We Are What We Absorb

Will Brink

"You are what you eat" is an old expression your grandmother's grandmother probably used, but it's not actually correct technically speaking. Putting on my nerd hat to be a stickler for the details, it's more accurate to say "you are what you absorb." Grandma's sage advice does a good job of illustrating that what we ingest is obviously essential to our health, but what we ingest that actually gets absorbed and utilized by the body is the crux of the issue truth be told.

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The piles of studies that have been growing in recent years showing all manner of potential benefits of various nutrients has been very encouraging. We are experiencing an exciting time in nutritional science where new compounds are being discovered—and tested for their potential benefits—almost daily. Compounds that may help prevent cancer, improve immunity, improve weight loss, improve brain function, or improve athletic performance, to name just the tip of the iceberg of where science is currently looking to isolate and test various nutrients for their bioactive properties.

How the process works:

Once a compound is discovered, it tends to get isolated, and then tested in either animal models and or in vitro (test tube) to test what positive or negative properties may exist as well as elucidate how they work. That is, understand not just what system they may impact (such as increase an animal's ability to resist cancer causing chemicals for example) but also examine the isolated compounds' "mechanism of action" which shows how it achieves the effect. How does that work? Let's say some spice has been used for generations to reduce infections or improve immunity. Scientists might then feed, or inject, large amounts to lab animals (e.g., mice, rats, rabbits, etc.) and see if it does indeed have activity; perhaps testing how that spice reduces the size of tumors when the mice are exposed to known carcinogens, or bacteria known to cause infections and so forth. If that spice shows biological activity, scientists will often look deeper into that spice to see which specific constituent(s) in the spice are having the "active" compounds, and once found, will concentrate and isolate that active compound and further tests on animals, or humans, or in vitro (test tube) will continue. Foods and spices for example, are highly complex and can have hundreds or even thousands of biologically active compounds in them.

A few examples:

Green tea is a good example. Studies found green tea associated with a reduced risk of a number of diseases—such as various cancers—in populations who regularly consumed green tea. Green tea extracts were developed and tested, and scientists began to test the actual individual compounds found in the green tea extracts. Green tea was found to contain compounds known as polyphenols classified as catechins. Green tea contains six primary catechins: catechin, epicatechin, gallaogatechin, epigallocatechin, epicatechin gallate, and apigallocatechin gallate (EGCG). EGCG appears to be the most biologically active and is the most studied catechin found in green tea to date. Green tea also contains alkaloids including caffeine, theobromine, and theophylline. Many will recognize those last three as they are responsible for the stimulant effects of green tea and often found in various pre workout and energy type formulas. Finally, L-theanine is found in green tea and has been studied for its calming effects on the nervous system and often sold alone as a stress reducing supplement. BTW, It's not unusual that a plant, or herb or food may contain compounds that have seemingly opposite effects to each other (such as caffeine and L-theanine found in green tea), but that's another topic for another article.

Compounds must be "solubilized" by the body before they can be absorbed.

A similar story exists for popular extracts such as grape skin extracts and Curcumin. Population based studies found reduced rates of certain diseases in people who consumed them, extracts developed and tested, and individual compounds within those extracts isolated . For

example, Resveratrol is a compound found in grapes, red wine, and purple grape juice, and shown to have a wide range of potential health benefits, which include anti-inflammatory, cardioprotective, anti-oxidant, and anti-tumor activities, and is marketed and sold as a supplement. Resveratrol has garnered a great deal of interest with researchers as it continues to show a wide range of potential benefits, some quite unexpected.

Curcumin is found in turmeric spice and is getting a great deal of attention in the scientific and medical community, and rightly so. Curcumin contains a number of bioactive compounds collectively called curcuminoids. Studies have been very promising and suggest curcumin may positively impact a wide range of human conditions, acting as an anti-inflammatory, antioxidant, chemopreventive (cancer-preventive) agent, and antineoplastic (cancer-fighting) , to name a few possible benefits of curcumin and its bioactive constituents. As one would expect, curcumin is quickly becoming a popular nutritional supplement.

