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Other facts about the distribution of Carnosine were also intriguing. Researchers wondered why there’s such a wide range of tissue Carnosine levels across the animal kingdom – and why it is that longer-lived animals tend to have more Carnosine in their cells than do shorter-lived species,7 or that levels of Carnosine appear to decline with aging in humans (by 63% between the ages of 10 and 70).8

Based on their results, scientists “propose that carnosine is an important component of cellular maintenance mechanisms,” and “favor the view that it may have a very important role in controlling cellular homeostasis”12 – that is, in keeping cells in the tightly-regulated condition that optimizes their function.

Researchers have documented Carnosine’s “Striking effects on the cell morphology [shape and structure],” noting that “carnosine preserved a nonsenescent [youthful] morphology.”13 And adding Carnosine to the culture medium of aging cells doesn’t just slow down cellular aging, but makes the cells younger: “These cells showed a remarkable rejuvenation, with regard to their morphology and finally reached [ages] significantly greater than the control culture from which they were derived.”

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The fascination surrounding this nutrient began with a series of studies carried out at the Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia’s premier scientific research center,12-15 and later verified by independent researchers.16 Over the course of the last few years of the twentieth century, scientists painstakingly documented the unthinkable: that under culture conditions, carnosine can not only slow down, but actually reverse, cellular senescence – the process of “aging” at the cellular level.

The pages of the Annals of the New York Academy of Sciences are being written by unemployed supermarket tabloid reporters. “Carnosine, the protective, anti-aging peptide.”

“Use of carnosine as a natural anti-senescence drug for human beings.”10 “A possible new role for the anti-ageing peptide carnosine.”11 “Further evidence for the rejuvenating effects of the dipeptide L-carnosine on cultured human diploid fibroblasts.”12 And yet the recent scientific literature on Carnosine is positively soaked with this kind of language.

The AGE-Less Eye

A Breakthrough in Visual Health!

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Taking Out the Trash

But how Carnosine exerts these effects remains a mystery. In test-tube studies, Carnosine protects cells and biomolecules against a sweeping range of toxic insults.\textsuperscript{17} The one protective effect that’s probably received the most attention in the life extension community is its ability to protect proteins against glycation – the process through which sugars bind to proteins and warp their structure, turning functional proteins into dysfunctional Advanced Glycation Endproducts (AGEs).\textsuperscript{18} But this effect has only been shown to happen in test tubes; it’s not really clear that the same thing would happen in a living person, and in fact there’s good reason to believe that it won’t.\textsuperscript{19}

But it appears that Carnosine may attack the same problem from a different angle, by actually boosting the cell’s ability to clear out damaged proteins once they’ve formed. One of the problems with damaged proteins is that their mangled structures often don’t give easy access to the enzymes that normally digest worn-out cellular components, making it difficult for the cell to maintain and renew themselves. Experimental studies have found that Carnosine reacts with proteins which have already been damaged by glycation\textsuperscript{20,21} and other assaults on their structural/functional integrity,\textsuperscript{20,22} forming “carnosylated” complexes which appear to be more easily removed than the original, warped protein.

At the same time, other such studies suggest that Carnosine revs up the proteasome – the cell’s “recycling center” for malformed proteins.\textsuperscript{15} Instead of blocking the formation of AGEs, in other words, Carnosine might actually help the body to eliminate glycated and other dysfunctional proteins.\textsuperscript{20} (For more on the “anti-aging peptide,” see “Of Carnosine and Cocoon” in The Holistic Lifestyle 1(5)).

The results at the cellular level are enticing. The question that begs to be answered next is: how do these effects translate out on a larger scale – on the health of our tissues and organs – when you supplement with Carnosine?

Eyes Syruped Shut

As already mentioned, the buffering role of Carnosine in the muscles was long thought to be its only biological purpose. So researchers were surprised to find it in such high concentrations in the eyes.\textsuperscript{24} Misshapen proteins accumulate across the entire structure of the eye with “normal” aging, interfering with visual functioning. AGEs, in particular, play a major role in the universal age-related loss of eye structure and function, as well as in the more specific degenerative diseases of the aging eye, such as cataracts, glaucoma, and age-related macular degeneration (AMD).\textsuperscript{23} Granted its many protective roles, researchers began to wonder about the implications of Carnosine’s presence in the eye, how these effects might be exploited by the use of Carnosine as a topical supplement.

