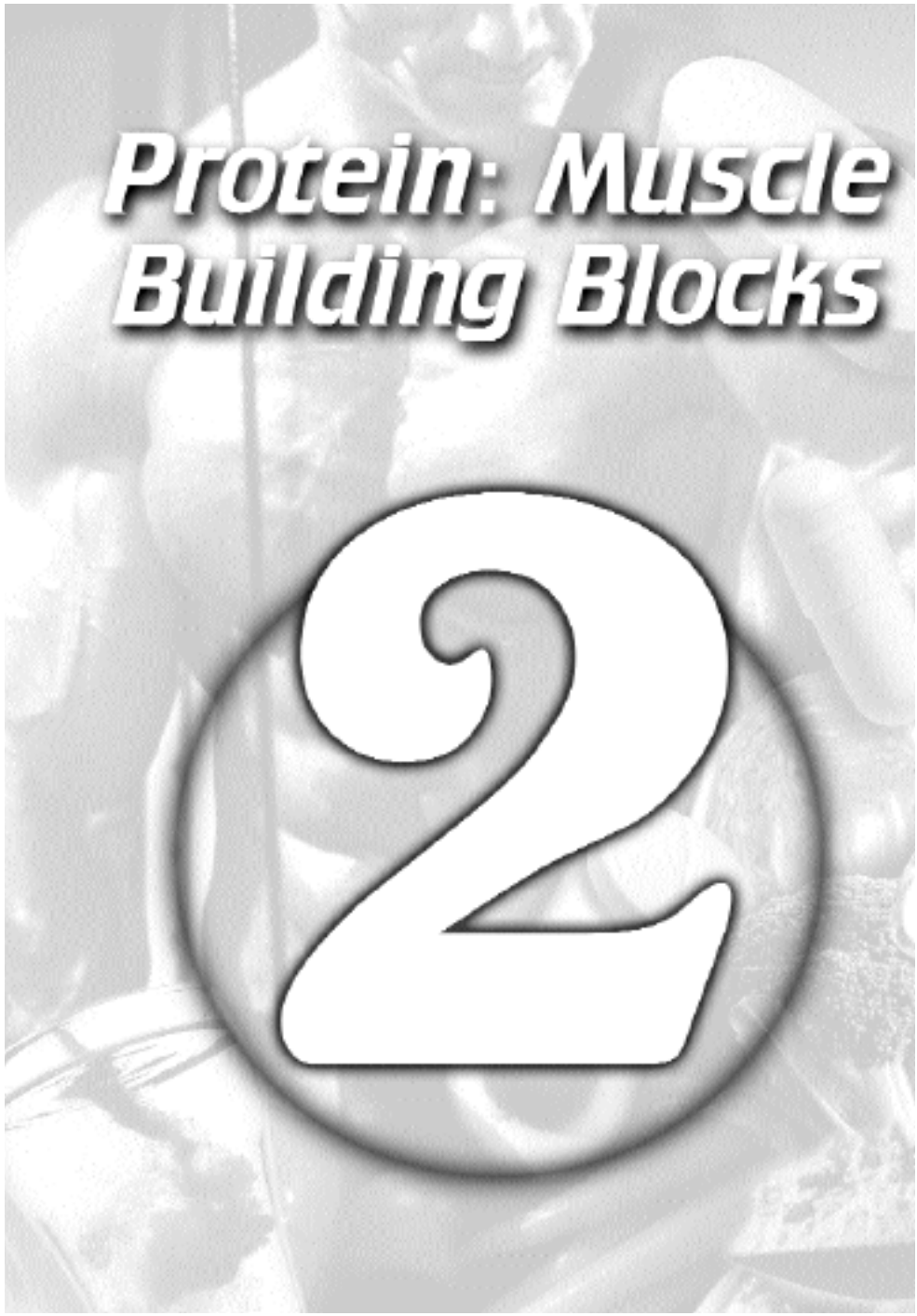
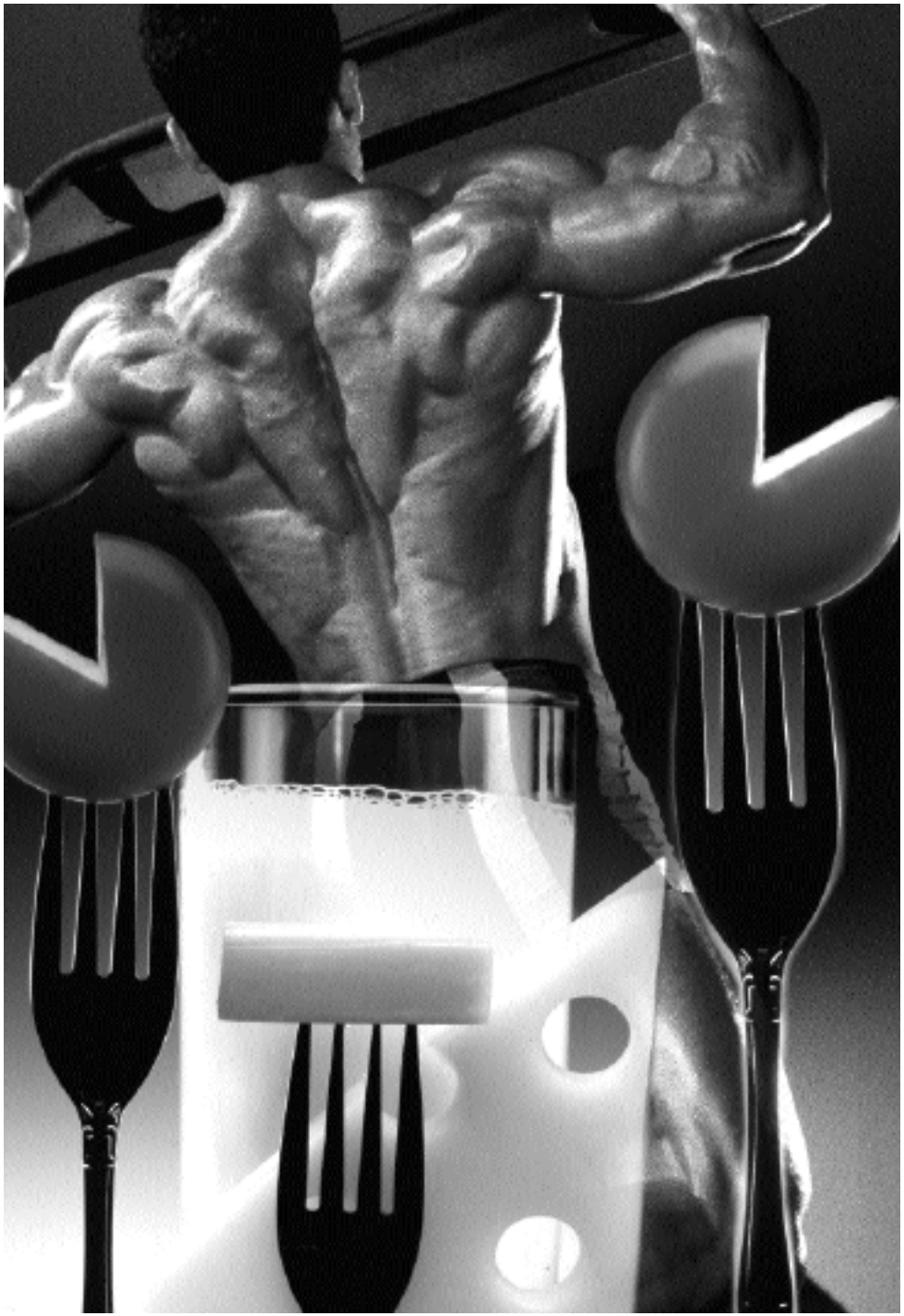

Protein: Muscle Building Blocks
2



Protein and Bodybuilding

by Daniel Curtis, R.D.

At a sports nutrition seminar I attended some time back, a woman who was a marathon competitor and the author of several books on sports nutrition gave a lecture on optimal nutrition for various sports, including carb loading, adequate hydration and carb snacks to eat during endurance events. She presented her material well and supported it with well-designed studies.

