



PHOTOGRAPHS BY CHRISTOPHER GRIFFITH

BY MICHAEL BEHAR

YOU'RE NOT

EATING NEARLY

ENOUGH

pr otein.

PERIOD.

We all know protein is the single most important building block of muscle growth. But, amazingly, science is only now discovering exactly how much protein we should be getting and—just as important—when we should be getting it.

# A

A small plastic pouch filled with dark brown, organic matter arrived at my doorstep today. ¶ No, I didn't immediately bolt down the stairs in hot pursuit of some teenagers. Instead, I took a closer look and found that the bag actually contained something else entirely: dead crickets. ¶ Alex Drysdale, founder of Crik Nutrition, was so eager for me to sample his flag-

ship product that he shipped it overnight via DHL from his office in Winnipeg, Canada. I just hadn't expected it so soon. Drysdale, a former communications technician who quit his job last year to cash in on today's protein boom, swears that his critters "are loaded with nutrients because they're made from whole, crushed-up cricket—you're eating the exoskeleton and all the organs." I try not to picture cricket guts when I open the pouch and take a whiff. Surprisingly, the smell is sweet and nutty. Feeling ballsier than usual, I shove a spoonful in my mouth. Compared with gritty and bitter whey and soy powder varieties, this stuff dissolves instantly on my tongue and tastes like almonds and honey.

Crik is just the latest form of protein I've happily eaten lately; the others include protein-infused granola, protein pancakes, high-protein Greek yogurts, and the gamut of powders—whey, soy, pea, hemp, and now cricket. The protein industry reaps about \$9 billion annually, a figure that's quadrupled since 2005. Some dismiss this as just another fleeting food fad, the result of a connection to certain popular high-protein diets, such as Paleo. A few experts—along with new federal dietary guidelines announced in January—claim we're eating too *much* protein. But, I'm happy to report, scientists who study protein insist otherwise.

For the record, the U.S. Recommended Dietary Allowance (RDA) officially recommends just 0.36 grams of protein per pound of body weight. "That's designed for the average person to just exist—hang out, watch TV, do whatever," says Mike Nelson, Ph.D., an exercise physiologist and founder of Extreme Human Performance, a fitness coaching firm that espouses a high-protein diet. It was also written during the wartime 1940s to recommend the minimum amount for good nutrition when Americans were rationing food. "But," says Nelson, "if you're not the average person, and you're exercising more intensely, you're going to need more protein."

At 160 pounds, the RDA puts me at 58 grams per day, which is a scant more than a cup of Greek yogurt at breakfast and a small chicken breast for lunch, with zero protein for dinner. But based on recent findings, protein scientists now advise at least 0.68 grams per pound and up to 0.75 grams if you're doing intensive weight training

(more than two hours daily) and want to bulk up fast—which would put my recommended intake at 120 grams per day, divided into four servings, consumed roughly four hours apart. Because I exercise five or six days a week, Stuart Phillips, Ph.D., a professor of kinesiology at McMaster University in Ontario, who studies how protein supports muscle growth, tells me that 110 grams per day should be ample. I bump up my intake accordingly, almost doubling it.

Two weeks later I've dropped five pounds—most of it off my belly. I'm stacking on extra weights for chest and shoulder presses. But the most profound change is in recovery. The throbbing quads and calves I'd suffer after long runs? Gone. And when I overload my muscles while lifting (think: big burn),

the soreness lasts for mere hours instead of days.

Right now I crave protein like a drug. I eat it in the morning and, as you'll soon learn why, even before bed. I eat everything from omelets to salmon to pulverized insects that look like shit. And here's the thing: I've never felt better.

Later, when I convey my experience to Robert Wolfe, Ph.D., one of the early pioneers in protein science and now director of the Center for Translational Research in Aging and Longevity at the University of Arkansas, he's not surprised. "When you look at the research, it's impossible not to be impressed with the benefits of a higher proportion of protein than the RDA in the diet," he says. Eat more protein and "by and large, you're going to be fitter. That's the reality."