As this article is not intended as an extensive look into the science of these extracts per se, but an example of how discoveries are made and the growing list of studies that show real promise in preventing and or treating various human ailments using extracts and constituents found within them, bringing me to the reason for this article...

2+2 does not always = 4

The above would lead the reader to conclude the study findings must mean using these various extracts will help fight diseases or prevent them in humans. Well, per usual, it's not that simple. If my decades of research in the nutritional sciences have taught me anything, it's that 2+2 rarely = 4 in human physiology. Sometimes it equals 6, and sometimes it equals zero, but rarely as you expect. Such is the case for many of these extracts, hence the title of this article! As explained above, the typical process is to look at these extracts and or bioactive compounds isolated from those extracts in isolation, doing in vitro (test tube) studies and or feeding them (or injecting them) at very high doses to animals. Those studies are often extrapolated to humans. However, it's often the case that when tested directly in humans, the results are less than impressive. Why? The answer to that gets complex quickly and depends very much on the individual compound being examined and studied, but some useful generalities can be discussed. Although each compound, be it extract, food, vitamin, etc. may have its own unique properties as to why human studies don't live up to the effects found in animals or test tubes, two key issues are often at play as to why the human studies are disappointing when studies in test tubes and animals looks so promising, which can be summed up as "absorption and metabolism".

Absorption and Metabolism

Resveratrol is an excellent example of the second issue listed: metabolism. Resveratrol, in particular as trans- Resveratrol, appears to be adequately absorbed by humans. However, due to its rapid metabolism and elimination—and other factors—it's actually considered to have a relatively low bioavailability and research is ongoing to find ways of improving Resveratrol's effects in humans by employing novel delivery systems that may extend its metabolism. It's important to note that the term "metabolism" as it applies to the topic covered here, is a highly generalized term for an extremely complex system beyond the scope of this article.

Curcumin is the poster child for the first issue mentioned: absorption. For any compound, vitamin, or nutrient, it must get digested and absorbed to be metabolized. Many people are under the impression digestion and absorption are a simple matter of everything we eat being dumped into some acid in the stomach, and absorbed. Nothing could be further from the truth and human digestion is an extremely complex system. For brevity's sake, I'm going to cover the essential basics, using curcumin as an example. It's well established that compounds with poor solubility are poorly absorbed and have poor bioavailability. Compounds must

be "solubilized" by the body before they can be absorbed. It's accurate to say that solubilization, absorption, and metabolism are three key steps that modulate oral bioavailability of an ingested compound. In many cases, there's a direct relationship to the solubility of the compounds or nutrient and its bioavailability. Most people have heard of fat soluble and water soluble vitamins for example, and have a better understanding of the basic concept of solubility than they may think.

If you dump a teaspoon of table sugar into a big glass of water and stir, it mixes fairly quickly. Its solubilized. If you dump a teaspoon of vegetable oil into the glass, no amount of stirring will get them to mix together, because oil (lipids) are not water soluble. If you dump a teaspoon of sand into water or oil, no amount of stirring will get it to mix into either, as an extreme example. What if something has very poor water and fat solubility? Well, it tends to go right through you just as the sand would! That's a highly simplified overview of a very complicated process, but it's "good enough for government work" as they say to explain the essential concept of solubility.

From the above discussion then, it should come as no surprise that improving the solubility of a compound with poor solubility will often dramatically improve its absorption and bioavailability. In fact, the rate at which poorly water soluble compound dissolves is often

the slowest step and therefore can be what's referred to as the "rate-limiting" step in bioavailability of the compound. Needless to say, for compounds with poor solubility, a key step to improving their bioavailability and effect, is to improve its solubility. There's a number of technologies companies can employ, some times as simple as micronizing it (reducing it to very small particle sizes) to complex and proprietary processes unique to a company.

Using curcumin as the example, in one study, people were fed up to 12,000mg (12g) of curcumin extract, and virtually no detectable curcuminoids were found in their blood. Curcumin is considered to have extremely poor solubility and various technologies have been attempted to improve it. One potential benefit of improving solubility that benefits buyers and sellers is, improving solubility may allow lower doses to be used to derive benefits, saving space and money for all involved.

