How We Finally Got the Active Ingredient Where It Belongs

Analysis by Dr. Joseph Mercola | July 15, 2026

STORY AT-A-GLANCE

- Targeted delivery technologies — lipid nanoparticles, liposomes, and microencapsulation — solve the absorption problem by protecting an active compound and carrying it across the barriers that would normally destroy it or block its absorption
- These are not fringe ideas. They are the same class of delivery science behind some of the most advanced medicines of the last decade, now applied to nutrition with striking results
- By formulating a compound at the nanoscale and wrapping it in a protective carrier, researchers can dramatically increase how much survives digestion and reaches the bloodstream
- Microencapsulation adds a second capability: a protective shell that shields a compound from stomach acid and releases it precisely where it is needed, such as the lower gut
- This technology is the headline of a new generation of supplements, and the reason a thoughtfully delivered product can outperform a conventional one many times over, without raising the dose

In the first article, I laid out the delivery problem in detail: most of what you swallow never reaches your cells, and the active ingredient is rarely the limiting factor — the delivery is. If that article was the diagnosis, this one is the treatment. Because the solution exists, it is well-validated in the scientific literature, and it changes what a supplement is capable of doing.

The breakthrough is a family of approaches that scientists call targeted delivery. Instead of dropping a raw compound into your digestive tract and hoping for the best, targeted delivery wraps that compound in a carrier engineered to survive the journey and release its cargo where it counts. If the old way was tossing a letter into a river and praying it floats to the right house, targeted delivery is hand-couriering it to the doorstep and getting a signature.

Let me walk you through how it actually works, because once you understand the mechanics, the marketing language on modern supplement labels stops being mysterious and starts being meaningful.

Lipid Nanoparticles — Borrowed from the Frontier of Medicine

You have very likely benefited from lipid nanoparticle technology already, perhaps without knowing it. It is the same broad class of delivery system that made several of the most important medicines of recent years possible. The fact that this technology has now matured enough to apply to everyday nutrition is, to me, one of the most exciting developments in the field.

A lipid nanoparticle is a microscopic sphere built from fat-like molecules that encloses an active compound inside it. Two things make this powerful. First, because the carrier is itself fat-soluble, it can ferry fat-loving compounds that would otherwise refuse to dissolve in the watery gut. Second, because the particle is vanishingly small, it slips across the intestinal barrier far more readily than a raw compound could on its own.

According to research compiled on PubMed, nanocarriers including liposomes, solid lipid nanoparticles, and related systems have been shown to improve the oral bioavailability of notoriously hard-to-absorb compounds in several ways at once: protecting them from degradation in the gut, increasing their effective solubility, and reducing the fraction lost to first-pass metabolism in the gut wall and liver. The compound arrives intact because it traveled first-class instead of swimming the river alone.

Liposomes — The Bubble That Protects Its Cargo

A liposome is a specific and well-studied form of this idea: a tiny bubble whose wall is made of the same kind of material that forms your own cell membranes. Because the liposome's outer shell is so similar to the membranes of your cells, it is both gentle on the body and remarkably good at merging with cells to deliver its contents.

Reviews of vesicular delivery systems in the scientific literature describe consistent improvements in the stability and bioavailability of difficult compounds when they are carried inside liposomes and related vesicles. Compounds that were previously dismissed as too poorly absorbed to be useful become viable when they are protected and delivered this way. The vesicle takes the hits of digestion so the cargo does not have to.

Microencapsulation — A Shield That Opens on Cue

The third major technology, microencapsulation, solves a slightly different problem. It surrounds an active compound in a protective shell that shields it from stomach acid and then releases it at the right point further along the digestive tract. Think of it as a bodyguard that absorbs every blow during the dangerous part of the journey, then steps aside to let the cargo out exactly where it is supposed to act.

This is especially important for compounds that are destroyed early in digestion, or that need to act in a specific location rather than being absorbed high in the gut. Without protection, only a tiny fraction of such a compound typically survives to reach its target. With an enteric coating or microencapsulation, a far greater share arrives intact and on target. The location of release becomes something you can engineer rather than leave to chance.

Why Particle Size Is the Whole Game

The thread connecting all of these technologies is size. When a compound is milled down or formulated at the nanoscale and protected by an appropriate carrier, several things change at once. Its surface area increases dramatically, which improves how readily it dissolves. Its ability to cross biological barriers improves. And its vulnerability to being lost in transit drops.

The same molecule that passed through you untouched in a conventional tablet can become highly absorbable when it is delivered at the right size, in the right carrier, released in the right place. Nothing about the molecule itself changed. Everything about its delivery did. That is the lever, and it is a far more powerful one than simply increasing the dose.

What the Transformation Actually Looks Like

It helps to make this concrete. Consider what happens to the kinds of compounds I described in the first article — the ones that perform so poorly in conventional form.

A fat-soluble plant compound that clumps and passes through largely unabsorbed in a standard capsule behaves completely differently when it is reduced to nanoscale particles and carried in a lipid vehicle. Now it disperses readily, slips across the gut wall, and arrives in circulation in a meaningful amount. The compound did not change. Its delivery did, and that changes its ability to produce real-world effects.

A compound that needs to act in the lower gut but is normally absorbed and lost high in the digestive tract behaves completely differently when it is microencapsulated. The protective shell carries it past the early absorption zone and releases it where it is supposed to work. A molecule that was effectively wasted becomes a molecule that does its job.