For example, glycation plays a role in the breakdown of the structure of the vitreous fluid – the Jell-O-like material that fills the eyeball (see Figure 3).\textsuperscript{24,25} This breakdown leads to the gradual shrinking and liquefaction (syneresis)
of the vitreous, so that by the time the average person is in his or her nineties, nearly half of the vitreous has degenerated into unstructured goo.

Syneresis ultimately leads to tiny “cave-ins,” in which the vitreous gel collapses away from the retina. These microcollapses often underlie “floaters” and light flashes, and they can ultimately cause the retina’s sensory and pigment layers to tear apart (retinal detachment), causing devastating damage to the vision. On top of that, new evidence has emerged to suggest that syneresis is also a contributor to the formation of nuclear cataracts.

So test-tube studies showing that Carnosine can prevent early glycation products from degrading the hyaluronan fluid of the vitreous gel, and animal studies showing that injected Carnosine protects the lens of the eye from toxic lipid peroxide products in the vitreous, reinforce the idea that a topical Carnosine supplement might provide a powerful defense against the deleterious processes that age our eyes.

But lots of exciting-looking things happen in test-tubes or under irrelevant dosing conditions that never pan out in living, breathing human beings. And too often, companies sell people supplements based nothing more than on this kind of limited, preliminary evidence — supplements that actually do nothing to promote your health, however much they may cushion the company’s bottom line. What we need to see is real proof that Carnosine is effective as a topical eye-health supplement: human studies (especially randomized, placebo-controlled trials) that document in the body the test-tube finding that Carnosine can protect against — and perhaps even actually undo — the damage to your eyes wrought by glycation and other protein-warping mechanisms of aging.

Those studies have been performed.

Flex that Lens!
The first human trials of topical Carnosine supplementation for eye health were performed in patients with presbyopia, by researchers at Harbin Medical University working in the late 1990s. Presbyopia — the creeping, age-related loss of flexibility in the lens of the eye that leads to difficulty in focusing the eyes on close-up objects — is a major cause of the deterioration of sight that accompanies aging. The loss of flexibility, in turn, is in large part the result of AGE cross-links in the crystallin proteins of the lens. So the test-tube and animal experiments showing that Carnosine can prevent — and perhaps even reverse — the accumulation of AGE and related damage to crystallin’s structure suggest that topical Carnosine supplements might restore lens flexibility, easing the strain on the ciliary muscles (which adjust the shape of the lens to focus on objects at different distances) and improving vision.

In an open study protocol, topical Carnosine supplements were used by patients in late middle age who had varying degrees of visual impairment, but no symptomatic cataracts. Their results were consistent with Carnosine’s ability to protect the proteins of the eye from AGE damage — and perhaps even to help the body to undo it. Over the course of two to six months, the scientists observed that the use of topical Carnosine supplementation “appears to alleviate eye tiredness and … obviously improve eyesight.” Users found that topical Carnosine “could brighten and relax their eyes.” The improvements were statistically significant.

AGES in the Cornea
Like the lens, the aging cornea (the transparent front portion of the eye — see Figure 3) also suffers structural damage with age. Much of this degeneration can be attributed to the warping of the corneal stroma — the collagen fibers whose specific structure and uniform layering is the foundation of the cornea’s transparency. At about the same time that the Harbin Medical University team was working with patients with “normal” eye aging, other researchers were reporting success using Carnosine eyedrops against a variety of disorders of the cornea.

In clinical studies involving 109 patients, these scientists found Carnosine to be effective in cases of primary and secondary corneal dystrophy, corneal erosions, trophic keratitis, and bullous keratopathy, as well as corneal...
ulcerations and other damage wrought on the cornea by viral and bacterial infections. The Russian government accordingly approved topical Carnosine supplementation for these uses as early as 1997.

"Set Phasers To Haze!"
People who have undergone laser surgery (both Photorefractive Keratectomy (PRK) and LASIK ("LAser in-Situ Keratomileusis")) are sometimes left with corneal haze – glare and haloes in their vision. Temporary corneal haze is normal in the early days after laser surgery, because the process actually removes the "skin" (epithelium) of the cornea, and the new epithelium which grows back over the site of the old corneal tissue is often temporarily opaque. But in some people, the damage is permanent.