Suddenly, in the middle of her presentation, however, she flashed a slide of former Mr. Olympia Chris Dickerson. The photo was great, but her subsequent comments regarding bodybuilding nutrition were not. Her take on it was this: "When a young man comes in to see me regarding nutrition and bodybuilding, I simply emphasize that all he needs are well-balanced meals. Using protein powders and all those other supplements is a waste of time and money and won't add beneficial results. If he's adamant that he must have something in addition to balanced meals, I tell him to buy dry nonfat milk and add it to his beverages. I do this to pacify him, as it isn't necessary. The literature shows that bodybuilders really don't need any more protein than the RDA [recommended dietary allowance] of 0.8 to 1.0 grams per kilogram of bodyweight per day."

Hogwash!

For a 154-pound man, that's 70 grams of protein per day. Obviously, the woman knew less about bodybuilding and nutrition than most bodybuilders know about marathons.

The sad part was, the auditorium was packed with dietitians, physical therapists, sports trainers and other health professionals, who took her words as gospel.

Is that really what "the literature shows"? Let's review it and see.

My favorite study, although not recent, was reported in the highly respected *American Journal of Clinical Nutrition* (28:29-35; 1975). It involved men performing "heavy physical activity," including isometric exercises, treadmill sessions, stationary bike riding and other "sports activities," during a 40-day period.

One group took in 100 grams of protein per day; the other, 197 grams. The calories were the same for both groups.

What were the results? The researchers reported that the additional protein "did not enhance physical performance." That means the men who ate the higher-protein diet didn't walk longer on the treadmill, ride further on the bike or apply more pressure on the isometric exercises. The study concluded that consuming additional protein failed to improve sports performance and so was "unnecessary." Nevertheless, it did have an interesting "side effect." The researchers went on to report that the men who ate the high-protein diet did "increase body protein stores and muscle mass."

Oops! I guess the sports nutrition author forgot to mention that while extra protein won't help those young men she counsels lift heavier weights or enable them to train longer, it will let them build bigger muscles. (Of course, the irony is, that's why they come to her in the first place—they want bigger muscles.)

That's what success means to bodybuilders—more muscle mass. The guy with 20-inch arms couldn't care less about the guy who can curl 20 more pounds than he can but has arms that are only 17 inches. That's the reason bodybuilders never win the World's Strongest Man Competition, though they often place higher than most other sports superstars. The winners are usually the guys with big muscles and big bellies—in other words, the strength athletes.

If your goal is simply to be stronger, then use low repetitions and heavy weights and eat like a horse, without worrying about muscle size and symmetry. If your primary goal is bigger muscles without excess fat (you'll also increase your strength to a significant degree), then the literature clearly states that you do need to increase protein intake. In the study cited above, the group that gained more muscle mass ate twice as much protein as the control group. They didn't do it just by eating more food. In order to reach the high protein

A positive nitrogen balance indicates that the body is taking in more protein (nitrogen) than it excretes. You must have a positive nitrogen balance before muscle growth can begin, as your body builds the new muscle with the extra.

intake without unnecessary fat and sugar, they used Casec (a milk protein isolate—not powdered milk) and Meritene, an early protein supplement that was often used in hospitals.

A more recent study that was reported in the *International Journal of Sports Nutrition* (1:127-145; 1991) came to a very different conclusion than the 1975 study: "Present data indicate that strength athletes should consume 1.5 to 2.0 grams of protein per kilogram of bodyweight per day, which is 188 to 250 percent of the RDA for protein."

The idea that bodybuilders need more protein is backed up by numerous other studies.

•As reported in the *Journal of Sports Medicine* (8[3]:161; 1989), "Weightlifting training can also lead to a daily protein requirement that exceeds the current RDA."

•In the journal *Metabolism* (12:259-274; 1970) the authors of another study found that 2.0 to 2.2 grams of protein per kilogram of bodyweight per day was "barely sufficient to maintain nitrogen balance during moderate-intensity strength training." Their conclusion was that a weightlifter's protein requirement "increased proportionally to training intensity."

•An article titled "Maximizing Performance With Nutrition," published in *Medicine and Science in Sports and Exercise* (19, July '97), reported that "the protein RDA may be 10 to 100 percent higher for individuals who exercise on a regular basis. Optimal intakes, although unknown, may be even higher, especially for individuals attempting to increase muscle mass and strength." In reviewing a number of studies, the author stated that "these studies indicate that the current protein RDA is insufficient for both strength and endurance athletes, and several suggest that the actual requirement is considerably higher."

A positive nitrogen balance indicates that the body is taking in more protein (nitrogen) than it excretes. You must have a positive nitrogen balance before muscle growth can begin, as your body builds the new muscle with the extra. There's some speculation that as positive nitrogen balance increases, so do muscle size and strength. The last article suggested that "perhaps, by maintaining a more positive nitrogen balance, protein synthesis would be further enhanced, leading to larger and stronger muscles." It pointed to a study that involved elite Romanian weightlifters who increased muscle mass by 6 percent and strength by 5 percent when their protein intake was increased from 225 percent of the RDA to 438 percent.

Why have the study results differed so much about the amount of protein necessary for muscle growth? According to the authors of that last article, "Exercise intensity appears critical and may explain why some studies have not observed an increased protein requirement."

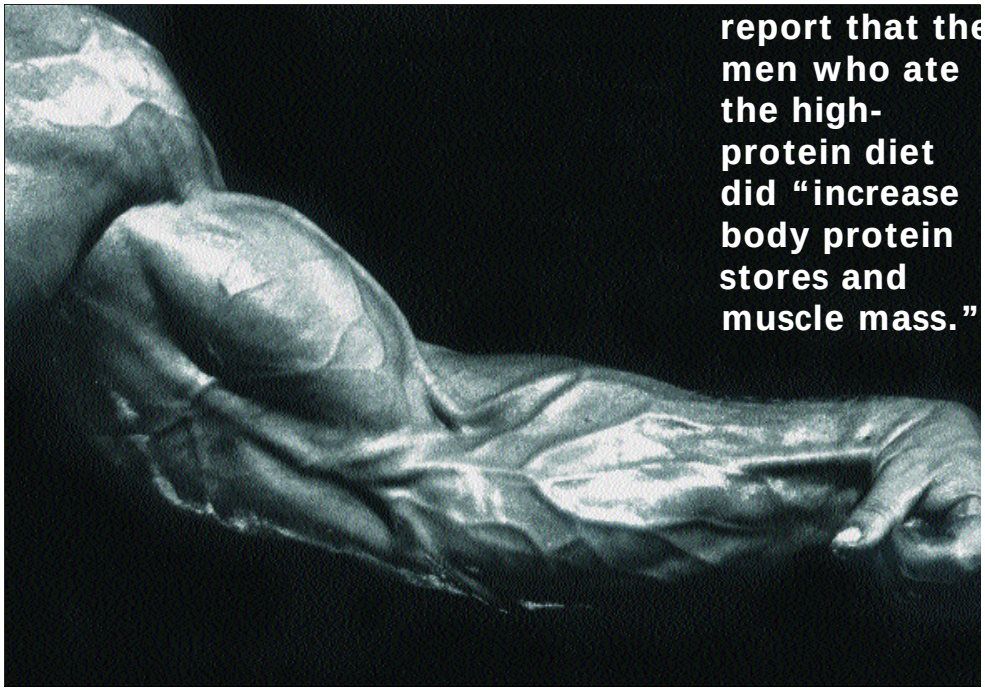
As for the frequently mentioned health hazards—including the claim that excess protein can cause liver or kidney damage: "Actually, except in preexisting liver or kidney abnormalities, there is little documented evidence of health problems due to a high protein intake.… In an active individual the fate of ingested protein is likely quite different than in a sedentary individual."