#### WHAT'S "ENOUGH" PROTEIN—AND WHAT'S TOO MUCH?

Despite everything we know about the connection between protein and muscle growth (for the record, protein refers to the amino acids from foods that our bodies require to be healthy and strong but don't produce intrinsically), it wasn't until very recently that scientists began to determine just *how much* protein we should be eating, what types (animal or plant), when (morning or evening), and how much.

"Back in the early 1980s, we used to think that if you averaged out your recommended protein intake over a week, you were OK," says Nancy Rodriguez, Ph.D., a professor of nutritional studies at the University of Connecticut. "But fast-forward 10 years, and we realized it wasn't just having protein every two or three days. You should be eating it *every* day and distributing it among meals and snacks."

For decades, dietitians and trainers generally adhered to the RDA. But Donald Layman, Ph.D., a professor of nutrition at the University of Illinois, suspected this number might be too low. Often regarded as a leader in protein requirements, Layman had been investigating how humans metabolized amino acids and whether there was a threshold amount required to trigger protein synthesis, the biological mecha-

Prop styling by Ariana Salvato/Apostrophe

-CH<sub>2</sub>CH(CH<sub>2</sub>)<sub>2</sub>

**Feeling ballsier than usual, I shove a spoonful of crickets in my mouth. Compared with gritty and bitter whey and soy powder varieties, it tastes fabulous—like almonds and honey.**

# PROTEIN POWERHOUSES

The greatest protein sources on the planet: packed with muscle-priming leucine, low in calories, and containing all nine essential amino acids



WHEY PROTEIN ISOLATE  
**90g**  
(Protein per 100g)

SOY PROTEIN ISOLATE  
**88g**

LEAN BEEF  
**36g**

CHICKEN BREAST  
**31g**

YELLOWFIN TUNA  
**30g**

SOCKEYE SALMON  
**27g**

**25g**

**21g**

**13g**

**10g**

**1) WHEY PROTEIN ISOLATE**  
■ The runaway winner. To mask the bitter taste, mix into a fruit smoothie.  
Protein per 100g (3.5 oz): **90g**

**2) SOY PROTEIN ISOLATE**  
■ Only about 60% as effective as whey in lab-based protein synthesis tests.  
Protein per 100g (3.5 oz): **88g**

**3) LEAN BEEF**  
■ Just avoid the fatty cuts like rib eyes (pictured) and stick to the more svelte sirloins.  
Protein per 100g (3.5 oz): **36g**

**4) CHICKEN BREAST**  
■ A hefty dose of branched-chain, muscle-building amino acids.  
Protein per 100g (3.5 oz): **31g**

**5) YELLOWFIN TUNA**  
■ Sushi lovers rejoice: A spicy tuna roll has about 26 grams of protein, or one-fourth of your total daily intake.  
Protein per 100g (3.5 oz): **30g**

**6) SOCKEYE SALMON**  
■ With fatty omega-3s, it's a perfect twofer.  
Protein per 100g (3.5 oz): **27g**

**7) PORK CHOPS**  
■ Packs every B vitamin.  
Protein per 100g (3.5 oz): **25g**

**8) HALIBUT**  
■ One of the lowest-cholesterol seafoods.  
Protein per 100g (3.5 oz): **21g**

**9) EGGS**  
■ Hard-boiled, they're an eminently portable snack for road trips, so you can steer clear of McDonald's.  
Protein per 100g (3.5 oz): **13g**

**10) NONFAT GREEK YOGURT**  
■ It ranks last in protein by weight but is remarkably low in calories—one 100-calorie cup has 17g.  
Protein per 100g (3.5 oz): **10g**

NONFAT GREEK YOGURT

EGGS

HALIBUT

PORK CHOPS

nism that spawns muscle. In 1999, Layman conducted experiments on rats and found that a specific amount of the essential amino acid leucine, contained in all protein, is necessary to kick-start synthesis. Leucine alone can't create muscle—you need all nine essential amino acids to do that; leucine is just the catalyst that ignites the process. "Until you get enough leucine, protein synthesis won't run at 100%," Layman explains. When he extrapolated his data to humans, he determined that for someone like me to optimize post-workout muscle growth, I should be consuming upward of 30 grams of protein per meal, which provides 2.5 grams of leucine. (For that, a whey- or soy-based protein smoothie with a half-cup of yogurt added would do the trick; so would a four-ounce T-bone steak.)