Doctors usually try to reduce the risk of corneal haze in PRK by administering steroid drugs, whose anti-inflammatory effects cut down on the hazing of the new epithelium as it grows. But these drugs can cause problems of their own, including an increase in intraocular pressure (IOP – the fluid pressure that the vitreous exerts on the eyeball itself). Increased IOP can damage the eye and, in its extreme cases, cause nerve damage leading to glaucoma.

Because animal experiments have shown that Carnosine improves wound healing after experimental surgery, and because previous trials had established the beneficial effects of Carnosine eyedrops on corneal structure and function, a team of scientists with the Moscow Research Center decided to test topical Carnosine supplementation as a way to promote healthy regrowth of normal corneal epithelium after laser surgery, thereby reducing – or even preventing – corneal haze.

The Russian team first demonstrated that, when laboratory animals are treated with Carnosine eyedrops after experimental PRK, the corneal epithelium grows back more quickly and with less haze in than in eyes on which dummy eyedrops are applied. Encouraged by this preliminary success, the investigators initiated two human trials in patients who had undergone PRK or LASIK.

In the first trial, 21 people who had suffered corneal haze following PRK (27 eyes were affected) were given topical Carnosine three times a day for two months. Fully 57.9% of people using the Carnosine eyedrops experienced a reduction in corneal haze intensity, accompanied by an improvement in visual acuity; only 14% of users’ eyes continued to worsen. The positive results appeared in patients with low to moderate myopia, who had developed moderate haze (1 to 1.5 on a 3-point scale) within a month of surgery (there are no known treatments which are effective for late corneal haze of a higher grade than this).

In a second, larger, and more rigorous trial, patients who had just undergone PRK (41 patients (including 73 affected eyes)) or LASIK (34 people, 60 eyes) were given the same thrice-daily regimen of topical Carnosine as was used in the first trial, while corresponding control groups (41 PRK patients and 34 LASIK recipients) received Carnosine-free dummy eyedrops.

Because the regrowth of the corneal epithelium following laser surgery usually takes three to five days, it didn’t take long for the researchers to see that users of topical Carnosine supplements experienced better outcomes than nonusers. Compared with people applying the placebo solution, the healing of Carnosine eyedrop users’ corneal epithelia regrew nearly a day and a half earlier – a speeding of the regrowth process of roughly thirty to fifty percent! Even better, users of topical Carnosine supplements following LASIK were one-third less likely to suffer corneal haze than those using the unsupplemented eyedrops.

Clearing the Lens
Cataracts are the most well-established form of havoc known to be wrought by AGEs and other damaged proteins in the eye. The clarity of the lens depends on the precise molecular structure of the crystallin proteins of which it is made, and once these proteins have been twisted out of shape they can no longer transmit light. Over the course of decades of glycation and exposure to free radicals from ultraviolet light, crystallin becomes increasingly malformed, and its proteins begin to clump together into "aggregates," causing the lens to grow cloudy and dim. It’s no surprise, therefore, to learn that diabetes is a major risk factor for cataracts … or that aging itself is the greatest risk factor of all.

Could there be a role for Carnosine in protecting the structure and function of the aging lens? Research has long

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And as we’ve discussed, test-tube evidence suggests that Carnosine can not only prevent the disfigurement of the body’s proteins by glycation and free radicals, but may even facilitate the body’s removal of the wreckage, clearing the way for healthy, new growth.

In the most remarkable of these studies, researchers first glycated crystallin proteins in a test tube, causing it to form insoluble aggregates. At the molecular level, fluorescent polarization probes showed that the molecular conformation of the glycated crystallin proteins had been warped by AGEs and carbonyl groups. Just like real cataracts, the glycated crystallin proteins could no longer transmit light properly, scattering about four times as much light as unglycated crystallin and increasing the opacity by about 20%. Then, they dropped a dilute **carnosine solution** into the medium.