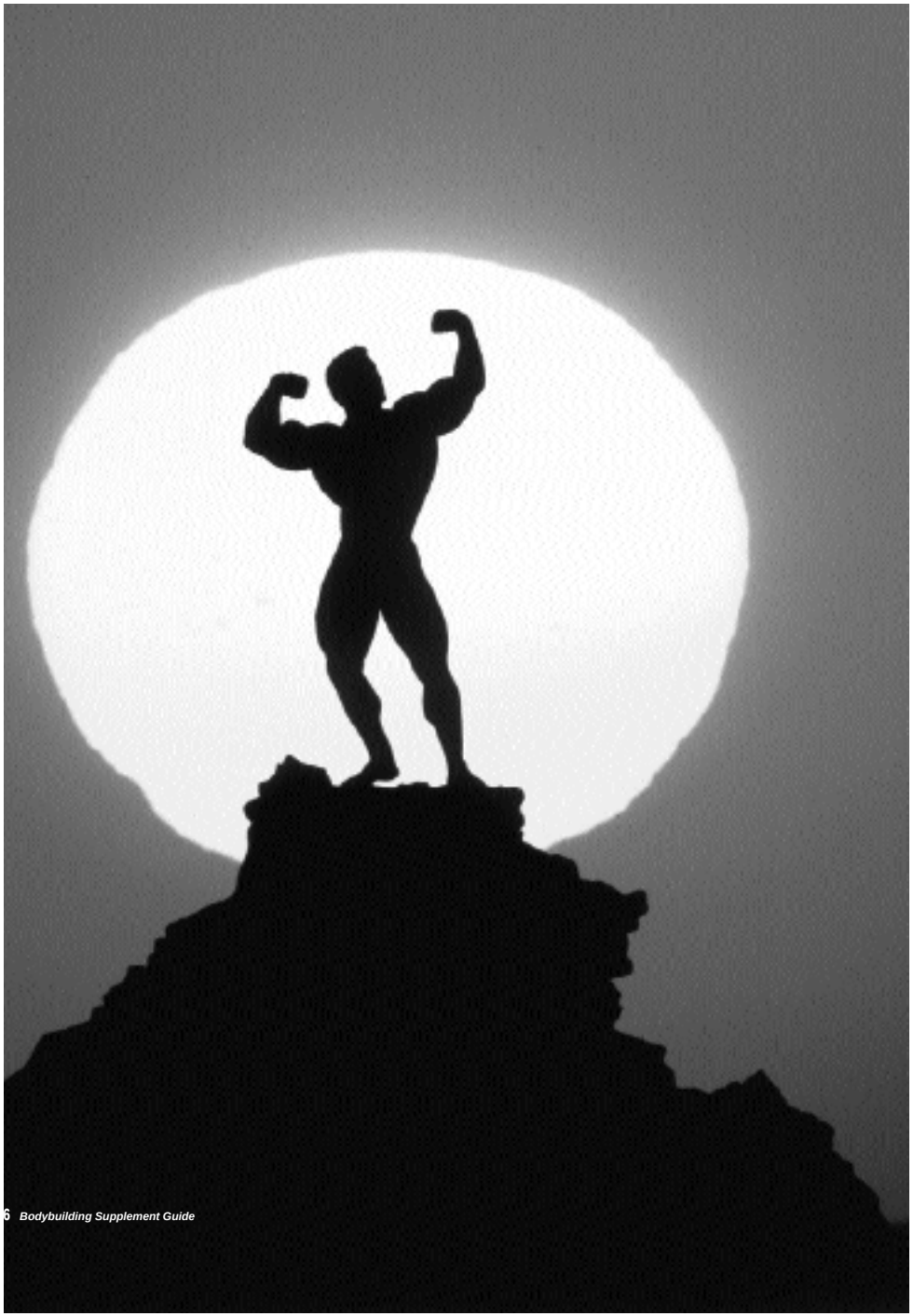
So the scientific literature doesn't clearly state that bodybuilders don't need additional protein to build muscle mass. In fact, it clearly states the opposite—that bodybuilders looking to increase muscle size need significantly more protein than nonbodybuilders.

To tell people to simply eat more at meals is very ambiguous. They may eat more fats and carbohydrates, in which case their muscles won't grow but their waists certainly will. Remember that in the first study cited above, both groups of subjects ate the same calories but one got double the protein with that calorie level, and they were the ones who gained mass.

The bottom line is that bodybuilders need more protein, and supplements like protein powders do help. You also want to be leery of so-called nutrition experts who aren't familiar with bodybuilding and think that performance in bodybuilding equates to performance in other sports. In bodybuilding, performance means big, symmetrical muscles—and for that very reason bodybuilding nutrition is a different animal from nutrition for other sports.

The researchers reported that the additional protein "did not enhance physical performance." Nevertheless, it did have an interesting "side effect." The researchers went on to report that the men who ate the high-protein diet did "increase body protein stores and muscle mass."





Wheys and Means

Interview by Jerry Brainum

When it comes to protein intake, bodybuilders tend to be quite savvy. Many can tell you precisely how many grams of protein are in an egg or a chicken breast. They take the meaning of the word protein literally, with the perception that it's the most important nutrient for successful muscle building. Few bodybuilders would argue about the necessity of consuming increased amounts of protein to foster anabolic effects in muscle. Points of both contention and confusion arise, however, when it comes to the subject of protein supplements.

The fact that so many different kinds of high-tech protein supplements are now available doesn't clarify the issue. The ads all sound scientific, a fact that's underscored by the inclusion of medical references and sometimes even quotes from medical professionals, who appear to endorse the product's efficacy. The many scientific-sounding terms that are bandied about in the ads, such as ionization, cross-flow filtration *and other equally nebulous words, further obfuscate an already confusing subject.*

To help clear up the confusion, much of which is the result of misrepresentation and factually false advertising, Icontacted an expert on the subject. He's worked in protein research and development for more than 25 years, and he's involved with many companies that sell protein supplements or meal-replacement formulas. Since he prefers to maintain good relations with all of them, he's requested that I keep his identity confidential.

By the way, this guy is real; he's not a fictional character or a composite of several people rolled into one, something that's been done in several other publications. The man was motivated to give this interview by the many misrepresentations and outright lies he sees in protein ads. As such, he's providing a public service for consumers to make informed decisions based on fact rather than hearsay.

Q: Some nutrition texts list the biological value (BV) of whey as 104, yet many advertisements for whey protein supplements boast of biological values as high as 159. Why the apparent discrepancy?

A: Biological value is an attempt to measure how efficiently protein is used in the body. To determine a food's BV, scientists provide a measured intake of protein, then note the nitrogen uptake vs. nitrogen excretion. That's a gross simplification, since the actual process is more complex.

In theory, a biological value of 100 is maximal. The BV for whey is often listed at 104 because the extra 4 percent represents a margin of error in the calculation. Even so, biological value is not a universally accepted measure of protein quality because of several factors. For example, BV testing is always done in the fasting state, which affects nitrogen uptake differently from what takes place when subjects are in a fed state. Simply put, not eating changes the way the body absorbs nitrogen in protein.

The 159 BV value for whey you see in some advertisements comes from a study in which the author quoted two earlier researchers who had claimed a 159 BV for whey protein. The problem is, the researchers had confused BV with chemical score, which involves measuring the activity of amino acids in the body. The 159 figure refers to whey's chemical score, not its biological value. A true biological value of 159 for a protein just isn't possible, since the maximum BV is around the 100 mark.

Q: A number of high-tech terms are frequently mentioned in ads for commercial whey products, such as* ionization *and* cross-flow filtration. *What do they mean, and are some processing techniques better than others?

A: To understand the answer to that question, you need to know the history of whey proteins. Until about 25 years ago whey was considered a waste product of the dairy industry. You made cheese or casein from milk, and the by-product of the manufacturing process was whey. The question

The biologically active whey protein fractions, such as lactoferrin, are just about nonexistent in true ion-exchange whey protein isolate. It's a notable disadvantage because the limited whey fractions have considerable health benefits.

facing dairy companies was, What do we do with all that whey?

In its raw state whey is about 6 percent solids, is an unappetizing greenish color and both looks and tastes terrible. It spoils easily due to its high content of lactose (milk sugar), which is a favorite food of bacteria. For the most part whey didn't appear to hold much commercial promise for dairy factories. As a result, they simply dumped their whey in nearby rivers and streams, which quickly led to an environmental hazard due to the high biological oxidation demand of whey solids, something the government frowned on.

The dairy factories began processing whey into a powder containing 11 percent protein, 72 percent lactose and some ash, or minerals. It was yellow, and it didn't taste great. Some factories persisted in dumping whey, such as one in Australia that built a pipeline to dump it directly into the ocean.

