Phosphatidylcholine is a wunderbar nutrient – yet, it remains an enigma. At 6 syllables it’s a bit of a tongue twister, easier to say PC. In Europe, it’s even longer, Polyenylphosphatidylcholine, 10 syllables, which abbreviates to PPC. Both mean exactly the same. Both refer to the same wonder nutrient. While most all supplements such as anti-oxidants, B- vitamins, minerals, pro-biotics, CoQ-10, electrolytes, digestive enzymes, etc., have excellent nutritional value and contribute to better health, few rank on a level with PC – in fact – none do.

So – why is it that PC is still a relatively modest player in the world of nutrients and natural medicine, while the research literature on PC is awash with positive studies? Why, in the normal evolutionary process of recognition, has PC failed to obtain its rightful role? There’s a story underlying that needs to be told. Somehow, a glitch on this side of the Atlantic essentially sabotaged its climb up the ladder. About the mid 90’s, our illustrious North American edible oil producers made a decision which muddied the waters and threw a wrench into our wonder nutrient, however, that decision was a profitable one, for them. The history begins with the pressing of the oil from the seeds, such as sunflower, canola, corn, flax, etc., but mainly soybeans, the largest seed oil produced in the world. After pressing, hydrating and harvesting the oil and the seed protein, one of the products left over is a gummy substance called lecithin, found in all cells.

That sticky substance became an important ingredient in foods such as spreads, margarines, chocolates, cosmetics, etc. Nutritionally, it contained PC, so there was also an effort to introduce it as a supplement. The concentrated lecithin was combined with oil, encapsulated in bulk and sold to the vitamin companies who repacked it under their own label. Somehow, in the ensuing effort, someone in charge had the bright idea to call it – Phosphatidylcholine, instead of Lecithin, which is what it really was. The ruling established was this: if the PC content in the lecithin was at least 30% – it could be called Phosphatidylcholine. That turned out to be the ultimate monkey wrench for our wonder nutrient. Soybean lecithin is a complex mix containing ~65-75% phospholipids together with triglycerides and smaller amounts of sterols and carbohydrates. The major phospholipid is phosphatidylcholine, including phosphatidylethanolamine and inositol-containing phosphatides. That singular decision, to name lecithin PC, was clearly a gross biochemical error. It’s just not done in the realms of science because it’s not scientifically accurate. The confusion that followed has been with us to this day with products being marketed and sold as PC regardless of the fact that they are not PC.

Even though it is a component in the lecithin mix, PC and its membrane partner phospholipids, P-ethanolamine, P-inositol, and Phosphatidic Acid, because of digestion, cannot make it through the gut intact. The lipase enzymes in the gut disassemble all oils which include phospholipids and triglycerides. Gut enzymes, such as proteases and amylases digest proteins and carbohydrates in the same manner as lipases do to the oils, they cut them apart. Only the basic components are allowed through, not the whole PC molecule.

To obtain PC along with the other PLs, which every cell membrane needs, those parts must be created from scratch or reconstituted from the digested components, which young and healthy cells can easily do. For aging or diseased cells, it’s another story. For PC, and the other PLs in lecithin to become valuable nutrients, they must first be separated from the raw lecithin, an expensive complex process, which only a small group of nutrition companies have succeeded in doing. Once separated, PC and its associate phospholipids become miscible in water – repeat – they dissolve in water, enabling them to make the trip through the gut – intact. Only then can PC perform its membrane enhancing wonders as we will see in the following Israeli studies.

Presently, as far as we know, the only companies that have succeeded to separate the phosphatides from lecithin are
BodyBio, American Lecithin, and Essentiale Forte®, sold in pharmacies in Europe. All other vitamin companies continue to market the misnamed capsules under their own label, which, will not succeed in providing any PC, and which recently, has been shown to be a possible cause of atherosclerosis (Wang 2011). Imagine – how many people have heard about the wonder nutrient PC, searched on Google, and bought the misnamed lecithin capsules in shops, or on line? How many of those funny capsules with zero value have been consumed worldwide in over a half a century as a result of that labeling loophole? And it’s still going on, unfortunately, to the detriment of all those who, as yet, don’t know the difference. Talk about selling snake oil…

So, why is PC such a wonder nutrient and why is it important in maintaining health and longevity? Are we destined to succumb to illness as we age and lose PC? Our cell membranes naturally contain PC and SM (sphingomyelin), both are phospholipids and both have a choline head group. However, there is a shift that occurs in the composition of the membrane with the growth of SM and a fall in PC levels. SM is a combination of ceramide and PC, wherein ceramide combines with PC and absconds with PC’s choline head, enabling the formation of SM. The relationship between those two choline phospholipids in mammalian plasma membranes is critical and directly affects cell function. This was demonstrated most clearly by Professor Yechezkel Barenholz and his colleagues in 1985.