The results were exciting. **AGE-related fluorescence quickly dropped by about 15% after exposure to Carnosine solution**, restoring the natural mobility of the previously AGE-shackled protein chains. For comparison, the scientists tested chemicals which can affect the same test in a non-AGE-specific way at the same concentration, and found no effect. And the **functional impact was even more suggestive**: **Carnosine solution completely reversed the increase in light scattering, and reduced the increased opacity of crystallin almost completely to normal baseline levels!**

If those results panned out in the real world of the living body, the implications would be remarkable. It would mean that Carnosine was actually undoing the damage wrought over the decades by these deleterious biochemical processes — that the supplement could, in fact, **reverse aspects of the aging of this tissue.** In the case of the lens of the eye, it would mean that eyedrop-format Carnosine supplements would not only reduce a person’s risk of developing cataracts, but actually help the body to repair and remove damaged crystallin proteins, restoring clarity to the eye lenses of people with existing cataracts.

The potential of this approach created enough of a charge for some researchers to perform preliminary experiments using topical Carnosine supplements in animals with cataracts. When these studies showed that topical Carnosine could not only prevent model cataract formation, but actually clarify the animals’ existing cataracts, the excitement of discovery must have been electric. And when two human trials — one using Carnosine itself topically and another using a Carnosine metabolite as a deeper-penetrating delivery system for Carnosine — demonstrated the same astonishing result in humans, there must have been **jolts of juice arcing through the research centers.**

The first human trial (an open investigation) involved 96 senior citizens who had suffered with senile cataracts for periods ranging from as little as two years to as many as twenty-one. These individuals dropped topical Carnosine supplements into their eyes three or four times a day, for periods ranging from three to six months.

At the end of the study, the researchers found that Carnosine eyedrops lead to improvements in eyesight and lens transparency in the great majority of patients. They saw improvements in every single one of the people suffering with early-stage cataracts; and even in mature senile cataract, a remarkable 80% of the topical Carnosine users experienced a benefit. The investigators went on to expand on these preliminary results with the sequential treatment of nearly a thousand cataract patients — to similar success, and with no side-effects observed.

In an innovative move, a second trial used N-acetyl-L-Carnosine, a metabolite of Carnosine which the body slowly converts back into free Carnosine, instead
of Carnosine itself. (For the rationale for the use of this unique form of Carnosine, see the sidebar, A “Penetrating” In-Sight). In this randomized, double-blind, placebo-controlled study,4 scientists affiliated with the Helmholtz Research Institute of Eye Diseases first evaluated the baseline state of cataract victims’ eyes, testing their visual acuity and glare, as well as evaluating the lenses themselves using sophisticated imaging systems which allow for digital analysis of light-scattering and -absorbing centers. The trial included people with cortical, nuclear, posterior subcapsular, or combined cataract types.

The scientists then randomly handed out either topical N-Acetyl-L-Carnosine supplements (as a 1% solution) or an identical-looking placebo solution with no N-Acetyl-L-Carnosine, without anyone knowing who was getting which kind of eyedrop. Twenty-six people (with 41 cataract-afflicted eyes) used the genuine article, while thirteen individuals (21 eyes) received the bogus eyedrops. People in each group applied two drops of solution to their affected eyes twice a day, while a third group of cataract patients (10 patients, 14 eyes) received no eye drops at all. For six months, everyone came back to the research center every alternate month to have their eyes re-evaluated; as well, a subgroup of the original patients joined a second trial which extended the original study to a total of two years, with checkups every six months.4

After just six months, the differences between the two groups were striking. Ninety percent of the eyes of people supplementing with N-Acetyl-L-Carnosine eyedrops saw their visual acuity improve, with the strength of the effect ranging from a modest gain to a full 100% recovery.4 In the same period, only 5.7 percent of the eyes of people using the stand-in eyedrops were judged to have improved visual acuity – and over a third (34.7%) suffered a worsening of acuity, while most (60%) simply retained the same impaired vision with which they had begun the study.