Eventually, a membrane system was developed to filter whey. The first process was called ultrafiltration, and it was developed by the French. It involved separating the whey protein from the ash and lactose, which resulted in a 35 to 70 percent protein content. The process continued to be refined, particularly for the Japanese market, where there's a high tax on the import of any protein that has less than an 80 percent protein content. The Japanese were huge consumers of whey because they used it as a substitute for egg white in certain foods.

The next big breakthrough in whey processing occurred about 15 years ago, when a Welsh engineer developed the ion-exchange process. This process revolved around the positive and negative charges, or ion properties, of whey proteins. It featured the use of a resin to isolate the protein material from the whey, adjusting the pH, or acidity level, along the way. This was followed by ultrafiltration methods to further concentrate the protein. He called his product Bipro whey protein isolate. It provided an unprecedented 90 percent protein content while containing less than 1 percent lactose.

The inventor of this ion-exchange process patented its use in all types of applications. Upon later learning that he had terminal cancer, however, the Welshman put his whey patents up for sale. They were purchased by a company that owned a dairy business in Minnesota. That company evolved to Davisco, which today manufactures Bipro. The important point is that this product is a true whey protein isolate, which means that it contains more than 90 percent protein.

Since Davisco now had a lock on the resin method of manufacturing a whey protein isolate, competing dairy companies sought another way to produce higher-protein whey powders that wouldn't infringe on patents held by Davisco. Enter microfiltration, which featured filtering membranes with microscopic holes. Still another process that used even smaller holes in the filtering membranes for whey was called nanofiltration. The smaller the holes in the filtering membranes, the more expensive the process.

The usual whey processing used today involves an initial ultrafiltration, which brings the protein content to 75 to 80 percent. The resulting whey liquid is run through either micro- or nanofiltration, screening out more fat and lactose. That results in the whey's having about 1 percent fat content, while the protein content goes up to 81 to 86.5 percent.

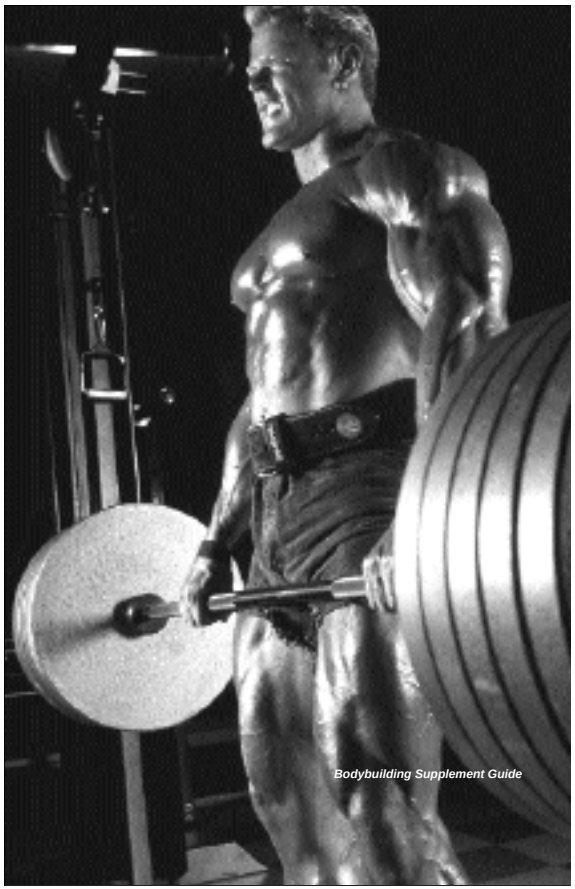
Cross-flow filtration is more of an advertising ploy than the new technical advance the ads imply.

Cross-flow filtration is more of an advertising ploy used by a particular company than the new technical advance the ads imply. In reality, this type of whey processing is no better than the others.

Q: What are the drawbacks and advantages of the various whey-processing techniques?

A: True ion-exchange whey is clear in solution, an advantage if you're using it in bottled protein drinks. This is the Bipro whey, since Bipro's maker, Davisco, still retains the patents for producing ion-exchange whey. Among the disadvantages of ion-exchange whey are the high price and limited supply.

In addition, studies show that ion-exchange whey protein isolates sometimes contain as much as 70 percent beta-lactoglobulin and as little as 10 percent alpha-lactalbumin. Those percentages aren't even similar to the ones that are naturally found in cow's milk and are significantly different from the proportions found in mother's milk, where alpha-lactalbumin content is high and there's no beta-lactoglobulin present. The significance is that beta-lactoglobulin is considerably more allergenic than alpha-lactalbumin in humans.



The biologically active whey protein fractions, such as lactoferrin, are just about nonexistent in true ion-exchange whey protein isolate. This has to do with the processing system used to produce ion-exchange whey, which doesn't favor the retention of the smaller vital whey protein fractions. It's a notable disadvantage because the limited whey fractions have considerable health benefits.

The primary disadvantage of the filtered whey proteins as opposed to the ion-exchange variety is that the filtered types aren't as pure. True ion-exchange protein—specifically, Bipro—is 90 percent protein, while filtered whey protein isolates aver-

Human mother's milk contains a balance of 50 to 60 percent whey protein-to-40 to 50 percent casein protein. That's a far different balance from what you find in cow's milk, which is about 80 percent casein and 20 percent whey protein.

age 86.5 percent protein on an as-is basis. The filtered whey also contains slightly higher fat and lactose contents, although the differences aren't significant enough to matter to a consumer.

The advantages of filtered whey proteins include higher levels of valuable whey protein fractions, such as proteose peptone and lactoferrin, and the much heralded glycomacropeptides.

Lactalbumin is often used as a synonym for whey protein, which isn't quite correct. In the protein industry the word lactalbumin refers to a protein powder manufactured from whey using a high heat process. Lactalbumin contains abnormally high amounts of heat-denatured beta-lactoglobulin. Since high heat and acid are used in the manufacture of lactalbumin, most of the vital whey protein fractions present in the powder become denatured, or broken apart.

The original ion-exchange proteins offered to bodybuilders about five years ago were probably the lowest quality from a nutritional standpoint when compared to ultrafiltered whey. One frequent criticism of ultrafiltered whey is that it has a higher fat content. But the truth is that all whey proteins contain some fat, since completely removing all traces of fat would require hydrolyzing the protein, which in turn denatures the protein. Once protein is denatured, its biological activity is gone.

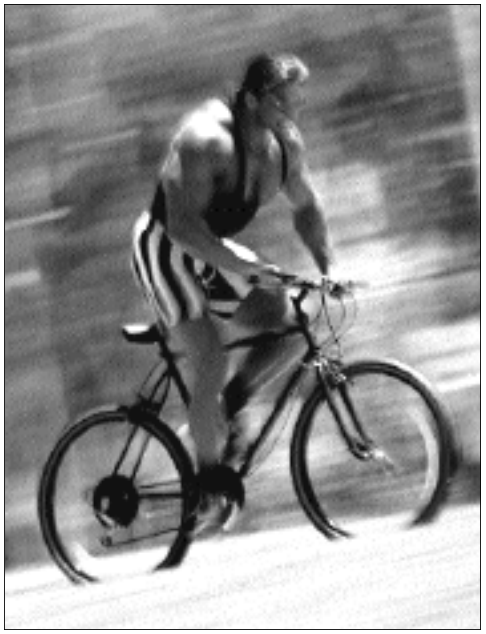
The fat bound in the whey protein structure is higher in saturated fat and cholesterol than normal milk fat. The reason you don't often see the true fat content of whey supplements listed is that the bound fat in the whey can only be analyzed by acid hydrolysis, which would denature the native proteins in the whey. The fat content of whey is usually analyzed by ether extraction, which only measures free fat, not the fat bound to proteins. Using the ether extraction technique results in a much lower—though inaccurate—listing of the fat content of a whey protein supplement.

In fact, I've yet to see a commercial whey protein supplement that has a true listing of its fat and cholesterol content on the label. If these companies get caught by the Food and Drug Administration, they'll face stiff penalties for false labeling. Any milk-derived protein supplement or meal replacement that lists zero fat and cholesterol on the label is misleading consumers and may be guilty of fraudulent label practices.

For every 50 grams of milk-derived protein per serving, the cholesterol content will probably equal 50 to 75 milligrams. In 20 grams of whey protein there will be at least 15 milligrams of cholesterol, and if one of the primary ingredients listed on the label is whey protein concentrate, the cholesterol levels are probably closer to 50 milligrams or higher.