In a dramatic study, Dr. Barenholz, head of biochemistry at Hebrew University in Jerusalem, reported on the changes of PC and SM in the lipid composition of rat myocytes (heart cells). They were able to extract rat hearts and separate the myocytes, the heart cells, and keep the cells alive in Petri dishes in their lab with a nourishing culture. After a day or two, by themselves, the myocytes would congregate together and begin to beat in unison. They did what heart cells are designed to do. They beat – and they did it at ~160 beats/minute. The scientists measured the beats as well as the PC and SM content in the cells and watched the decline of the PC/SM ratio in the first three days from 20% SM to ~33% SM -- then, over the next 14 days, from 33% to about 50% SM. What occurred in the culture was a steady loss of PC, replaced by Sphingomyelin, from 20% to 50% in 14 days, accompanied by a steady decrease in heart beats. Between days 7 and 12 in culture, the beats/minute fell from a vibrant 160, down to a near lifeless 20 beats/minute. On day 16, they added PC into their Petri dishes, and in one day, the myocytes reverted back to their healthy rate of 160 beats per/minute. In just 24 hours, they went from near death back to vibrant heart cells. This was also accompanied by a normalization of seven vital enzymes (Yechiel 1985a, 1985b).

Simply changing their diet by adding PC into their cultures, reversed the rise in SM and brought life back to the near dead myocytes, a dramatic example of the wonders of PC. However, Professor Barenholz delved even deeper. In 1989, he was awarded a US patent #4,812,314, on the use of PC for increasing male longevity and fertility. Dr. Barenholz, a recognized world leader in lipid technology, together with colleagues, focused on the changes that occur with cell aging, principally on the loss of PC as with the myocyte example, which showed a rise in the levels of SM, and a concomitant rise in cholesterol (CH) (Barenholz 1982, 1984). The scenario of lowered PC and raised SM is especially pronounced in senescent or diseased tissues. For example, plasma membranes associated with the aorta and arterial wall show a 6-fold decrease in PC/SM ratio with aging. SM is also increased in several diseases, such as the hereditary Niemann-Pick Disease, and in toxic exposures. In atherosclerosis, the leading cause of death and morbidity worldwide, the SM content can be as high as 70-80% of the total phospholipids in advanced aortic lesion (Barenholz 1982, 1984). To put this in context, Kummerow et al, University of Illinois, Urbana, analyzed the SM content in umbilical cord, and discovered that it was ~10% (Kummerow 2001). In essence, we start life with ~10% SM and 90% PC, and thereafter SM increases, and as recorded, with disturbing cellular outcomes. Kummerow further has shown that arteriole obstructions are directly related to the change of PC and SM...
reaching above 45-48% SM, resulting in a rise of arteriole sclerosis and death, similar to the findings of Barenholz fifteen years prior. Type in ‘sphingomyelin atherosclerosis’ on Medline, and you will get 228 studies from around the world, corroborating Barenholz and Kummerow on SM and cardiac disease. Clearly, a loss of PC is an unhealthy event. Thus, maintaining the level of PC in the cell membrane as we age is vital to cellular health and longevity. It may even be the sought after fountain of youth we are looking for.

The 1989 invention involves administering PC liposomes as an intravenous injection (parenterally, not orally as used earlier), to an individual (animal or human) to reverse age-related changes in the lipid composition of organs and tissues, such as heart muscle cells and red blood cells, by an infusion of egg PC as a lipid exchange (egg PC is molecularly similar to soy PC, the fatty acids may alter, but not the molecule). Since the aging process in heart muscle is characterized by a decrease in PC, with a coinciding increase in SM and cholesterol, the PC liposomes have the ability to promote an exchange of PC for SM and CH within the membrane. Adding PC liposomes into the blood induces an exchange of PC within the heart cell membranes and reverses the membrane concentration of SM and CH. This would also occur in membranes throughout the body, including the brain.