One interesting technology recently developed by Glanbia Nutritionals called PhytoForce™ shows real promise when applied to compounds with poor solubility like Curcumin. The PhytoForce™ technology applied to Curcumin showed a 350% increase in solubility and an even more impressive increase in permeability, which are substantial improvements that should result in greatly enhanced bioavailability. Additional botanically derived extracts the technology has been applied to are Milk Thistle, Chrysin, Green tea extract, resveratrol, quercetin as well as others.

Readers should note this technology is not sold retail, but directly to companies looking to apply it to their products or formulas. For additional information on the PhytoForce™ technology, the company can be contacted directly at: nutrition@glanbia.com

Conclusion

Discovery of various compounds derived from herbs and other botanicals is an exciting area of nutritional research. Some are proving to be of value in both disease prevention and treatment in humans, vs. say just rats and mice! However, as outlined in this article, discovery and isolation of the active components is only part of the process in terms of being of any real benefit to human beings ingesting them in supplemental form. They need to actually be absorbed and utilized to be of any real value. The application of specific technologies to greatly enhance absorption—especially as it applies to compounds with poor solubility—is an area of research starting to yield novel and useful technology that will improve bioavailability.

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Companies interested in the applying this technology to their products should contact: nutrition@glanbia.com

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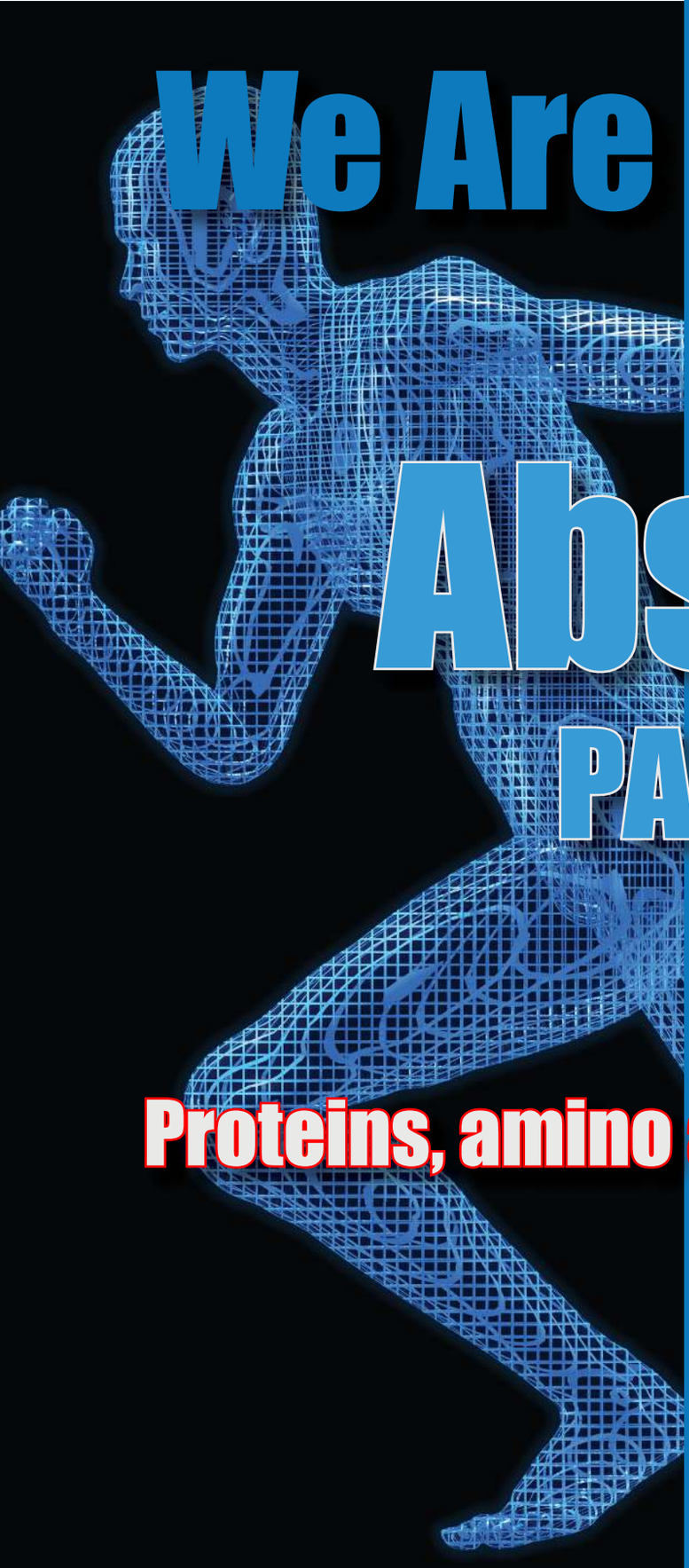