But what happens if I eat more than that? Would devouring, say, 90 grams of protein in a single sitting—or about 12 ounces of salmon—triple muscle growth? No one knew the answer until Doug Paddon-Jones, Ph.D., a professor of nutrition and metabolism at the University of Texas, consulted with Layman for a study. In 2009, Paddon-Jones enlisted a group of volunteers, including eight men in their early 30s, all weighing about 175 pounds, and fed them each a four-ounce steak with 30 grams of protein. Five hours later, he took blood samples and muscle biopsies from the volunteers. "There was a 50% improvement in muscle protein synthesis," says Paddon-Jones. When he repeated the test but ramped up the size of the meal, eventually tripling protein intake, synthesis remained the same. "That suggests that somewhere around 30 grams [for a 175-pound male] there is a ceiling effect for your ability to use actual protein-rich foods to build and repair muscle," Paddon-Jones says. For bigger guys, of course, those numbers will rise proportionately. If you clock in at 250 pounds, for instance, your per-meal protein intake would rise to 42 grams. (And there are other factors that can push that number even higher, such as genes.) Granted, if you're consuming way more protein than you should, there are still some added nutritional benefits—thanks to the amino acids and micronutrients in a varied protein diet (meat, legumes, seafood, soy)—but muscle protein synthesis falls off precipitously.

Too much protein in a single meal is like filling the 20-gallon tank in your SUV with 60 gallons of gasoline—two-thirds of the fuel gets wasted, spewing out onto the pavement. (Excess protein ends up in your urine.) "You don't have a storage site for protein," explains Phillips. "You can't pack it away for further use."

Paddon-Jones warns about racking up extra calories: "The biggest problem with overconsuming protein is you're going to get fat. There's an upper limit in terms of what your body can process at one time. You can eat more, but it's likely not doing your muscles much good."

#### BEFORE WORKING OUT OR AFTER: WHAT'S THE PROTEIN-SMOOTHIE SWEET SPOT?

At the University of Connecticut, Rodriguez hones diets for collegiate and pro athletes, including those in the NFL, NBA, and NHL. She instructs them to get about 35 grams of protein per meal and scales it up for heavier guys. But will any protein do? Rodriguez cites several new studies that have examined plant versus animal proteins, and whole foods compared with supplements. The upshot: To grow new muscle and get bigger while adhering to a low-calorie diet, whole,

animal-based sources are preferable, specifically meat, poultry, fish, eggs, and dairy (milk, cheese, yogurt). Now, you might be wondering about the recent World Health Organization (WHO) report from late last year that caused carnivores to panic because it labeled meat a carcinogen and lumped bacon with tobacco in the certain-death category. Not to worry. First, the WHO study surveyed people who consumed almost nothing but—that is, heaps of meat every day. These folks are also often overweight and sedentary. So does meat give you cancer? Or do you get it from being fat and lazy? The answer is almost certainly the latter, meaning that if you're fit and work out regularly, a modest serving (about four ounces) a few times a week of beef, pork, or, yes, even bacon isn't going to put your health at risk.

"I don't think you can become the best athlete you can be without meat," says Luc van Loon, Ph.D., an exercise physiology professor at Maastricht University in the Netherlands, adding that he favors whole animal foods like

beef because they digest slowly—a steak can take 24 hours for the body to process—so it provides a steady protein supply all day.

If you're a vegetarian or vegan, good old-fashioned rice and beans, and tofu are acceptable alternatives. But remember: By proportion, animal meat packs up to three times the protein content as plant-based food like legumes and nuts. So with tofu, for example, you'll have to eat a lot more of it to get the same protein you would dining on a six-ounce filet mignon or a three-egg cheese omelet. Some plant-based proteins are also high in carbohydrates, which, if not readily burned off, end up as fat. (Crickets are about 70% protein by weight.)

