could do something like this now. The only thing preventing it from happening the way EPO happened is that you need very qualified technical help to do this. But with the way funding for science is going. . . ."

This, potentially, is the dark side of the next wave of performance enhancement. While Sweeney's work is nothing but admirable — he's looking for new therapies to treat degenerative diseases like muscular dystrophy — if the antidoping authorities fail to keep pace, athletes may find rogue scientists able to inject them with extra copies of human genes essential to performance. The genes, piggybacked onto viruses, will be incorporated into the athlete's own DNA, programming his body to build more muscle or to develop more aerobic capacity, without the injections of synthetic boosters like steroids or EPO.

In the late 1990s, Sweeney created a small media stir when he unveiled a bunch of hypermuscular mice, quickly dubbed "Schwarzenegger mice," that he had injected with an extra copy of a gene that produces a growth factor called IGF 1 — which promoted an Arnold-like physique. (A Pennsylvania junior-college football coach contacted Sweeney about procuring some of the experimental product so that he could begin injecting his players.) Practically from that moment on, sports-science insiders have predicted the imminent arrival of gene doping in sports. The future took awhile to get here, but in the past year, several of Sweeney's Penn gene-therapy colleagues have successfully treated genetic diseases in humans, and one research group in Ohio has begun to treat muscular dystrophy with the therapies that he pioneered.

Sweeney's new research project reads like a blueprint on how to construct the perfect all-purpose athlete. He will insert a gene in his mice that blocks the action of myostatin, a protein that limits growth in muscle tissue. He will also insert a gene that pumps up the production of PGC1 Alpha, a signaling protein involved in muscular endurance. More PGC1 Alpha means more energy being produced in the mitochondria, the cell's power plant, which means more capacity to go long and hard. In specialized athletes, these two different power systems are at war with each other. A marathoner's muscles grow into superefficient mitochondrial powerhouses but become physically smaller and less capable of short, intense contractions. The powerlifter gets essentially the reverse effect. "What if you start hammering both of these pathways?" Sweeney asks. "What does the muscle do with that information? Does one system become dominant, or does it integrate the two the way you can with exercise, when you combine weightlifting with endurance running? Maybe we're making a middle-distance runner." Or a basketball or a soccer or a tennis player.

By midsummer, Sweeney will begin injecting the mice with the two genes and putting them through a kind of mouse Olympics to measure their performance: how long they can run on the treadmill (endurance); how long they can hold on to a wire (strength). If they perform like champs, no doubt a certain class of sports trainer will notice. Sweeney himself takes the long view. "I think if these kinds of therapies become widespread," he says, "you're not going to be able to deny the athletes. They'll say, 'If everyone else can do it, so can we, and as long as it's safe, who cares?'"

JUICING THE WEEKEND WARRIOR

While world-class jocks have to be vigilant about not running afoul of their sports' doping guidelines, no restrictions inhibit the amateur. Dr. Florence Comite, endocrinologist and prominent Manhattan anti-aging physician, combines liberal prescriptions of hormones with a state-of-the-art sports lab to get optimal performance from her clients. Comite and her associates design workouts, put together nutrition and supplement packages, and subject clients to a battery of tests to make sure they hit their performance marks. Her primary weapon — detailed in her forthcoming book, *Keep It Up: A Bold New Formula to Expand a Man's Physical and Mental Power for Life* — is pushing up testosterone levels. For middle-aged men, she does this not with the patches and gels you see shilled on TV, but with regular injections of a hormone, HCG, which stimulates testosterone production. And she's learned to leverage men's competitiveness to improve their health. In her lab is a whiteboard ranking patients' top scores on a handful of physiological measures. "Some of these guys are in the top 99th percentile for VO_2 max for 20–29 year olds," an associate, Steven Villagomez, says. "And they're almost 60."