We Are What We Absorb PART II

Proteins, amino acids, and peptides

Will Brink

This is a topic so large it could take stacks of text books (and it does!) and many semesters in college and years of research afterward, so an exhaustive review is both beyond the scope of this article and my brain!

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There's a few key areas however I plan to address in this article people will find helpful to making smart decisions the overhyped ads for protein, amino acids, and peptides don't cover. For the most part, I recommend whole protein sources, such as whey, eggs, lean meats, fish etc. in terms of dietary protein* intakes, but some individual amino acids can be of benefit in specific applications. Those applications may be sports performance related, general health, or medical, but I'm getting ahead of myself.

Back In The Day...

Back in the day when I was taking my first nutrition courses and reading what research existed—right after the Pleistocene era—the mantra of nutrition was that digested proteins were broken down into individual amino acids during digestion and absorbed, and that was that. As with virtually all overly simplified models generated from the early research examining human nutrition and physiology, it was wrong. To this day however, there are still those who believe it, but I digress. However, most know that ingested proteins are broken down primarily into small peptides and individual amino acids.

"It's well established that compounds with poor solubility are poorly absorbed and have poor bioavailability. Compounds must be solubilized by the body before they can be absorbed. It's accurate to say that solubilization, absorption, and metabolism are three key steps that modulate oral bioavailability of an ingested compound. In many cases, there's a direct relationship to the solubility of the compounds or nutrient and its bioavailability."

The fact is, to this day, human digestion, absorption, and utilization of nutrients we ingest is still being elucidated with more discoveries being made than most people realize or appreciate. It's amazing to me however the number of people—some educated enough in the sciences to know better—who think digestion, absorption, and utilization of the food we eat can be summarized as "it gets dumped into the acid in your stomach, then absorbed via voodoo, the end." Human digestion, absorption, and utilization of the nutrients we ingest, is an incredibly complex process, that as previously mentioned, is still being elucidated. If you want to get a glimpse of how complex, the Encyclopedia Britannica site has a nice write up on that, and remember: digestion, absorption, and utilization of protein is but one very small aspect of it.

As mentioned previously, there are benefits and potentially unique effects to using individual amino acids, but studies indicate peptides are better absorbed and/or utilized than individual amino acids. What that suggests is, even if the goal is to derive benefits from a single amino acid (e.g., Leucine, Glutamine, etc.), its likely best to get it in peptide form. For example, instead of taking L-leucine alone as the free amino acid, to increase intakes of L-leucine, ingesting a leucine rich peptide is likely to be the superior approach. The science and understanding of the value of peptides in human nutrition, be it for health, performance, increased muscle mass, etc., is an evolving area of research yielding useful findings, and still in it's early stages in fact. Because this is such a wide-open and extensive topic, I'm going to stay focused on a few key issues, such as the value of using individual amino acids or "free" amino acids vs. peptides even if the goal is to increase levels of a specific amino acid.

Free Amino Acid vs. Peptide Absorption and Utilization.