If you're going the supplement powder route, scientists suggest you choose whey, the wildly popular animal-based protein derived from cow's milk. For a 2015 study in the *Journal of Food Science*, Phillips analyzed whey, soy, and rice powders and found that whey had the highest leucine content of the three. "And when we're talking about regenerating muscle, the key is protein higher in leucine," he says. "Based on our work, whey tops the list."

Whey also ranks first in its ability to feed muscles faster than any other protein type. "Whey protein is absorbed really quickly in the blood, within 15 to 20 minutes," Paddon-Jones says. Train hard and your body burns stored carbs and fat to produce glucose for energy. But unlike fat, there's no protein cache to tap for making muscle. And as van Loon points out, "when you combine exercise with protein, you get a synergistic response—muscle protein synthesis is doubled." That's why experts love whey: Its rapid absorption improves the rate of rebuilding compared with other protein sources.

But timing is everything. When muscles contract during strenuous exercise the cells become more anaerobic, and protein synthesis shuts off. So chugging a protein smoothie right before hitting the gym or while exercising is pointless—and a few studies suggest it may even be counterproductive, impeding your muscle's ability to grow. "There's no good reason to do it," Phillips says. On the other hand, researchers have measured the largest gains in lean muscle growth in athletes who consume whey protein 30 to 90 minutes after training. "That's when you get the biggest bang for your buck, because the machinery is set up to resynthesize muscle," Rodriguez says.

—CH<sub>2</sub>CH<sub>2</sub>SCH<sub>3</sub>

**I now crave protein like a drug. I eat it in the morning and before bed. I eat everything from omelets to salmon to dead insects. And you know what? I've never felt better.**

# YOUR PROTEIN POWER CALCULATOR

-CH<sub>2</sub>CH(CH<sub>3</sub>)<sub>2</sub>

What, when, and how much to eat, in four simple steps



## STEP 1 WHAT TYPES?

■ Mix it up: beef, pork, chicken, seafood, tofu, even hemp seed, which has more protein by weight than any other veggie source. Variety is not only more fun, it also feeds muscles with a good medley of micronutrients and aminos. If you're the type who insists on bang for the buck, opt for foods that rank highest by protein-to-weight ratio: lean beef, tuna, chicken breasts, and whey.

## STEP 3 HOW MUCH?

■ Disregard the Recommended Dietary Allowance (RDA), which suggests 0.36 grams of protein per day, per pound of body weight. At 160 pounds, for example, that's 58 grams, or roughly one large chicken breast. That's not enough. Increase it to at least 109 grams, or 0.68 grams per pound. If you're in the gym daily and trying to bulk up, up to one gram per pound of body weight is OK.



## STEP 2 WHEN?

■ Let's say your weight puts your ideal protein intake at 140 grams per day. Research suggests there is likely a threshold for protein, and your muscles can use it only in small batches. You should divide your daily intake into four servings. In this scenario, that's 35 grams per meal—breakfast, lunch, dinner—and a fourth snack right before bed. Also—and this is important—at least one of these meals should immediately follow a workout (see Step 4).

## STEP 4 ANYTHING ELSE?

■ Yes, at 90% protein, whey tops the supplements—and even whole foods like steak and salmon—in protein density and also digests faster. So pairing a whey smoothie with a workout is a no-brainer. Thirty to 90 minutes after exercise, get 35 to 40 grams of it. (Mix it into a smoothie with berries, banana, honey, and milk.) Timing's essential: Post-workout, your body sucks up protein like a sponge and converts it to new muscle almost twice as fast as other times.