Q: So the hidden fat in all whey protein supplements is a disadvantage?

A: Not unless you consider the various growth factors found in whey proteins a liability, which I don't think most bodybuilders interested in



building muscle would tend to do. Included in the fat globule membrane of whey or milk are various anabolic factors, such as IGF-1. If you were to completely eliminate all the fat in whey, you'd also be throwing out those coveted anabolic factors.

Q: Mother's milk is often called the ideal protein, but are the protein proportions in mother's milk ideal for active, athletic adults?

A: Human mother's milk contains a balance of 50 to 60 percent whey protein-to-40 to 50 percent casein protein. That's a far different balance from what you find in cow's milk, which is about 80 percent casein and 20 percent whey protein. Also, the types of proteins present in the two milks are significantly different. Human mother's milk contains as much as 17 percent lactoferrin, while cow's milk contains about 1 percent lactoferrin. The dominant whey protein fraction in human mother's milk is alpha-lactalbumin, while the dominant whey protein fraction in cow's milk is beta-lactoglobulin. Human mother's milk doesn't contain any beta-lactoglobulin, a highly allergenic protein in humans compared to alpha-lactalbumin.

Nature doesn't do anything by chance, and the high content of lactoferrin found in mother's milk is there for a reason. Among other properties lactoferrin has antiviral activity and is a potent immune system booster. That's clearly advantageous for newborn humans, who lack full immune system function. From an athletic standpoint, lactoferrin may reduce tissue regrowth time. Some studies have shown that it may assist in increasing tissue regrowth.

Lactoferrin is one reason that you can't duplicate mother's milk. The cost of purified lactoferrin is prohibitively expensive. Another factor making it difficult to duplicate mother's milk is the beta-lactoglobulin content of cow's whey protein. Infant formula companies have experienced considerable difficulty in making efficacious products from cow's milk protein. In order to make the formula less allergenic to human infants, they usually hydrolyze the whey protein to a high degree. If the beta-lactoglobulin is sufficiently hydrolyzed, its allergenicity in humans is decreased.

The high content of lactoferrin found in mother's milk is there for a reason. Among other properties lactoferrin has antiviral activity and is a potent immune system booster. From an athletic standpoint, lactoferrin may reduce tissue regrowth time.

Generally, whey protein concentrate contains more lactoferrin than isolates. From both growth-promoting and health standpoints whey protein concentrates may be best for bodybuilding purposes.

It may be difficult to exactly duplicate human mother's milk, but one can at least try to achieve the proper whey-to-casein ratio. It's only logical to conclude that if nature makes mother's milk 50 percent whey protein-to-50 percent casein, that ratio is probably best for growing humans. Nature didn't make mother's milk from 100 percent whey protein or 90 percent casein. It seems obvious that growing humans should thrive on the natural balance of whey protein and casein that's found in mother's milk.

Q: What constitutes a good whey protein supplement?

A: Contrary to those ubiquitous ads, the type of whey processing, whether filtration or ion exchange, has little to do with the ultimate quality of the supplement. All changes in pH levels or exposure to high temperatures affect protein quality by promoting denaturation, the permanent breakdown of the natural protein structures. You want to maintain the native structure of the various protein fractions contained in whey as much as possible. You're after biologically active proteins, and you want to avoid denaturing them because it would minimize their biological activity and, therefore, their value to customers.

The manufacturers who supply the raw protein material vary in their processing techniques, so in many factories each batch of protein may differ in quality from the next. Even the way the cows are fed has an effect on protein quality.

All things being equal, the factory supplying the whey determines the quality of the finished product. Some factories use harsher processing techniques that destroy the delicate whey protein fractions. You cannot, however, completely avoid denaturation because of the necessity of killing existing bacteria before filtering the whey. That involves pasteurization, or the use of heat, which unavoidably alters some protein.

As a consumer you want to look for a company that actively does everything it can to preserve the vital whey protein fractions. Some companies don't bother to analyze the batches of whey they receive and often get their whey from various sources.

You also want to look for whey that contains the greatest amounts of those important whey protein fractions. Generally, whey protein concentrate contains more lactoferrin than whey protein isolates. In fact, the concentrates contain double the amount of health-promoting immunoglobulins than isolates have. In addition, the concentrates are less expensive. Thus, from both growth-promoting and health standpoints whey protein concentrates may be best for bodybuilding purposes.

Q: Many people worry about the lactose, or milk sugar, content of whey because of lactose intolerance. Which types of whey are best for them?

A: Whey protein concentrate contains 6 to 7 percent lactose, while whey isolates contain only 1 percent lactose. It sounds significant until you consider that for every 100 grams of whey protein isolate you get 86.5 grams of protein and 1 gram of lactose. For the same quantity of whey protein concentrate you get 80 grams of protein and six to seven grams of lactose. I don't think that amount would approach the threshold that results in symptoms of lactose intolerance.

What people should be concerned about is maintaining the health of their intestinal membranes, since that's the area most likely affected by dietary changes. One way to do that is to take glutamine. The amino acid fuels the regeneration of the intestinal lining, which breaks down every three days. The body also uses up available glutamine under high-stress conditions, as it's a favored fuel of immune cells. Anyone who's under stress, including the stress of exercise, should aim to take in about 20 to 25 grams of glutamine daily divided into smaller doses of about four to five grams each.

Q: Various commercial whey products tout their glutamine content, often referring to "glutamine peptides." Is it possible to take in enough glutamine by using a whey supplement?

A: While glutamine makes up half the body's amino acid pool, whey protein contains about 6 percent peptide-bonded glutamine. So 100 grams of whey protein provide about six grams of glutamine. On the other hand, casein, the other milk protein, naturally contains 8 to 10 percent glutamine.

The term peptide-bonded glutamine refers to glutamine that is linked to at least one other amino acid via a peptide bond, or peptide chain. The bonded glutamine is superior to L-glutamine, or free glutamine, because the free form of the amino acid is very unstable in the presence of water, heat and pH changes. The half-life of glutamine in water is comparatively short, which is something to think about the next time you see a drink or protein bar that touts its L-glutamine content.

Peptide-bonded glutamine is far more stable than the free-form variety, able to resist such hostile environments as acid and heat. By the way, peptide-bonded amino acids are always better than free-form, since free-form amino acids compete with each other for absorption into the body. In contrast, peptide-linked aminos are absorbed by a more orderly and efficient mechanism. Some studies have shown that peptide-bonded glutamine is absorbed as much as 10 times more efficiently than L-glutamine into the body.

Some companies use deceitful tactics that make it appear that significant amounts of peptide-bonded glutamine have been added to their product, including claims that a product contains 10 grams of peptide-bonded glutamine. The question you want to ask is, How much of that is actual glutamine? It may be less than you think.

Others companies tout a "whey-glutamine-peptide blend." What is that? The glutamine content of whey is so low that a whey-glutamine-peptide blend would be ridiculous, and I'm not even sure the FDA would allow the name to be used. A so-called whey-glutamine-peptide product could never provide the same glutamine content as you get from what's commonly called peptide-bonded glutamine.

If you're looking for the latest nutritional superstar, glycomacropeptides, you want to consume whey protein concentrate made from

The bonded glutamine is superior to L-glutamine, or free glutamine because the free form of the amino acid is very unstable in the presence of water, heat and pH changes. Studies have shown that peptide-bonded glutamine is absorbed as much as 10 times more efficiently than L-glutamine.

Casein, in its native micelle structure, forms a stable suspension in water and contains a number of biologically active peptide sequences that could be of great value to athletes.

cheese whey, which generally contains far more of that protein fraction than whey protein isolate does. I once had one of the most popular whey protein supplements analyzed for protein fractions and found that it contained almost none of the bioactive protein fractions, including glycomacropeptides.

Q: Is hydrolyzed whey useless because it's denatured?

A: No. When you hydrolyze whey protein, you permanently modify the native protein structure, meaning that the protein is denatured and so has little or no biological activity. The hydrolysis process breaks apart peptide bonds, which destroys the protein structure. Even so, you still get the amino acids of whey proteins from the hydrolyzed whey protein. Half the reason we eat proteins is to get those healthful smaller protein chains.