Studies find that diets fed to animals with identical amino acid composition, but fed as either free amino acids or as whey derived peptides, finds peptides have a greater nutritive value than free amino acids and greater tendency toward production of lean body mass. Additional hu-

man studies find the same effect, although not all studies concur in humans. The protein efficiency ration (PER) is superior with peptides over whole proteins or free amino acids (FAA), and as alluded to above, digestion of whole proteins in humans produces mostly peptides for absorption and possible utilization vs. FAA.** Why are peptides more easily absorbed over FAA? Some amino acids have relatively low solubility for starters. As pointed out in part one of this series, solubility is essential and often rate limiting to digestion, absorption, and perhaps utilization of various nutrients we ingest:

"It's well established that compounds with poor solubility are poorly absorbed and have poor bioavailability. Compounds must be solubilized by the body before they can be absorbed. It's accurate to say that solubilization, absorption, and metabolism are three key steps that modulate oral bioavailability of an ingested compound. In many cases, there's a direct relationship to the solubility of the compounds or nutrient and its bioavailability."

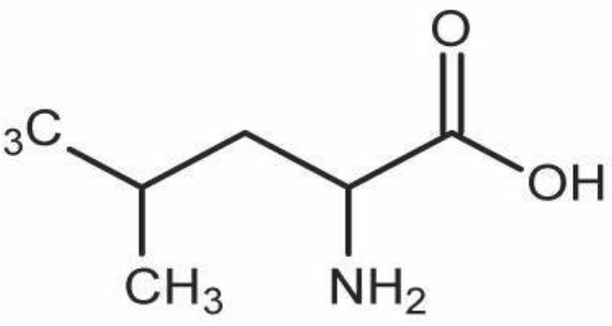
Other possible reasons why FAA are not as readily absorbed and utilized compared to peptides may be an interference with amino acid transporters, and the tendency of FAA to be oxidized by the liver, the different availability to gut flora of peptides vs. FAA, and differences in osmolarity between peptides and FAA which can impact gastric emptying and nutrient utilization. However, to reiterate, although the data is strongly supportive of the conclusions I'm making in this section, it's far from conclusive and research is ongoing.

What of hydrolysates?

"Pre digested" proteins or hydrolysates yield peptides of varying lengths and appear to have some unique effects and advantages to whole "native" proteins or FAA alone. However, a major limitation of the differences between native proteins and their hydrolysates is that all hydrolysis does not yield the same hydrolysate end-product. That is to say, the degree of hydrolysis varies considerably between products yielding relatively large protein fragments down to di- and tripeptides and combinations thereof.

Unfortunately, the degree of hydrolysis is rarely reported in studies much less on product labels, leaving both those reading studies and buying products essentially in the dark. "On paper" hydrolysates should be of value, but the complete lack of standardization in both the research and end product sold to consumers makes them difficult to recommend at this time. Of course, if one is attempting to increase their intake of a specific amino acid, hydrolysates are not the right choice for that goal regardless as they will supply the amino acid profile of the hydrolyzed protein vs. a specific amino acid.

Specific Peptide Products



Science-focused companies have developed promising peptide technology. For example, Glanbia Nutritionals has developed a unique method of developing peptides that are rich in a given amino acid. Because L-leucine is getting so much attention in the literature and sports nutrition community, *** I'll focus on their Leucine peptide. The technology is called PepForm® and is already being added to various formulas on the market and can be identified by looking for the PepForm® logo on product labeling. The product yields a soluble and highly bioavailable peptide rich in a specific amino acid (in this case Leucine) and preliminary results with the PepForm® Leucine peptide product have been very encouraging; testing both PER values in animals as well as absorption characteristics in human volunteers.****

Typical of the supplement industry, some companies who have identified the obvious benefits of peptides rich in Leucine—or other amino acids—simply responded by invented marketing terms and using buzz words like "micro enhanced delivery techno functional peptide delivery system" to lead consumers to assume there's legit peptide technology in their products when they don't... Such is the reality of the supplement industry, so per usual, consumers need to read labels and do a little digging on their own to see what's got legit peptide tech behind it and what's marketing mumbo jumbo.