## CAN YOU ACTUALLY BUILD MUSCLE WHILE YOU SLEEP?

When we bulk up in response to resistance training, it's because there's a net gain of new muscle growth. Squats break down quads, which respond by rebuilding themselves bigger and stronger—a process that protein amplifies. But like other scientists, van Loon once believed this occurred only when we were awake. Then three years ago, he met with a few colleagues at a bar and “after too many beers,” as he puts it, “we thought, ‘What happens if we give people protein during sleep?’” Scientists had never considered whether protein could be metabolized at night, or if it could, whether muscle synthesis would occur.

When you eat protein, its amino acids are dispatched to various tissues—muscle, organ, bone—where they're used to repair and rebuild cells. But to determine what happens at night, van Loon had to pinpoint the exact where and when of this process. So at a university animal research facility in the Netherlands, he rigged a Holstein cow with intravenous tubing and pumped in \$40,000 worth of chemical compounds called tracers that allow scientists to follow them throughout the body. From the cow's milk, van Loon derived a protein supplement he could give to human

test subjects and then track the amino acids throughout their bodies. “I could see the digestion and absorption, how much of the protein becomes available in the circulation, and how much of what you eat lands in the muscle over a few hours,” he explains.

Next he conducted two separate protein-and-sleep studies by recruiting healthy, active men in their early 20s. In the first experiment, the men exercised in the evening, then half took a protein supplement before bedtime, with the remainder fed a placebo. Van Loon found that the protein was effectively digested and absorbed while the men slept, and muscle rebuilding was also higher. In the next study, he had the subjects lift weights for three months in the evenings, with half taking a protein supplement before bedtime and the other half a placebo. He found the group who consumed protein prior to sleep had a greater increase in muscle mass and strength.

Based on his initial results, van Loon recommends a so-called “fourth meal” of protein approximately 30 minutes before bedtime—that would be about 30 grams for a guy my size. But keep calories to a minimum, since anything in addition to the protein isn't going to burn off. (You're asleep, remember.) Good choices are Greek yogurt, cottage cheese, or a protein smoothie, assuming you minimize the sugary fillers like berries and juice. “Protein prior to sleep gives you a

Clockwise from left: Christopher Griffith; Stockfood/Food Collection; Christopher Griffith; Marek Ullasz/Alamy

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greater window of opportunity to facilitate muscle reconditioning,” van Loon says. “It turns out that nighttime is an unused period when you can stimulate the adaptive response to exercise.”

#### WHAT'S THE BEST WAY TO GET YOUR PROTEIN HIGH?

Because I'm a carnivore, to me more protein means more seafood, chicken, pork, and beef. On top of ample salmon and bison—two of my favorite foods—during my investigation, I added van Loon's fourth bedtime “meal,” as well as whey after workouts.

And my grocery bills went out of control.

Ultimately, I decided to mix things up: A few times a week I now splurge on pricey seafood (often tuna or halibut, among the protein kings of fish), and for smoothies I go with organic, grass-fed whey or Drysdale's Crik powder: the yummiest of the supplements, but—at roughly \$5 for a 32-gram serving of protein—also the most expensive. Primarily, though, I rely on protein-packed basics like yogurt, eggs, peanut butter, and cheese. For breakfast, I do one cup of nonfat Greek yogurt, blended with blueberry kefir, a tablespoon of peanut butter, and a teaspoon of honey. I follow my late-morning workout with a whey smoothie, using the provided scoop to get the correct amount of protein, then sweeten it with whatever fruit happens to be in the fridge—and call that lunch. Dinner varies, but the main dish is almost always a high-protein whole food, such as pork or salmon, eyeballing the portions to get roughly eight ounces. Before bed, I might snack on a bowl of cottage cheese topped with sliced chicken or turkey breast, dishing it out based on the serving-size info based on the packaging.

After two weeks not only do I feel great but also—as previously mentioned—I'm five pounds lighter, chiefly because protein makes me feel fuller and satiated (which keeps me from snacking), and because of protein's thermic effects (I actually burn calories while digesting it). I also notice something else with my new diet: I'm always thirsty. As it turns out, protein is hygroscopic, which means it attracts water like iron filings to a magnet. “If you shift to high-protein, you should drink 50% more water than you were drinking before,” Layman advises. This gets me wondering: Besides dehydration, what other potential risks might protein pose?