What’s more, the two-year extension showed that N-Acetyl-L-Carnosine eyedrop users maintain their improved vision, while the eyesight of those not receiving the supplement continues to deteriorate. By the end of the study, 87% of the eyes supplemented with topical N-Acetyl-L-Carnosine were still better than they had been before starting use of the eyedrops, and none were worse off than they’d been at the beginning; by contrast, a depressing 89.5% of the eyes of nonusers had lost acuity.4

On top of the gains in visual acuity, researchers observed that N-Acetyl-L-Carnosine topical supplementation also clearly improves glare sensitivity, with 88.9% of N-Acetyl-L-Carnosine eyedrop users’ eyes seeing improvements ranging from 27 to 100% after just six months; again, the divide separating supplementers from nonsupplementers was unequivocal, with over half (56.3%) of nonusers’ eyes deteriorating and none getting any better.4 The glare sensitivity tests were not repeated at the two-year mark.

The scientists were also able to directly evaluate the power of topical N-Acetyl-L-Carnosine supplementation on the actual opacification (clouding) of the lens, thanks to new medical imaging techniques. At the end of the full two-year trial, the image analyses showed that 47.8% of N-Acetyl-L-Carnosine topical supplement users’ lenses were clearer than they had been at the beginning of the trial – and none had worsened. As you might expect, people whose eyedrops did not contain N-Acetyl-L-Carnosine suffered a dark mirror opposite of these sunny results: none of their eyes showed improvements on the image analysis, and a predictable 47.4% of the lenses continued the hazy slide into blindness.4

The results of these trials can only be described as revolutionary. For the first time, simple eyedrop treatments were proved to improve the vision of cataract victims, and to actually reverse the clouding of the lens. And the treatment was not a drug, but an orthomolecule: a substance naturally present in the body and essential to its health. And this is on top of the results observed in presbyopia, corneal disorders, and people whose vision has been damaged by laser surgery gone wrong.

With Carnosine’s wide-ranging powers, and N-Acetyl-L-Carnosine’s ability to bring those benefits to a wider range of eye tissues, what else might we expect from this remarkable new topical supplement?
A “Penetrating” In-Sight

You might be wondering why, after so many successful human and animal studies of topical supplementation using plain Carnosine for eye health, the Helmholtz Eye Clinic team would instead use the Carnosine metabolite N-Acetyl-L-Carnosine in their studies.

These researchers’ animal studies had shown the potential of Carnosine injections as a treatment for cataracts. And some of these results they using injected Carnosine appeared to be the result of protecting the lens of the eye against lipid peroxides present in the aqueous humor of the eye – the clear fluid between the cornea and the lens (see Figure 3).

But research performed by this same group and others revealed that conventional Carnosine eyedrops do not result in the accumulation of free Carnosine in the aqueous humor. The most likely culprit in the case of the missing Carnosine is an enzyme in the body called carnosinase, which breaks Carnosine down into its constituent amino acids (beta-alanine and histidine).

(This carnosine-degrading action is also the reason why you need to take high doses of Carnosine (a gram or more, in human-equivalent terms) if you want to effectively increase tissue levels of Carnosine using an oral supplement, and why such high doses are necessary to elicit Carnosine’s many protective benefits in living organisms).

In order to get the full range of benefits of Carnosine in the eye, these researchers wanted to find a way to increase free Carnosine levels in the aqueous, without the necessity of injection. To overcome the carnosinase problem, the Russian team looked to N-Acetyl-L-Carnosine, a natural metabolite of Carnosine.

N-Acetyl-L-Carnosine is one member of a family of Carnosine-related biomolecules found in the body. These compounds are concentrated in many of the same tissues as Carnosine: the brain contains roughly equal proportions of Carnosine and N-Acetyl-L-Carnosine, and there’s actually more N-Acetyl-L-Carnosine in muscle tissue than there is Carnosine itself.

But N-Acetyl-L-Carnosine is resistant to the degrading influence of carnosinase. So these investigators theorized that topical N-Acetyl-L-Carnosine might penetrate, intact, into the aqueous humor. Once there, N-Acetyl-L-Carnosine would then be slowly converted into Carnosine, thanks to enzymes in the body (N-acetylesterase and N-acetyltransferase) that interconvert these two forms of Carnosine as part of their normal biological function. The liberated Carnosine would then be free to work its magic from within the aqueous humor.