This is the recurring story across the delivery literature, and it is why I find the field so compelling. We are repeatedly discovering that compounds dismissed as "not very effective" were never given a fair chance. They were effective all along; they simply never arrived. Fix the arrival, and the effectiveness was waiting there the whole time.

Where This Technology Is Heading

The trajectory here matters. Delivery science is not standing still — it is advancing rapidly, much of it driven by decades of investment in pharmaceutical delivery that is now flowing into nutrition. The same precision that lets modern medicine target where and when a compound is released is increasingly available for the compounds nature already gave us.

What this means in practice is that the gap between conventional supplements and well-delivered ones is widening, not narrowing. The products built around delivery are getting better, while the products built around brute-force dosing are staying exactly where they have always been. For consumers willing to look past the milligram count, this is a genuinely exciting moment — the difference between the two approaches has never been larger.

In practice, the most sophisticated formulations combine these approaches. A compound might be reduced to nanoscale particle size for solubility, enclosed in a lipid carrier for transport across the gut wall, and given a protective coating so it is released in the right location. Each layer addresses a different leak in the pipe. Together, they can transform a compound's real-world performance. Here is how the old approach and the new approach compare, step by step:

Challenge	Conventional supplement	Targeted delivery
Poor solubility	Compound clumps, passes through	Nanoscale sizing dissolves readily
Stomach acid	Compound degraded early	Protective shell shields the cargo
Crossing the gut wall	Low permeability, little absorbed	Lipid carrier ferries it across

Challenge	Conventional supplement	Targeted delivery
Reaching a target site	Released too early, wrong place	Engineered release at the target
Real-world result	Fraction of label dose used	Far more of the dose reaches cells

Which Technology for Which Job

These approaches are not interchangeable, and the best formulators choose among them based on what a particular compound needs. Understanding the differences helps you read a label with a more informed eye.

Lipid nanoparticles and liposomes shine when the central problems are solubility and crossing the gut wall. For fat-loving compounds that refuse to dissolve and struggle to be absorbed, enclosing them in a lipid carrier addresses both problems at once. This is the right tool for many plant compounds and fat-soluble nutrients.

Microencapsulation shines when the central problems are survival and location targeting — when a compound is destroyed early in digestion, or needs to be released at a specific point further along the tract rather than absorbed immediately. The protective shell is what makes targeted release possible.

Nanoscale particle sizing is often combined with the others rather than used alone. Reducing particle size increases surface area and solubility, which improves the performance of nearly any delivery approach it is paired with.

In the most sophisticated products, these are layered together — nanoscale sizing for solubility, a lipid carrier for transport, and a protective coating for targeted release. Each layer plugs a different leak in the delivery pipe described in the first article.

How to Read an 'Advanced Delivery' Claim

Because these terms carry real meaning, they have also attracted marketing that uses them loosely. A few questions help separate substance from decoration:

- **Does the product name a specific technology, or just say 'enhanced'?** Vague language like "high potency" or "enhanced absorption" without a named mechanism tells you little. A specific named technology is a more meaningful signal.

- **Does the delivery match the compound's actual problem?** A protective coating matters most for a compound that needs to survive to a specific location. A lipid carrier matters most for a fat-soluble compound with poor solubility. The technology should fit the compound's specific weakness.

- **Is the delivery described in a way that makes mechanistic sense?** A credible product can explain, in plain terms, what its delivery system does and why. If the explanation is all adjectives and no mechanism, be skeptical.

- **Read for delivery, not just dose —** A product that tells you how the compound is protected and delivered is telling you something that can actually influence results. A product that only shouts a big number is leaving out the part that matters.

- **Understand that less can be more —** A smaller dose delivered well can outperform a massive dose delivered poorly. Do not assume the highest number on the shelf is the best product.

- **Match delivery to purpose —** If a compound needs to reach a specific place to work, the delivery system is not optional — it is the entire reason the product will or will not do anything.

This is the heart of what I have been calling 22nd Century supplements: products designed from the delivery system outward, so that what is printed on the label more closely matches what reaches your cells. We are not inventing new vitamins. We are taking the compounds nature already gave us and finally delivering them the way the body can actually use.

In the next article, I will show you the first place we chose to prove all of this — a molecule whose benefits are deeply documented but which conventional supplements almost entirely fail to deliver. The choice, once you see it, is obvious.

Ask Pax About Your Stack

Open your Pax app and ask: *"Based on my labs and goals, which nutrients should I be prioritizing — and for each one, what delivery format gives me the best absorption?"* Pax translates the science in this article into guidance built around your specific biology, not a generic recommendation. That is exactly what it was made to do.

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FAQ

Q: What is a lipid nanoparticle?

A: It is a microscopic sphere built from fat-like molecules that encloses an active compound. Because it is fat-soluble and extremely small, it can carry compounds that would not otherwise dissolve and help them cross the gut wall far more readily than they could alone. It is the same broad class of technology behind several advanced modern medicines.

Q: How is microencapsulation different from a liposome?

A: A liposome is mainly about transport — carrying a compound across barriers. Microencapsulation is mainly about protection and timing — shielding a compound from stomach acid and releasing it at a specific point in the digestive tract. Many compounds benefit from both.

Q: Is 'liposomal' on a label always meaningful?

A: The technology is real and well-supported, but the term can be used loosely in marketing. Look for products that explain what their delivery system does and why it fits the compound, rather than using the word as a label with no mechanism behind it.

Q: Does better delivery let me take a lower dose?

A: Often, yes. When far more of a compound reaches your cells, a smaller, well-delivered dose can outperform a much larger, poorly delivered one. The delivery system is effectively part of the dose.

Sources and References

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