PhosphatidylSerine or PS (pronounced fos-fa-tie-dil-see-reen) is a biological substance that occurs naturally throughout the human body. PS has a unique molecular structure that makes it a building block for all the cells of the body. When added to the daily diet as a supplemental nutrient concentrate, PS can have great benefits for the human brain.

The PS (PhosphatidylSerine) molecule

- PS occurs naturally in all cells, and this may explain how it can be an extremely safe dietary supplement.
- PS is found mostly in the brain, and clinical trials show that supplementing the diet with PS improves a variety of brain functions.
- PS is lacking in the typical daily diet, and takes a lot of energy for the body to synthesize, making dietary supplementation a convenient and effective option.
Chemically PS is a phospholipid, one of a unique group of substances that play many lifesaving roles in the body. PS and other phospholipids serve as cell membrane building blocks, lipoprotein building blocks, surface-active agents, emulsifiers, and as protein function regulators. The phospholipids (PL) are so essential to life that they have been called vital lipids.2

Technically, PS is not a vitamin because the body can make it from simpler substances (using processes of “bio-synthesis”). However, the energy it costs the body to “bio-synthesize” PS is quite high, making it more energy-effective to obtain PS as a nutrient from foods. The intake of PS from foods is quite low.

Plant foods supply very little PS, and animal foods (other than brain, not a common food) have only modest amounts, so that the total dietary intake of PS is in the range of 75–100 milligrams (mg) per day. This may explain why people can experience benefit from supplemental intakes of 100–300 mg per day. This amounts to a doubling of the daily intake of PS, at a minimum.

PS is more concentrated in the brain than in any other tissue of the body. The findings from controlled clinical trials suggest that when the dietary intake of PS is doubled or better still, quadrupled, through taking it as a dietary supplement, a majority of individuals derive measurable brain benefits. The modest supply of PS coming from the modern diet simply may not be adequate to support optimal brain function.

The PS molecule is involved in many aspects of human biochemistry. PS was first isolated for chemical examination in 1948, by Folch, and this breakthrough spurred research into its many life functions.3 There are now thousands of research studies available on PS.4

Starting around the mid-1980s, through research trials with human volunteers, it quickly became evident that PS as a dietary supplement had highly positive benefits for a variety of higher brain functions. Among the functions benefited by PS were memory, learning, comprehension, word recall—all individual features of the brain performance spectrum called cognition. At this point PS has been investigated in a larger number of clinical trials and other controlled human studies than most pharmaceuticals have had.

Along with its measurable improvements to cognition, mood, anxiety, and coping with stress, PS improves many technical measures of brain activity. Take EEG, (ElectroEncephaloGraphy) for
instance. From EEG studies it was found that PS can partially correct abnormal brain electrical activity, as sometimes seen in Parkinson’s disease patients and in epileptics. These “normalizing” changes under the influence of PS would sometimes improve the patient’s quality of life.

Then there were more modern results from brain imaging. Sophisticated imaging PET (Positron Emission Tomography) has established that PS can boost energy production throughout the brain. The brain is so dependent on energy production that any means of improving its capacity to make energy offers promise for far-reaching improvements in function.

At the biochemical level, PS is found to improve numerous nerve transmitter systems in the human brain. PS is required for the packaging, release, and receptor actions of acetylcholine, serotonin, dopamine, epinephrine, norepinephrine, GABA, and other transmitters. Rather than simply raising transmitter levels in the brain tissue, PS improves their effectiveness fundamentally at the cell membrane level.

Acting through many different pathways, PS is clinically proven to benefit a diverse array of the subjects who took part in the many clinical trials.

**The Clinically Proven Benefits of PS**

PS as a brain nutrient is doubly positive, being highly efficacious AND having zero bad side effects. This sets PS apart from pharmaceuticals. After more than twenty years of extensive, controlled testing with human volunteers, with lab animals, and in other experimental systems, PS is confirmed to have a near-ideal “benefit-risk profile.” This profile for PS is exceptional, not just against pharmaceuticals but also when compared to other nutrients.

The randomized, controlled, double blind clinical trial is the “gold standard” for medical assessment of a drug, nutrient, or medical device. Though the double blind trial has its limits, it is the most objective way to test whether an agent truly has human benefits. The meaning of double blind is that neither the researchers nor the human subjects knew which subjects were getting the most active treatment and which were not.