To cut a long story short, they tried it, and it worked. After applying N-Acetyl-L-Carnosine as a 1% solution to the eyes of the rabbits, Carnosine began to appear in the animals’ aqueous humors within fifteen to thirty minutes, boosting Carnosine concentrations to 162% of their baseline levels. These concentrations were similar to the ones which test-tube studies suggested would achieve the specific effect that they were after – namely, the protection of the lens from lipid peroxides.

Does any of this really matter? That depends on how you look at it. The Russian researchers were looking to achieve a specific effect for a specific reason – to concentrate Carnosine into the aqueous humor, because of their theory about the importance of delivering Carnosine to this part of the eye to get its anti-cataract benefits. As other human studies show, “regular” Carnosine achieves the same goal without penetrating into the aqueous, suggesting that this specific effect may not be a necessary – or even important – part of Carnosine’s cataract-fighting powers.

But the finding that topical N-Acetyl-L-Carnosine supplementation can increase Carnosine concentration in parts of the eye where regular Carnosine can’t reach has broader implications. Because in addition to cataract patients, Carnosine eyedrops are also of interest as a supplement for people with healthy eyes, who would like to use topical Carnosine to support that eye health. For such people, this research shows that N-Acetyl-L-Carnosine is the preferred topical supplement for total eye health, because it can boost Carnosine levels in places where topical supplements using Carnosine itself would be ineffective. Topical N-Acetyl-L-Carnosine extends Carnosine’s benefits to regions of the eye which are inaccessible through conventional Carnosine.
Resisting the Pressure
A prominent example of a potential – but as-yet unproven – place for Carnosine in eye health is in glaucoma. Glaucoma is a major cause of vision loss, which results from damage to the nerve cells of the innermost layer of the retina (the retinal ganglion cells – see Figure 3). These neurons are located at the back of the eyeball to the brain, and come together to form the optic nerve; the spot where they come together to pass through the white outer coat of the eyeball called the optic disk, and the surrounding junction with the white of the eye is termed the lamina cribrosa (Figure 3 again).

What, then, is the potential role of Carnosine? The nerve damage that underlies glaucoma is the result of excessive stress placed on the optic nerve by the fluid pressure inside the eyeball (intraocular pressure, or IOP); yet in about a third of people with glaucoma, the pressure in the eye is within the “normal” range. That’s because vulnerability to glaucoma is also affected by factors other than IOP, such as age-related changes to the optic disk and the retinal ganglion cells. AGE damage to the retinal ganglion cells themselves – or to supporting structures such as the lamina cribrosa, which accumulate AGE proportionately to a person’s biological age – may be one such key factor. In the diabetic animal model, the atrophy of the optic nerve can be prevented by inhibiting AGE formation.

There’s also evidence that Carnosine may help to support more normal, healthy IOP. Carnosine is a member of a group of compounds that run the molecular water pumps in at least some eye tissues, a function critical to these cells’ viability. When Carnosine is injected into the eyes of rabbits, IOP falls; the use of N-Acetyl-L-Carnosine instead of regular Carnosine may again play a key role in ensuring that Carnosine gets where it has to go in order to exert this beneficial effect.

The Rest of Us
The results of the many human trials documenting the benefits of using topical Carnosine (and especially N-Acetyl-L-Carnosine) supplements for eye health are exciting – and they’re probably just the tip of the iceberg. These studies appear to constitute proof-of-concept for the wider thesis that the use of topical Carnosine and Carnosine precursors can allow the body to remove dysfunctional proteins from the eye, facilitating the replacement of misshapen old proteins with fresh new ones and the rejuvenation of the tissue.

An Important Note About N-Acetyl-L-Carnosine Topical Formulations
In all of the clinical trials, N-Acetyl-L-Carnosine has been used by itself, with no added antioxidants or other ingredients other than formualnts. The results of the many human trials documenting the benefits of using topical Carnosine (and especially N-Acetyl-L-Carnosine) supplements for eye health are exciting – and they’re probably just the tip of the iceberg. These studies appear to constitute proof-of-concept for the wider thesis that the use of topical Carnosine and Carnosine precursors can allow the body to remove dysfunctional proteins from the eye, facilitating the replacement of misshapen old proteins with fresh new ones and the rejuvenation of the tissue.