Q: Does whey protein really help to suppress appetite?

A: The glycomacropeptide fraction of whey protein stimulates the release of cholecystokinin (CCK) in the gut. CCK may blunt food consumption while also triggering pancreatic digestive enzyme release and insulin secretion. An important—and often overlooked—point, however, is that glycomacropeptides are found only in cheese whey. What's more, you have to be careful about saying that whey protein helps to suppress appetite. In fact, the human stomach can make glycomacropeptides from casein when it's consumed in its native structure.

Q: Why does casein have a bad reputation compared to whey?

A: Contrary to what some misinformed people have written, casein isn't a bad protein. It is very stable and resistant to pH or heat denaturation when compared to whey proteins. Many people confuse casein with caseinate, which is made by adjusting the pH of acid casein toward a more neutral level by using an alkali. The resultant caseinate is more soluble in water than acid casein and provides a better mouth feel in food products. Casein, in its native micelle structure, however, forms a stable suspension in water and contains a number of biologically active peptide sequences that could be of great value to athletes. Native micellar casein has a different structure from caseinate and is probably used differently by the body.

Caseinate isn't cheap; it costs more than a whey protein concentrate. From a nutritional standpoint, caseinate has no drawbacks, contrary to what you may read in whey protein ads. Caseinate is considered to be a high-quality protein source. It's just nonsense to suggest that it will cause gas or indigestion any more than whey or other proteins will. In fact, whey proteins are generally thought to be more allergenic in humans than caseinates.

Q: But isn't whey superior to casein for promoting increased protein synthesis in the body?

A: The study quoted in many current whey protein ads compared the metabolic effects of consuming native structure whey proteins and native structure casein in active, fed subjects. It differs from older studies, which often used fasted subjects, who don't realistically reflect common protein uptake in an athlete's body. The study found that whey protein consumption leads to a rapid but transient increase in plasma amino acids levels and a subsequent stimulation of protein synthesis. It also found, however, that amino acid oxidation was increased and that whey protein had no effect at all on catabolic protein breakdown.

The study tells us that when you consume whey protein, it's so rapidly absorbed that much of it is shunted to the liver, where the amino acids are oxidized for energy purposes instead of for synthesizing muscle tissue. The rapid uptake of whey does favor increased protein synthesis. The question is, however, How much of the whey protein is used to make muscle tissue and how much is shunted to the liver for oxidation? An important and misrepresented conclusion of this study is the author's own statement that whey provides zero anticatabolic effects in the body. Many people have erroneously interpreted that finding to state that consuming larger amounts of whey protein more frequently throughout the day will provide the same anticatabolic effect as casein did in the study. That isn't what the study showed, though. The author specifically stated that whey protein effected no change in protein breakdown in the body.

In contrast, the same study found that casein consumption led to a lower, slower and more prolonged appearance of plasma amino acid levels. The authors even stated that the slower amino acid appearance from casein led to a different metabolic response in the body than that of whey protein. Casein consumption slightly increased protein synthesis, and liver oxidation of casein was moderate compared to whey protein. The important point is that the authors clearly said that casein significantly inhibits catabolic protein breakdown in the body. Even more important, they concluded that casein consumption results in a better net protein balance in the body than you get with whey protein.

Unfortunately, there are people in the protein supplement industry who are perverting the results and conclusions of that study to push their marketing agendas. I've read numerous unscientific and invalid interpretations of the study's findings. Instead of being afraid of the effect of the researchers' conclusions on their company's profitability and what it means to their marketing tactics, these people should be educating the industry about the potential benefits for bodybuilders.

For example, the study confirmed that whey protein is rapidly absorbed and strongly promotes protein synthesis. At the same time it also found that casein provides a time-released effect and can significantly blunt catabolic protein breakdown. Instead of trying to bend those results or misinterpret them to fit their company's marketing plan, supplement manufacturers should accept the study results at face value.

Both whey protein and casein provide beneficial effects. They're absorbed at different rates and elicit different metabolic responses. In reality, they complement each other and should be consumed together for maximum benefit. Recall that mother's milk is roughly 50 percent whey protein and 50 percent casein. Any companies that try to convince you

The study confirmed that whey protein is rapidly absorbed and strongly promotes protein synthesis. At the same time it also found that casein provides a time-released effect and can significantly blunt catabolic protein breakdown.

ook at other's milk, hich is a ombination of ast-acting roteins and ore prolonged roteins. Fast- nd slower- cting protein ombinations re the best for ny type of rowth.

that consuming only whey protein or only casein is the best approach are just blowing smoke. Contrary to what the ads say, there is no scientific basis for their claims. Sure, they can quote many studies, but a closer examination reveals that the studies have little or no applicability in the real world.

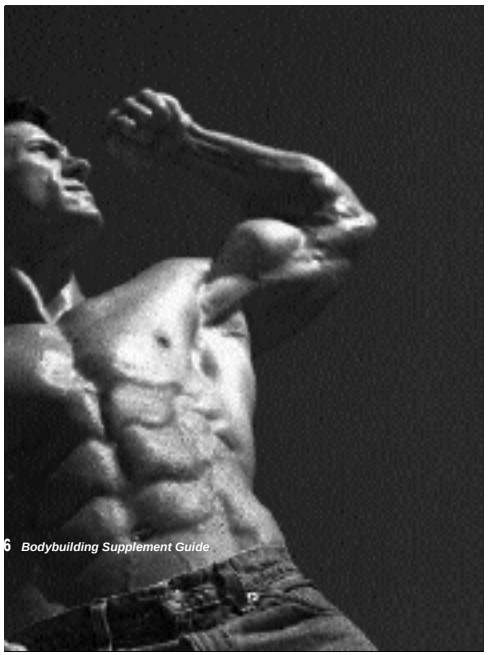
Q: Since some studies show increased muscle protein synthesis after exercise, should bodybuilders focus on whey as a postworkout protein source?

A: Look at mother's milk, which is a combination of fast-acting proteins and more prolonged proteins. That takes care of the necessity for rapid protein synthesis while preventing the excess breakdown of newly formed proteins. Fast- and slower-acting protein combinations are the best for any type of growth.

Q: But isn't whey protein richer in anticatabolic branched-chain amino acids?

A: I've had various milk proteins analyzed by a major laboratory for their amino acid profiles. After months of lab analysis I found that contrary to popular belief, the different milk-derived proteins don't markedly differ in amino acid content. First, the results of the amino acid assays varied by as much as 25 percent for any individual amino acid, with an average variance of plus or minus 12 percent. It's difficult to say that one protein contains significantly more of an amino acid when the actual results fall within the percentage of variance.

A leading manufacturer of whey protein supplements used to print right on its label that its product supplied side branched-chain amino acids at a level of 50 percent of the essential amino acid content of the whey protein. I was interested in that claim, so I compared whey protein, caseinate and a whole-milk protein that contained both whey and casein proteins. I found that the whey protein concentrate supplied an average of 49.5 percent of its essential amino acids as side branched-chain aminos. The caseinate also showed an average side branched-chain amino content of 49.5 percent. The milk protein averaged 49.3 percent. Those results may explain why the company that sold that leading whey protein supplement removed the ridiculous text from its label.



Q: What about combination protein supplements, such as milk, egg and soy?

A: I don't think that soy protein offers benefits for bodybuilders. For example, unlike casein, it doesn't form a good curd in the stomach, which makes it a fast protein. Also, the amino acid pattern in soy is inferior to that of milk proteins and not as favorable for promoting growth.

Egg albumin is similar to the lactalbumin found in milk. The problem with egg protein is that it's highly allergenic, but if you can tolerate it, it's a good protein.

If you look at this issue in terms of survival, it would be a good idea to combine various proteins, including soy. For promoting maximum muscle growth, however, milk proteins are best. That's reflected in a measure of how efficiently protein stimulates growth, which is called the protein efficiency ratio (PER). The currently accepted PER for soy is 1.7 to 1.8. It started out as 1.2, but the PER testing method was modified over a period of years so that soy protein scored better on the test. The result is that soy protein now has an accepted PER of 1.8. For casein it's 2.5.

Q: How accurate are the labels on most current commercial protein supplements?