Low-carb diets, like the Atkins, which became popular in the '90s, preached all-you-can-eat protein. You can fill up on steak and eggs as long as you limit carbs. With Atkins, protein functions like an inert, low-calorie filler: Consume enough of it and you'll be too stuffed to eat anything else. (In contrast, the Paleo diet rightly embraces protein for its superior nutritional value. It falls short, however, because it doesn't prescribe how much protein to eat or when to eat it. It also rejects dairy—even Greek yogurt, which new research has identified as a superlative protein.)

At the height of the Atkins craze, reports of health problems surfaced, the most serious being kidney failure. I ask Phillips whether I should be concerned, and I'm told no. Because many of the Atkins dieters were overweight, he explains, they were also “verging on type-2 diabetes,” a disease that can include kidney dysfunction. “But as the circular logic went, the high protein caused the kidney failure in the first place, and that's not true. There's no evidence of that.” The other myth is “protein is bad for your bones,” Rodriguez says. The going theory used to be that protein-rich

foods nudged your body's pH balance toward higher acidity—and too much acid would leach minerals like calcium from bones and lead to osteoporosis. But current research proves just the opposite: Protein increases bone density by improving calorie absorption. “We're realizing that eating adequate protein, along with calcium, is good for your bones, not bad for them,” Rodriguez says. In fact, in a 2008 study in *The American Journal of Clinical Nutrition*, Layman wrote, “Higher protein diets are associated with greater bone mass and fewer fractures when calcium intake is adequate.”

As I worked to harness the benefits of protein, I discovered that the plant-based soy doesn't build muscle as fast as animal protein or whey. “Soy is about 60% as effective as whey,” says Layman. “But if you use a small enough amount, say 12 to 15 grams, you will get no muscle-building effects.” I also learned about one big protein no-no: booze. Both Phillips and Paddon-Jones recount a now-famous tale shared among protein geeks, which involves a team of Australian football players. During the off-season they'd meet every Friday at a gym for weight training. Afterward, they'd go drinking at a nearby pub.

“No one was getting stronger in the off-season,” Paddon-Jones says. A coach with a hunch about the booze changed their training to Tuesdays—a less convenient night to souse it up—and they put on a ton of muscle mass and strength. Alcohol was shutting down protein synthesis.”

Last year, Phillips led the first-ever experiment to test the theory. He gathered eight men ages 21 to 26 and put them through an exercise routine that included weightlifting, cycling, and high-intensity interval training. After the workout, he gave them each 50 grams of protein over a four-hour period and then got them trashed. Over the subsequent eight hours, he took tissue biopsies from their quad muscles. The result: Muscle-protein synthesis had dropped by 24% compared with his control group, who got protein but no booze. “Eight solid drinks of vodka definitely messed up their muscles' ability to utilize protein,” he says. “Alcohol affects your ability to regenerate and repair muscle and get it ready for a subsequent workout. If you're an athlete, regularly consuming more than one or two drinks a day is not recommended.”

There's still one question that can't be overlooked: How will consuming 100-plus grams of protein a day for years on end impact long-term muscle health? “We can't answer that quite yet,” Layman says. One sure fact: Men in their mid-40s will find that their muscles begin to naturally shrink. “As we get older, we're less efficient at turning protein into muscle,” Layman says. This has led nutritionists to assume that adults need less protein as we age. Having documented what high protein does for younger men, scientists now challenge that assumption and plan to conduct longitudinal studies to track men and their muscles over a lifetime.

When such a study occurs, I tell Layman that he should enlist my father, who turned 82 last month and remains an avid athlete. He lives in Seattle, where he routinely devours chicken and salmon, plays competitive tennis with guys half his age, and often begins his day by paddling his kayak two miles across Lake Washington.

Is it the protein? Exercise? Lucky genes? A combo of all three?

No matter. The sudden jump in strength and recovery I experience after disregarding the RDA and doubling my protein intake is reason enough to stick with it long term. Bring on the crickets. ■