To date, clinical trials have demonstrated the ability of Carnosine – and especially the unique Carnosine metabolite N-Acetyl-L-Carnosine, a biological “delivery system” for Carnosine – to treat eyes damaged by a wide variety of specific disorders, from cataracts to corneal dystrophy, from improperly-healed corneal epithelia to presbyopia. But they bear an important implication for the rest of us. These studies clearly point to the potential of Carnosine/N-Acetyl-L-Carnosine eyedrops to support the maintenance of normal, healthy eye structure and function in people whose eyes are just fine – and whose owners want to keep them that way.

The Grand Vision
The DNA code lies coiled like the Serpent of Knowledge in the heart of your cells, untwisting to reveal its mysteries to the biological engines which build you up from its template. In a very real sense, you are the proteins that these enzymes make. And we age, in large part, because of the forces that degrade the integrity of these same proteins – and of the lipids and nucleic acids that many of these proteins exist to create.
The body is equipped with mechanisms that strive to keep this stochastic chemistry at bay, repairing damage and sopping up toxic molecules. But the repair is always imperfect, and the defenses limited. Slowly but surely, chemistry triumphs over biology.

Carnosine promises to intervene in this cycle in a fundamentally new way, making it easier for the body to rid itself of the cellular garbage that clogs our cells and creates structural deviations from the archetypal pattern laid out in the Code of Life. With Carnosine eyedrops, this potential may be delivered directly to the ocular proteins that need it; and with N-Acetyl-L-Carnosine, the power of Carnosine can be smuggled into the hidden recesses that Carnosine itself cannot reach.

The day is coming when radical new life extension technologies will undo the ravages of the aging process, creating an endless summer for the young and allowing the aged to slough off the ravaged husks of the years. As we’ve seen, topical Carnosine supplements may be the first, dawning glimpse of the regenerative medicine of tomorrow — and its users, the first to open their eyes to a new human potential.

The Bottom Line

- Research suggests that Carnosine may not only slow down, but actually reverse, some kinds of biomolecular damage. It may undo the clumping together of damaged proteins, increase the activity of cellular “garbage collectors,” and make it easier for those “garbage collectors” to pick them up.

- Many vision problems are closely related to the accumulation of these damaged proteins. Therefore, it was suggested that topical Carnosine eyedrops might be helpful.

- N-acetyl-L-Carnosine, a metabolite of Carnosine which the body slowly converts back into free Carnosine, acts as a biological “delivery system” for Carnosine, allowing for slower, more thorough delivery of free Carnosine into the eye’s tissues and access to areas of the eye where Carnosine itself cannot penetrate. Therefore, research suggests that N-acetyl-L-Carnosine is the superior form of Carnosine for use in topical supplements.

- Clinical trials have borne this out. Studies have found topical Carnosine and/or N-acetyl-L-Carnosine to be helpful in eye structure and function in people with age-associated visual impairment, primary and secondary corneal dystrophy, corneal erosions, trichic keratitis, bullous keratopathy, and above all cataracts. Other studies have reported more rapid and complete healing after laser eye surgery in people using Carnosine eyedrops.

- Because malformed proteins are implicated in nearly every aspect of age-related visual decline, these studies clearly point to the potential of Carnosine/N-Acetyl-L-Carnosine eye drops to support the maintenance of normal, healthy eye structure and function in people whose eyes are just fine — and whose owners want to keep them that way.

- In all of the clinical trials with N-Acetyl-L-Carnosine, the supplement has been used by itself, with no added antioxidants or other ingredients in the eyedrops other than the trace levels of formualnts such as buffering agents required to make a viable N-Acetyl-L-Carnosine ophthalmic solution. The metabolism of N-Acetyl-L-Carnosine into Carnosine depends on enzymes in the body which accomplish this transformation as part of their normal biological function. The activity of these enzymes can be significantly changed by the presence of antioxidants other than N-Acetyl-L-Carnosine in the area.

- Therefore, although you can feel free to continue to take any oral antioxidant supplements while you use N-Acetyl-L-Carnosine eyedrops, mixing antioxidants (such as vitamin A or alpha-tocopherol) into the eyedrops themselves is asking for trouble. Ensure that any topical N-Acetyl-L-Carnosine supplement you use is free of extraneous antioxidants.
References