PS has been subjected to at least 21 double blind clinical trials. The consensus from these trials is that PS benefits practically all of the brain’s higher functions. The clinical data accumulated from
PS (PhosphatidylSerine)

over twenty years' research substantiates that PS has the following clinical benefits:

- PS improves memory, learning and other cognitive functions in people who are substantially impaired compared to others in their age group.
- PS can improve activities of daily living (ADL) and other quality of life, for people who suffer more severe memory loss.
- PS can improve negative mood (depression) and ease anxiety in young people as well as the elderly.
- PS can help individuals cope with stress, both physical and emotional.
- PS has the potential to help children with attention and behavior problems.
- PS as a dietary supplement is very well tolerated, with virtually no adverse effects.

PS is so well proven that even the skeptical Food and Drug Administration of the United States has allowed it to have two "qualified health claims" (see the box below).

**FDA—APPROVED HEALTH CLAIMS FOR PS**

(Exact text as required by the FDA)

"Phosphatidylserine (PS) may reduce the risk of cognitive dysfunction in the elderly. Very limited and preliminary scientific research suggests that PS may reduce the risk of cognitive dysfunction in the elderly. FDA concludes that there is little scientific evidence supporting this claim."

"Phosphatidylserine (PS) may reduce the risk of dementia in the elderly. Very limited and preliminary scientific research suggests that PS may reduce the risk of dementia in the elderly. FDA concludes that there is little scientific evidence supporting this claim."

The overly cautious language for these claims, which FDA mandates can only be stated word for word, is at best a grudging concession to the extensive clinical research done with PS. Considering this agency's legendary toughness against dietary supplements, FDA's willingness to go this far with PS suggests that they must be sure it is safe to take; also, that they are unable to deny PS can improve human brain function.
PS, Vital Lipid and Premier Brain Nutrient

A Safe and Effective Orthomolecular Supplement
Its near-ideal benefit-risk profile sets PS apart from the drugs approved for treating memory decline and from the many herbal extracts often touted as brain panaceas. Without doubt, its decades-old track record of exceptional safety is attributable to PS being an orthomolecule.

The term orthomolecule stands for molecule orthodox (familiar) to the body, as first defined in 1968 by the legendary two-time Nobel Laureate Linus Pauling. An orthomolecule is naturally and routinely part and parcel of the body’s normal biochemistry.

The brilliant Professor Pauling had the vision that orthomolecules should be safe to take as dietary supplements precisely because they are biochemically familiar to the body. He also reasoned that their biochemical intimacy with human cells should give orthomolecules a metabolic advantage over substances that are not naturally a part of the body’s biochemistry. Now, almost four decades after Pauling developed this hypothesis, his reasoning is vindicated: orthomolecules have proven safer and more effective than herbal extracts and other non-orthomolecules.

PS is an orthomolecule for all life forms, all the way back to the most primitive single cells that already existed more than three billion years ago. This position of PS is so different from the pharmaceuticals, almost all of which are chemicals foreign to the body and toxic to our tissues in varying degrees. Its superiority as an extensively tested orthomolecule makes PS a premier brain nutrient, a vital lipid for nerve cells.

A Vital Lipid for Nerve Cells
Biochemically, PS is a phospholipid (fos-fo-lip-id). These lipid substances are distantly related to fatty lipids (triglycerides), which we know as fats. But in their function and their chemical structure, the phospholipids are very different lipids from fats.

The fat triglycerides are merely storage forms of lipid, the very material that we observe accumulating in our fat pads. The phospholipids are anything but storage fats: they are the main molecular building blocks for cell membranes, the dynamic structures upon which our cells rely for their functions. The phospholipids feed life dynamics at the cell level.

The phospholipids are used also to package up fats and transport them to the tissues. Phospholipids help the body to mobilize and
PS (PhosphatidylSerine) utilize fats. The liver also uses phospholipids to make the bile fluid that aids in the digestion of our foods. All these are reasons why PS (and the other phospholipids) are appropriately called vital lipids.