Conclusion

The reader should understand I have attempted to distill down an extensive amount of technical information while doing my level best to be accurate in the "take home" recommendations and conclusions. Whole protein sources should make up the majority of dietary protein intake, hydrolysates show great promise but don't appear ready for "prime time" and if one is attempting to increase their intake of a specific amino acid, peptide form appears the superior choice. Some additional info on new technologies I'm looking at for improved absorption and bioavailability can be found at http://www.brinkzone.com/supplement-science/new-supplement-technologies-teaser if interested in some visuals.

Additional Comments:

* = Why? Because whole protein sources deliver many nutrients beyond just protein or amino acids and should make up the majority of protein intake in any well rounded nutrition plan.

** = How is the PER figured? The PER is based on the weight gain of a test subject divided by its intake of a particular protein during the test period done with growing animals. The PER is one commonly used method for evaluating the quality of protein sources, but there are other methods, such a biological value (BV), net protein utilization (NPU) and the more recent PDCAAS. None are perfect, all have their potential drawbacks, nor reflect a 1:1 relationship to their score and how much muscle a person may gain from them, etc. As a rule, protein sources with higher scores PER/BV/NPU scored tend to be the more "complete" proteins, and or better choices for active people looking to gain or retain muscle, but that's beyond the scope of this article and a topic for a future article.

*** = The amino acid Leucine is getting a great deal of attention recently and rightly so. Leucine appears to be the most important amino acid of the BCAA's and is an essential nutritional anabolic driver. Leucine, acts as an essential signaling molecule in the mTOR cascade and a critical amino acid for increasing skeletal muscle protein synthesis as well suppressing muscle protein degradation. That's what we call in science a "win-win"!

**** = As tested in animals vs.humans an equal amount of free form L-leucine, PepForm® was found to have lead to increased lean body mass when compared to matched free form L-leucine in the diet of rats. In a group of human volunteers, PepForm led to serum leucine levels known to trigger protein synthesis in humans, but these results have not been published in the peer reviewed literature to date.

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Companies interested in the applying this technology to their products should contact: nutrition@glanbia.com

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Will Brink graduated from Harvard University with a concentration in the natural sciences has been a writer, scientific researcher, consultant to supplement companies, and trainer for 20 years relating to health/fitness and performance. He has co-authored several studies relating to sports nutrition and health and published in peer reviewed academic journals.

He is the author of 6 books; P*riming the Anabolic Diet, Bodybuilding Revealed, Fatloss Revealed, The Sports Supplement Bible, The Skinny on Diet Supplements, and P.A.S.T. : Practical Applied Stress Training for Tactical Law Enforcement.*

He has served as an NPC judge and as a Ms. Fitness USA judge. Will has helped many top level bodybuilders and fitness contestants through all facets of pre-contest and off-season training. He has worked with athletes ranging from professional golfers, runners, and baseball players and has worked with developing functional fitness courses for police and military personnel.

In 2007, he developed OptimalSWAT P.A.S.T.™ to fill the need for job applicable functional training for Military and Law Enforcement communities in the United States. This program became so popular that B-F.I.T™ was created in 2008 to address the needs of those who were looking for training that was life applicable.

In 2009 he developed and instructed the course Advanced Applied Stress Shooting I & II that was offered spring and fall 2009 at The Smith & Wesson Training Academy in Springfield, MA.

In the past 20 years Will has been published in a wide variety of publications in several languages, including *Muscle Insider, Muscle Media, MuscleMag International, Lets Live, Muscle n Fitness, Life Extension magazine, Townsend Letter for Doctors, IronMan, Inside Karate, Exercise for Men Only, Physical, Power, Body International, Oxygen, Penthouse, Fitness RX, Big, Corpo Sano, Knight Stick*, and many others, as well as being featured in SOF related publications such as *Special Operations Technology (SOTECH).*

Many of his articles and interviews can be found on many internet web sites such as: LEF.org, Testosterone.net, NavySeals.com, ThinkMuscle.com, MuscleMonthly.com, as well as many others, including his own site BrinkZone.com.

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