A: Not very accurate. Most labels misstate the powder contents. That would particularly apply to the protein fractions discussed above; take, for instance, glycomacropeptide, which is a hydrolyzed piece of kappa casein. Manufacturers add hydrolyzed whey proteins to their supplements. The hydrolyzed whey protein may contain pieces of whey peptides that are in the same molecular size range as glycomacropeptides and may even show up on analysis as them, yet they aren't glycomacropeptides. Despite that fact, the protein supplement labels state that they contain a certain amount of glycomacropeptides. Such labels are probably misleading because it would be very hard to guarantee a specific glycomacropeptide content from any current protein source. Also, remember that a true ion-exchange whey protein isolate contains no glycomacropeptides.

Q: What is the ingredient found in some products that's called "complete milk protein"?

A: Complete milk protein is a whole milk protein that is separated from the other constituents of cow's milk by a filtration process. Since no pH changes or excessive heat are used in the processing, the protein retains more of the biologically active protein fractions that are limiting in other protein sources. The casein and whey are in their native, undenatured structures. This is simply protein the way nature intended.

The best combination probably involves a filtered milk protein with whey protein concentrate, since you get all the bioactive protein fractions plus both rapid and extended protein activity in the body. The scenario favors increased protein synthesis and a significant anticatabolic effect.

The best combination probably involves a filtered milk protein with whey protein concentrate, since you get all the bioactiv protein fractions plus both rapid and extended protein activit in the body.

Both whey protein and casein provide beneficial effects. They're absorbed at different rates and elicit different metabolic responses. In reality, they complement each other and should be consumed together for maximum benefit.

Critical Protein Facts

•Human mother's milk contains a balance of 50 to 60 percent whey protein-to-40 to 50 percent casein protein.

•Contrary to those ubiquitous ads, the type of whey processing, whether filtration or ion exchange, has little to do with the ultimate quality of the supplement.

•Bonded glutamine is superior to L-glutamine, or free glutamine, because the free form of the amino acid is very unstable in the presence of water, heat and pH changes. Peptide-bonded amino acids are always better than free-form, since free-form amino acids compete with each other for absorption into the body.

•Caseinate is a high-quality protein source. It's just nonsense to suggest that it will cause gas or indigestion any more than whey or other proteins will. In fact, whey proteins are generally thought to be more allergenic in humans than caseinates.

•The study tells us that when you consume whey protein, it's so rapidly absorbed that much of it is shunted to the liver, where the amino acids are oxidized for energy purposes instead of for synthesizing muscle tissue.

•The same study found that casein consumption led to a lower, slower and more prolonged appearance of plasma amino acid levels. The authors even stated that the slower amino acid appearance from casein led to a different metabolic response in the body than that of whey protein.

•The important point is that the authors clearly said that casein significantly inhibits catabolic protein breakdown in the body. Even more important, they concluded that casein consumption results in a better net protein balance in the body than you get with whey protein.

•Both whey protein and casein provide beneficial effects. They're absorbed at different rates and elicit different metabolic responses. In reality, they complement each other and should be consumed together for maximum benefit.

•Any companies that try to convince you that consuming only whey protein or only casein is the best approach are just blowing smoke. Contrary to what the ads say, there is no scientific basis for their claims. Sure, they can quote many studies, but a closer examination reveals that the studies have little or no applicability in the real world.

A Solution for Smallness

by Michael J.B. McCormick

Much of what follows is in line with advice I was lucky enough to receive in the early 1970s from one of bodybuilding's pioneers, Pete Grymkowski, the co-owner of Gold's Gym International. In order to grow, he said, you have to consume large quantities of the highest-possible-quality protein supplements. In 1973 Pete achieved a peak contest weight of 256 pounds at 5'10", which was in large part due to the consistent consumption of a minimum of 500 grams of protein. That was during a time in which everyone he competed against was getting maybe 200 grams. This article describes a 12-month period in a gifted bodybuilder's career, during which he gained more muscle than he had in the previous eight years. I'll call him Joe, although it's not his real name. What Joe accomplished during that relatively brief 52 weeks can be repeated by anyone willing to let go of old habits and opinions in favor of a more effective approach, particularly with regard to nutrition.

For more than five years Joe had heard NPC national judges tell him, "It's all there. You just need to pack on more beef to take advantage of your structure." He was fed up with missing out on an IFBB pro card year after year. Eventually, he reached a point where he was willing to take any legal steps that would enable him to gain at least 25 pounds.

Following a period of intense introspection, Joe concluded that he'd been training the same way, with the same people, and eating the same food for years. He'd never changed his high-volume, pumping style of training, and he realized that not only was he training too much, but he was also using poor technique. He moved heavy enough weights during those high-volume sessions, but he rarely got sore. What was missing was the so-called feel for the muscle on each rep. He began to understand that he'd been training with excessive momentum.

For more than eight years Joe had trained six days per week, with each session lasting from 1 1/2 to two hours. His total training time in the gym was more than 12 hours each week. He trained individual bodyparts twice per week using 12 to 14 sets per muscle group. In fact, he consistently performed 26 sets per bodypart every week for a total of 156 sets. Joe's training had produced some great results. The best condition he achieved for a national show had been at 227 pounds. He's 6' tall, and for more than seven years he never weighed more than 235 pounds in the off-season. The problem was, he really hadn't made any significant gains for more than five years. His grinding workouts had ceased to be effective. That was the first area that had to be changed.

Joe's shift in training strategy was to significantly reduce the work volume while simultaneously increasing the intensity of each set. It was the first time he'd ever attempted ultra-high-intensity training, and he altered his exercise form radically to emphasize the eccentric—that is, the negative, or lowering—portion of each rep.

Because he was pursuing total momentary muscular failure on every working set, his workouts had to be as short as possible. Joe trained on Monday, Wednesday and Friday for less than 50 minutes per session. His total training time in the gym dropped to less than three hours each week. He trained individual bodyparts once per week at a volume of three to six sets per muscle group, which brought him to a total sets per week of 27, including all bodyparts. That's a volume reduction of 83 percent!

The training modifications were intended to induce a state of temporary muscle damage. Joe trained like a man who was escaping from prison. He poured his soul into the iron.

Damage without repair is death in bodybuilding, so, in order to recuperate from the phenomenal elevation in muscle microtrauma, Joe ate more—a lot more. Previously, his normal daily intake of protein had averaged only 175 grams, all of it coming from whole foods. His dietary modification was to synergize the biochemical recuperation from train-

Joe's incredible 12-month gains—30 pounds of muscle—were in large part the result of his increasing his protein by 250 percent. The lack of sufficient dietary protein is the single biggest obstacle for 90 percent of all bodybuilders.

ing by tripling his protein intake from 175 grams to 525 grams each day.

Granted, Joe was a large athlete, but 500 grams is still one whopping dose of protein. It's pretty difficult to consume that much as whole food. Knowing that, Joe used supplemental milk-and-egg protein throughout the day. He took in five grams of protein per kilo of bodyweight each day. He knew that research had documented the fact that taking in 400 percent of the recommended dietary allowance (RDA) for

protein (3.3 grams per kilogram of bodyweight vs. the RDA of 0.8 grams per kilogram) is safe for healthy individuals. More important, he knew that the increased protein load would result in a continuous increase in protein synthesis.

Joe started his transformation on May 12, 1994. His bodyweight was 227.8 pounds, at 15.9 percent bodyfat. One year later, on May 13, 1995, he weighed 258.3 with only 12.8 percent bodyfat. Joe had gained 30.5 pounds of muscle with a concomitant reduction of 3.2 pounds of bodyfat. During that time he performed a total of 156 training sessions, each lasting less than 50 minutes. Joe's complete departure from his prior habits produced more muscle in 365 days than the previous 2,920 days, or eight years, had.

Thirty pounds of muscle is phenomenal for an entire career, let alone a single year. Logical bodybuilders will ask, "But what about the drugs? It had to be the gear he was on that gave him those kinds of gains." The fact is, Joe was controlled and quite modest in his anabolic/androgenic steroid augmentation. There was no change in his program from the beginning to the end of that period. What's more, the amount and type of chemical additives he used were actually less than what he'd used for the previous five years, and still Joe exploded with more than 30 pounds of muscle. So the question is, What did it?