Top: A schematic of a generalized animal cell showing the various membrane compartments that delineate organelles. Bottom: A stretch of cell membranes, showing proteins and other large molecules immersed in the matrix of phospholipids.
Cells are the most fundamental units of life. Our bodies are made up of trillions of cells. All cells have elaborate membrane systems, and from life's beginning PS and the other phospholipids were building blocks for the cells' membrane systems.

Cell membranes are continuous, unending sheets of biological molecules. They have a universal basic organization—a double layer of phospholipid molecules into which are inserted a small number of cholesterol and antioxidant molecules and catalytic proteins embedded in the phospholipid bilayer. This apparent simple organization of cell membranes actually is a functionally versatile, biochemically sophisticated, supra-molecular system responsible for the life essence of the cell. And the molecular organization of PS makes it very well suited as a unit building block for cell membranes.

All cells have PS in their membranes. Some have more PS than others, depending on their specialized functions. Nerve cells carry the most PS. They need ample PS in their membranes in order to generate electrical impulses and pass these impulses on to other cells. This is the essence of brain activity. Perhaps more than any other known biological molecule, PS in our nerve cells endows us with sophisticated brain power.

PS is also used in the body to facilitate other essential functions. PS is an essential player in the ongoing disposal of dead or dying cells.
PS (PhosphatidylSerine)

A healthy cell carries PS in the inner half of the outer cell membrane, with just about no PS in the outer half that faces the outer environment. Keeping PS in this membrane compartment requires constant expenditure of energy. A cell, as it becomes unhealthy, reaches a point where it can no longer muster sufficient energy to maintain this strict control over its membrane PS. The PS molecules then proceed to "flip" from the inside of the cell membrane to its outer face. As PS appears facing the outer environment, it serves as a kind of "flag" to alert roving immune cells that the cell is no longer healthy. This is the normal, routine means by which dead and dying cells are disposed of in the body.

PS also serves throughout the body as an essential component of the normal clotting processes that help stem blood loss following injury. It is also known to be involved in the "secretion" (release) of tiny membrane-bounded spherules ("vesicles") that bone cells secrete to make new bone. Secretion of many chemical transmitters and of many hormones occurs via similar mechanisms involving PS. In these many ways, the PS of our cell membranes helps us make the most efficient use of our life energy. Adequate availability of PS helps all our cells, tissues, and organs remain efficient, self-renewing, resistant to attack... able to stay healthy with the passing of time.

**PS and Total Health Management™ Build Brain Power**

The availability of PS as a safe, effective, and affordable brain nutrient comes just in time for a lot of people. Western society is in the grip of an epidemic of severe memory loss. At least two of every five people who reach 55 years of age have memory loss serious enough to be holding them back in their daily lives.11,12 Anything that can be done to improve these cognitively challenged individuals would alleviate a great deal of anguish, not just for them but also for their families and communities. A further commitment to total health management would multiply their chances for breaking loose from this mental burden.

Taking PS is an excellent means toward long-term recovery of cognitive function (this doesn't usually happen overnight). Being so safe to take, PS can be used daily over a long period. It seems to have a regenerative type of effect, whatever the age of the individual. But PS cannot accomplish brain regeneration if nerve cells and circuits are being lost at too fast a rate. The rate of loss has to be slowed, and this is where daily practice of Total Health Management™ is the only
real option—at least for the person who really wants to succeed.

In these modern times, with their harsh mental, physical, and chemical stress on the human body, implementing a lifestyle of Total Health Management (THM) is a means for the embattled individual to do as much as s/he can to hold off mental decline. THM offers the best means for us to maintain our brain power against the ravages of modern living. This is also good for the whole body; as the brain thrives, so also can the mind and spirit. As these thrive, so does the person as a whole.

Total Health Management is a self-help strategy for the personal pursuit of optimal health. THM, by definition, takes into account all the factors that can positively or negatively impact our health. THM works best when the individual makes a total commitment to lifelong health. Over the past decade this author and others have published on every facet of THM in the pages of totalhealth magazine. Subsequent chapters will go deeper into the usefulness of PS for Total Health Management.

In the chapters that follow, the abundant scientific evidence on PS is reviewed and explained. It is my hope that this information will make PS more understandable and accessible for all who can benefit from it. That means all of us.
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