An important therapeutic application of the invention is increasing an individual’s ability to withstand cardiac stress. The utility of the treatment was shown in laboratory animals following congestive heart failure or serious damage to the heart, the red cells showed about a two-fold decline in PC/SM between ages 3 and 18 months. This was reversed by three PC liposome treatments within nine days with PC SUVs administered to 18 month aged rats, whereby there was an increase in the ratio nearly sevenfold. The treated 18 month old male rats were able to maintain blood pressure under stress about 50% longer than untreated rats. There were several additional studies, however, the most impressive were the next two on longevity and sex.

**Effect of Treatment on Longevity with PC SUVs**
(SUVs are small spherical membrane enclosures, cellular look-a-likes)

This study examines the effect of PC treatment on animal longevity. The rats tested were 30 month old male Sprague-Dawley rats. Since Sprague-Dawley rats normally die between the ages of about 24-30 months, the rats tested showed a dramatic increase in longevity. A test group of six rats were each given PC-SUVs, prepared as an IV, at a dose of between 0.5 and 1 g PC liposome lipid through the tail vein, and similarly dosed after one week, and then every two months thereafter. A second control group of same-age male rats was similarly injected with saline water on the same dose schedule, 2 doses a week apart, then one dose every 2 months, until the animal died of natural causes. The 6 animals in the control group had an average age at death of ~34 months. Of the PC treated animals, 2 were sacrificed at 44 months, 1 at 45 months, and 3 at 48 months, giving an average age at death of about 46 months, however all of the treated animals were sacrificed (killed), so, the actual length of survival remains unknown. Even so, this equates to a substantial life extension, approximately 33% in the animals treated.

**Effect of PC-SUV Treatment on Sexual Competence/ Virility**

It is known that sexual function in male rats declines with age. If males 30 months of age or older are housed with younger, fertile females, many have fewer litters, and the actual litter count is lower than would be born if the same females had been with young males. To test the effect of PC liposome treatment on sexual function, a group of 10 rats, each 34-36 months old (close to or near death), were treated with egg PC-SUVs every three days for six days (a total of three doses) with 0.5 to 1 gm lipid per animal through the tail vein with the untreated animals received just sterile saline over the same period. Nine days after the first injection, the animals were each placed in a cage with 3 female Sprague-Dawley rats 5 to 6 months old. The single male and 3 females stayed together for 1 to 3 weeks, or even more, ~7 weeks, after which the males were removed. Only 1 of the 3 females in contact with untreated males for the single week produced litters, and this increased to about 2 of the 3 females that were able to stay together for 7 weeks. In all cases, litter sizes were less than 10. With treated males, about 2 of the 3 females produced litters with 1 week of contact, and virtually all of the females littered with 3 weeks of contact. Litter sizes were the normal 10-14 animals. Thus, sexual performance and virility was substantially greater in the animals who received PC. Something to consider if conception has been difficult – PC.
Earlier, I indicated the three oral PC products with acceptable quality, which requires additional explanation. PC from BodyBio, American Lecithin and Essentiale are all miscible (water dissolving) and efficacious. However, there is recent research on mitochondria energy that is noteworthy. In 2012-13 there were a number of studies on mitochondria and ETC (electron transport chain). Production of ATP, which initiates on the inner membrane of mitochondria, is newly recognized to be dependent on PE (phosphatidylethanolamine) – not on PC (Böttinger, Joshi, 2012, Tasseva 2013). PE is generally ~half the concentration of PC in cell membranes; however, the dynamics responsible for the separation of protons that drive the production of ATP, sit on the inner membrane of the mitochondria, and are enshrouded with a predominance of PE for the ETC chemistry to play out. BodyBio PC contains both PC and PE, whereas Phos Chol® (and/or Nutrasal®) from American Lecithin, and Forte® contain only PC.

The results of Professor Barenholz and his colleagues in demonstrating the overwhelming, and mostly hidden results of PC, were performed over a quarter of a century ago, and are nothing short of ‘remarkable’. Dr. Barenholz used IV egg PC, which, to our knowledge, has not been commercially duplicated. However, he used oral PC liposomes as a food in the myocyte petri dishes and witnessed the myocytes recovery, which was admirable, even shocking. If PC is produced correctly, which BodyBio PC is, there is every reason to expect it to be the Super Star nutritional supplement. Maintaining sexual activity and disease-free life as we age has been a universal dream. Having experienced the life-saving, life-promoting qualities of PC with thousands of doctors and their patients has been a fascinating healing journey for all of us at BodyBio. We invite you to join us at www.bodybio.com and begin your BodyBio PC journey towards better health. Also, take a look at the video on PC and cancer – “An Amazing Story”.


*These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure or prevent any disease.