The answer is, Joe earned his new size. It was real and completely legit, and most of it has turned out to be permanent. Joe still weighs 265, and he's clean as a whistle, unable to compete due to a permanent torso injury. Once he hit the 250-pound mark, he never looked back.

The proteins contained in milk-and-egg supplements accomplish the job of growth that whey cannot. They maintain the blood levels of glucose and amino acids long enough to maximize the repair process.

It was the continual supply of amino acids and energy that enabled Joe's bodyweight to climb to 258 pounds in a single year.

Joe's incredible 12-month gains were in large part the result of his increasing his protein by 250 percent. The lack of sufficient dietary protein is the single biggest obstacle for 90 percent of all bodybuilders, and it's a self-imposed one. Most bodybuilders simply don't stay on top of their real protein needs, especially when it counts. The sheer amount of whole food it takes to generate 300-plus grams of protein a day is simply too much for most bodybuilders to eat. Enter a key training aid: milk-and-egg proteins.

The peptides found in milk-and-egg proteins contain numerous growth-activating protein fractions, producing more growth than whey protein. The proteins contained in milk-and-egg supplements accomplish the job of growth that whey cannot. They maintain the blood levels of glucose and amino acids long enough to maximize the repair process. It was the continual supply of amino acids and energy that enabled Joe's bodyweight to climb to 258 pounds in a single year. That's amazing when you consider that recent thinking had milk-and-egg supplements lost in whey protein's dust. Not so. There's a bold new world of size waiting for you. So what are you going to do?

Editor's note: *Michael J.B. McCormick is a freelance writer and researcher. His insider knowledge has helped produce the* Gold's Gym Encyclopedia of Bodybuilding *(NTC/Contemporary Books, 1998) and the soon-to-be-published series* Gold's Gym Essentials of Bodybuilding: Building Bulk, Total Torso Training, Book of Big Arms and Total Leg Training*. He has been passionately involved in bodybuilding for 25 years.*

References

Fern, E.B.; Bielinski, R.N.; and Schultz, Y. (1991). Effects of exaggerated amino acid and protein supply in man. *Experientia*. 47:168-172.

Kestin, M.; Rouse, I.L.; Corel, R.A.; and Nestle, P.J. (1989). Cardiovascular disease risk factors in free-living men: comparisons of two prudent diets, one based on lacto-ovo vegetarianism and the other allowing lean meat. *American Journal of Clinical Nutrition*. 50:280-287.

Park, D.V., and Ioanndes, C. (1994). The effects of nutrition on chemical toxicity. *Drug Metabolism Reviews.* 26(4):739-765

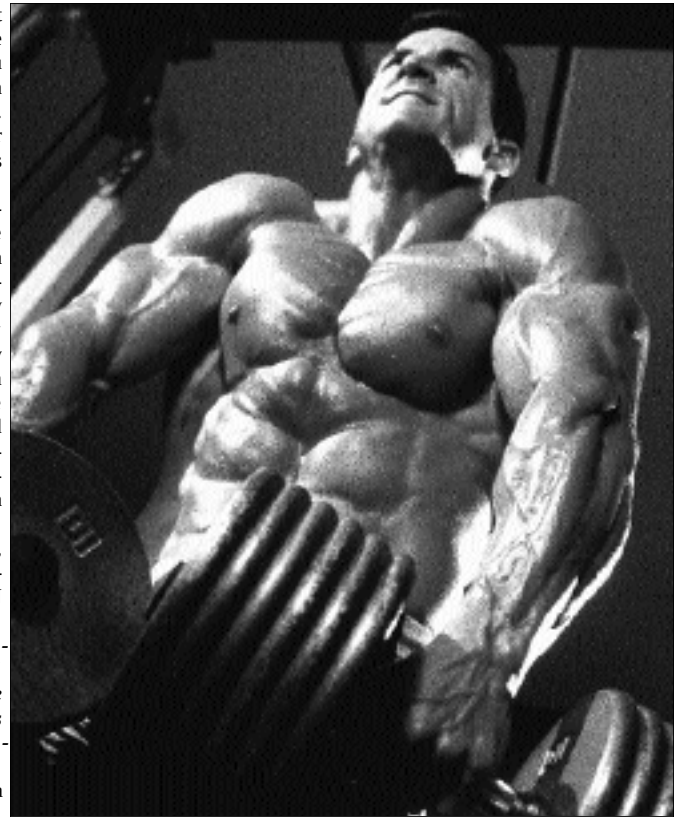
Prescott, S.L.; Jenner, D.A.; Beilin, L.J.; Margetts, B.A.; and Vandogen, R. (1988). A randomized control trial of the effect on blood pressure of dietary nonmeat protein vs. meat protein in normotensive carnivores. *Clinical Science*. 74:665-672.

Protein Q&A

Q: I just read in [a bodybuilding magazine] that whey is far superior to casein for bodybuilding purposes. Should I be using straight whey protein if I want the fastest gains possible?

A: The author of that article, while singing the praises of whey, missed the point. He states that whey has a higher biological value and is in and out of your system quickly—less than two hours—while casein "clots in your stomach, is released slowly and absorbed over a period of four to six hours." This trait of casein is a benefit, not the detriment he makes it out to be. It's the exact reason you should use casein in combination with whey—so that your body doesn't slip into a catabolic state between feedings.

Say you have a whey shake at 9 a.m. and then eat lunch at noon. It's good bet that your body won't have any circulating amino acids after 11 a.m. and the starvation mechanism will kick in because whey is in and out so rapidly. That means muscle cannibalization can occur, and unless you enjoy passively tearing down what you fight so hard to build up—like muscle tissue—you should avoid that catabolic state like the plague. Adding casein to the mix ensures that you get both a fast anabolic reaction and a slow anticatabolic absorption. The trickle-feed effect is the reason I believe every protein drink you have should contain both whey and casein.



It doesn't matter whether one protein is better than the other—a highly debatable subject in and of itself. The point is you get much better bodybuilding results with the fast-slow combination, especially if you can't eat every 1 1/2 to two hours on the dot. Take advantage of the latest studies and technology and use protein and meal replacements that include both whey and casein.

—*Steve Holman, editor in chief,* IRONMAN

Q: Based on your research, experience and observation, what type of diet do you think is best for building muscle and why?

A: I don't believe in a

Sleep time is growth time for only about the first two hours, when growth hormone output is high. After that cortisol levels shoot up and sleep turns into something akin to a catabolic coma.

one-diet-fits-all approach. People have individual food preferences and sensitivities, and that must be considered when you're designing an effective diet. Generally speaking, however, I think that high-protein diets averaging about one to 1 1/2 grams per pound of bodyweight suit the needs of most people seeking added muscle mass. Carbohydrate and fat intakes are more individualized and depend on factors like existing bodyfat levels, activity levels—such as whether you're doing aerobics—and so on.

For most people the popular approach of 40 percent carbs, 30 percent fat and 30 percent protein works well. The fat intake should not contain more than 10 percent saturated fat, with 20 percent being a combination of polyunsaturated fats—say, 10 percent fish oils, or alpha-linoleic, with another 10 percent as linoleic, or omega-6. You need carbs with a high glycemic index after training, with moderate-glycemic-index carbs before training and low-glycemic-index carbs later in the day, assuming decreased activity. [See the end of this book for a balanced diet-and-supplementation template.]

—Jerry Brainum, bodybuilding and nutrition researcher

Q: I've been having trouble sleeping lately, and I know that sleep time is growth time. Do you have any suggestions?

A: Sleep time is growth time for only about the first two hours, when growth hormone output is high. After that cortisol levels shoot up and sleep turns into something akin to a catabolic coma.

One thing you can do to decrease the catabolic actions of cortisol during the night is to drink a meal replacement right before bed, taking it along with phosphatidylserine. For example, a packet of a meal replacement like Muscle-Link's Muscle Meals has the right balance of calcium and magnesium, a 2-to-1 ratio that improves sleep. Also, the whey-and-casein protein mix will give you both fast and slow amino acid entry to the bloodstream. The casein helps provide a trickle-feed effect so you have amino acids in your system longer, and that can prevent some of the late-night catabolism, as can a PS supplement. Add Cort-Bloc, or one of the other PS supplements that are available, to the mix and you have a potent presleep anabolic-anticatabolic cocktail.

—Steve Holman, editor in chief, IRONMAN